US Army Corps of Engineers
Wilmington District

APPENDICES

Morehead City Harbor
Morehead City, NC

DRAFT

Integrated Dredged Material Management Plan And Environmental Impact Statement

Port of Morehead City, NC

October 2013

Morehead City Harbor
Morehead City, NC
DRAFT
Integrated Dredged Material Management Plan (DMMP)
and Environmental Impact Statement

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1.0 EXECUTIVE SUMMARY

The Wilmington District is committed to developing and executing a Dredged Material Disposal Plan (DMMP) for the Morehead City Harbor, NC (MHC) Federal navigation project. Work on the DMMP commenced in fiscal year 2009, with completion and implementation of the DMMP currently scheduled for mid fiscal year 2011.

During this three year duration it is the Wilmington District's intent to implement an interim maintenance dredging plan (Interim Operations Plan) for the MHC project. Development of this Interim Operations Plan was performed by utilizing historical shoaling rates, actual maintenance dredging quantities, recent geotechnical data, and current channel and disposal area conditions.

Below is a summary of the Interim Operations Plan. A more detailed description of the plan can be found in Section 2.0 and the attached figures.

	Dredging Area	Disposal/Placement Location	Approx. Quantity
Year-1	Ocean Bar	Fort Macon State Park / Atlantic Beach	1,100,000 cubic yards
Year-2	Ocean Bar	Near-shore Disposal Area	250,000 cubic yards
	Inner Harbor	Brandt Island	700,000 cubic yards
Year-3	Ocean Bar	Near-shore Disposal Area	750,000 cubic yards
	Inner Harbor	Offshore Disposal Area	100,000 cubic yards

Below is a summary of the projected funding for the Interim Operations Plan through 2012 and the DMMP through 2011.

PROJECTED 3-YEAR FUNDING REQUIREMENTS
MOREHEAD CITY HARBOR, NC

ACTIVITY	FY 10	FY 11	FY 12	TOTAL
	($000)	($000)	($000)	($000)
CESAW Labor	250	150	150	550
Hydro Surveys	250	250	250	750
SNELL Operations	100	50	50	200
Contractor Earnings	8,400	5,400	3,300	17,100
3-Year Ops Plan TOTAL	**9,000**	**5,850**	**3,750**	**18,600**
DMMP	500	500		1,000
3-Year Ops Plan and DMMP TOTAL	**$9,500**	**6,350**	**$3,750**	**$19,600**

2. INTERIM OPERATIONS PLAN

It is the Wilmington District's intent to provide unrestricted navigation within authorized project dimensions of the MHC project while striving for the least-cost alternative, consistent with sound engineering practices, and in an environmentally acceptable manner. The District proposes to accomplish this mission through execution of various maintenance dredging contracts on a 3-year dredging cycle. This plan was developed to provide an acceptable means of maintaining MHC harbor on an interim basis while the DMMP is being developed. The final DMMP may or may not be similar to this interim plan.

The Wilmington District has structured the Morehead City Harbor maintenance dredging into a three-year dredging cycle. The Interim Operations Plan was developed with using historical shoaling and dredging quantities, recent geotechnical data, and current channel and disposal area conditions.

The following paragraphs provide a detailed description of the dredging operations planned for 2009 – 2012 (fiscal year 2010 – 2012).

2.1 Operations Plan Year-1

In Year-1, the Wilmington District plans to solicit and execute a single maintenance dredging contract. The contract would commence approximately mid-November 2009 with completion in the mid-May 2010 timeframe (see Figure entitled Year-1).

Order of Work: Approximately 1.1 million cubic yards of dredged material would be removed from the MHC Ocean Bar portion of the project and placed along the shorelines of Fort Macon State Park and Atlantic Beach. Range A would be dredged to the authorized project depths 47-ft plus two feet of allowable overdepth. The Cut-off and portions of Range B will be dredged to the authorized project depth of 45-ft plus two feet of allowable overdepth.

It should be noted that, although Range A is authorized to 47-ft plus two feet of allowable overdepth, in recent years the Wilmington District has maintained this channel to only 45-ft plus two feet of allowable overdepth based on current user traffic needs. However, under this plan in Year-1, the Wilmington District will perform maintenance dredging of Range A to the authorized depth of 47-ft plus two feet of allowable overdepth. The intent of this advanced-maintenance dredging is to maximize the dredging volume in Year-1 and minimize, or possibly eliminate, the need for dredging within the Ocean Bar portions of the project in Year-2.

2.2 Operations Plan Year-2

In Year-2, the Wilmington District plans to solicit and execute an Inner Harbor Maintenance Dredging Contract and a possible Ocean Bar contract if shoaling within the Ocean Bar warrants maintenance dredging.

Maintenance Dredging Contract 1: Approximately 700,000 cubic yards of dredged material would be removed from the MHC Inner Harbor portion of the project and disposed of within the confined disposal area of Brandt Island. The Northwest and West Legs would be dredged to 36-ft plus one foot of allowable overdepth. The East Leg and Range C would be dredged to 46-ft plus one foot of allowable overdepth. It is anticipated that this work would be accomplished with a 16-inch hydraulic pipeline dredge.

Note: maintenance dredging within portions of the MHC Inner Harbor reaches has historically been accomplished every two years. However, Year-2 dredging will require the contractor to remove dredge material to 36-ft plus one foot of allowable overdepth in West and Northwest Legs and 46-ft plus one foot of allowable overdepth in Range C and East Leg. The intent of lowering the project depth by one foot is to decrease the frequency of dredging operations from every two years to every three years. Although a minimal amount of Inner Harbor maintenance dredging may occur in Year-3, the majority will be accomplished in Year-2 and again in Year-5 if necessary.

Maintenance Dredging Contract 2: The amount of maintenance dredging in Range A, Cut-off and Range B is anticipated to be minimal due to the advanced maintenance dredging performed in Year-1. Therefore, the amount of required dredging in Year-2 will likely be a small quantity (250,000 cubic yards or less), or may not warrant any maintenance dredging. In either case, any necessary Ocean Bar dredging in Year-2 would likely be incorporated into the annual Wilmington Harbor Outer Ocean Bar maintenance dredging contract. Evaluation of channel conditions would be based on the 45-ft plus two feet of allowable overdepth (current user traffic draft requirements).

If needed, approximately 250,000 cubic yards of dredged material would be removed from Range A, Cut-off and Range B and placed within the existing nearshore placement area, utilizing the ocean dredged material disposal site (ODMDS) during adverse weather conditions (see Figure entitled Year-2). This dredging would take place within environmental dredging window of January 1 through March 31, 2011.

2.3 Operations Plan Year-3

In Year-3, the Wilmington District would solicit and execute a single maintenance dredging contract. The contract would commence approximately January 1, 2012 with completion by March 31, 2012. The contract would likely consist of a base contract with a contract option (see Figure entitled Year-3).

Base Contract: Approximately 750,000 cubic yards of dredged material would be removed from the MHC Ocean Bar portion of the project with an Ocean Certified Hopper Dredge and placed within the existing Nearshore Placement Area, utilizing ODMDS during adverse weather conditions. Range A, Cut-off and Range B would be dredged to a depth of 45-ft plus two feet of allowable overdepth.

Potential Contract Option: Based on need, approximately 100,000 cubic yards of dredged material would be removed from portions of the MHC Inner Harbor and disposed of within the ODMDS. The Northwest and West Legs would be dredged to 35-ft plus two foot of allowable overdepth and the East Leg and Range C would be dredged to 45-ft plus two foot of allowable overdepth.

2.4 Potential Continuation of Operations Plan

Completion of the MHC DMMP will provide direction for disposal of dredged material for the at least the next 20 years. The DMMP is scheduled for completion in mid-2011. Under the current schedule, the first possible year to implement dredging operations under the MHC DMMP is FY 2013, as budget submission for FY 2013 is in June of 2011. The Wilmington District will request the appropriate level of funding, in alignment with the MHC DMMP, in June 2011 for FY 2013.

3.0 HISTORICAL MAINTENANCE OPERATIONS

The Wilmington District has provided unrestricted navigation within the MHC Harbor Project through various maintenance dredging techniques and associated disposal locations throughout the life of the project. However, MHC dredging techniques were altered in 2005 following the placement of an unacceptable amount of fine-grained material onto the shoreline of Atlantic Beach and Fort Macon State Park.

3.1 Inner Harbor Channels

From the mid-1970s through 2005, the Wilmington District performed Inner Harbor maintenance dredging on an approximately 2-year dredging cycle. The Inner Harbor material was temporarily stored within Brandt Island. Approximately every 10 years, Brandt Island material was removed, via a 30-inch hydraulic pipeline dredge, and pumped to the shoreline of Fort Macon State Park and Atlantic Beach. Disposal of Brandt Island material onto the shorelines of Fort Macon State Park and Atlantic Beach was intended to mitigate for any erosion caused by channel maintenance. The Brandt Island “pumpouts” occurred in 1986, 1994 and 2005.

3.2 Ocean Bar Channels

During the same timeframe, and until 1995, dredged material from the Ocean Bar portions of the channel, to include Range A, Cut-off and Range B, was removed from the channel and placed into the ODMDS. In 1995, the Wilmington District altered the primary disposal location for the Range A, Cut-off and Range B portions of the project from the ODMDS to the "Near-shore Placement Area." This change in project disposal practices was done, in part, to satisfy new State rules indicating a preference for the retention of beach-quality sand within the littoral system.

3.3 Brandt Island Pump-out – 2005

In 2005, the Wilmington District performed the last "pumpout" of Brandt Island onto the shoreline of Fort Macon State Park and Atlantic Beach. During this operation, a considerable amount of fine-grained material was placed onto the shoreline.

3.4 Geotechnical Investigation – 2006

Following the 2005 pumpout, the Wilmington District performed extensive geotechnical investigation within the MHC project. Based on the results from this sampling effort and the State rules related to beach disposal, the Wilmington District re-classified the Inner Harbor dredged material as non-beach suitable material. Due to this re-classification, further pumpouts are no longer an option.

4.0 COMPLIANCE WITH FEDERAL STANDARD FOR DREDGING

In the first NEPA document for this project, completed in 1976, CESAW stated that it would place beach quality material dredged from the inner harbor by pipeline dredge into Brandt Island. CESAW stated in its FEIS that in order to maintain capacity in the disposal area, and to "stabilize the shoreline that is influenced by the inlet," it would pump Brandt Island out every 8 to 10 years and place the material along 25,000 linear feet of shoreline (essentially the beach at Fort Macon State Park and the Town of Atlantic Beach).

Because pumpout to the beach as described in the FEIS for Morehead City harbor is no longer available as a mechanism to return sand to the beach to offset any impacts of the project, CESAW believes it is appropriate to request sufficient funds for FY 2010, Year 1 of this interim plan, to place beach compatible material dredged from the Ocean Bar onto the beach at Fort Macon State Park and Atlantic Beach.

While nearshore placement is the least cost alternative, it does not comply with CESAW's commitment to offset potential impacts to the adjacent shoreline by placing some MHC material on the beach. The proposed Interim Operations Plan places approximately 1,100,000 cubic yards of material on the beach over a three year period (an average annual amount of 367,000 cubic yards per year). This amount is roughly equal to the average annual amount placed over the 8-year period between Brandt Island pumpouts (312,500 cubic yards per year). Because the authorized MHC plan includes disposal of material on the beach to offset potential impacts, CESAW believes the Interim Operations Plan is the short-term environmentally acceptable plan until the DMMP is completed.

Historic Shoaling Rates

Purpose: The purpose of the shoaling analysis section of this report is to determine the average amount of material that is shoaling into the navigation channel at Morehead City Harbor on an annual basis. The Morehead City Harbor navigation channel is broken into six major ranges as follows:

- Range A
- Cutoff
- Range B
- Range C / East Leg
- West Leg
- Northwest Leg

These ranges are then separated based on the quality of material contained within each area (Figure 1). Ranges that contain coarse-grained (≥90 percent sand) which is suitable for beach disposal include: Range A out to station 110+00; the Cutoff; Range B; and a portion of Range C/East Leg from the seaward extent through station 17+00. Ranges containing fine-grained (<90 percent sand) material include: Range A from station 110+00 seaward; Range C/East Leg from station 17+00 landward; the West Leg; and the Northwest Leg. Beach compatibility is based on the most recent boring log information taken from each range and is discussed in detail within the Geotechnical Appendix of this report.

Shoaling rates for the given ranges can be used to estimate several future needs with regard to disposal/placement areas, to include ensuring sufficient volume is available for the estimated disposal quantities. Also, the rates can be used to determine disposal island pumpout frequencies as well as estimate quantities available for beach disposal of acceptable sand material.

Historical Data: The basis for the shoaling study is the historical surveys collected and maintained by the Wilmington District Navigation section. The entrance channel, ocean bar, and inner harbor are surveyed on a regular basis to ensure proper depth is maintained. In addition to these condition surveys, the channel is also surveyed just prior to and immediately after dredging events. These historic surveys were collected and imported into a new diagnostic modeling tool as part of a demonstration project by Taylor Engineering (Carvalho and Albada, 2006). The focus of the tool is to provide a useful way to monitor shoal rates within navigation channels. As part of the demonstration project, surveys were processed through 2005. The remainder of the surveys through 2007 were collected and processed by the Wilmington District Coastal Engineering section as part of this shoaling calculation effort.

Assumptions: Several assumptions were made for the calculation of channel shoal rates prior to beginning the work. They are as follows:

- First, the analysis is based on a comparison of bathymetric surveys only. Due to time constraints, a comparison of the surveys to the dredging template was not made.

- Partial surveys were included in the comparison with the assumption that the survey covered all areas within the channel that may have shoaled. Surveys that were very small in coverage area were excluded.
- All comparisons were made within the lateral bounding limits of the channel polygon. Any dredging that may have occurred outside the authorized channel lateral limits was not considered. Dredging volume that occurred within the lateral limits of the authorized channel that was below the authorized depth was included in the analysis.
- Shoaling rates were generally limited to between the years 2000 and 2007 due to funding and time limitations.

Methods and Results: As discussed earlier, the Diagnostic Modeling System ESRI extension was used to compute volumetric changes between surveys. Change values were computed between surveys and categorized four ways: condition survey to before dredge survey; after dredge to before dredge survey; after dredge to condition survey; and before dredge to after dredge survey. In the absence of a valid before or after dredge survey for a given time period, the condition survey closest to the date of the missing survey would be used as a substitute to measure trends.

Once volume differences were computed between survey events they were sorted to group similar survey dates. Survey comparisons between common dates, i.e. two different condition surveys compared to the same before dredge survey, would have their individual shoal rates averaged to produce one shoal rate that represented this time period. Once all shoal rates were computed the average shoal rate for the type of comparison, i.e. after dredge to condition, would be computed. This would ultimately produce three shoal rates, one each for the after dredge to condition, the condition to before dredge, and the after dredge to before dredge. These three rates would then be averaged into what is used as the representative shoal rate for a particular section of the channel. Final shoaling rates for each section of the navigation channel are shown in Table 1.

Historic Dredge Volumes:

Purpose: In an attempt to correlate the newly developed shoaling rates with the amount of material historically dredged from the channel, an average annual dredging rate was developed based on the historic dredge volumes.

Historic Data: The navigation channel and inner harbor was broken into six regions based on historic dredging contracts between 1997 and 2008, as follows:

- Range A
- Cutoff
- Range B
- Range C / East Leg
- West Leg
- Northwest Leg

Unlike shoaling rates developed previously using the actual survey data, these data were not separated into beach quality material and non-beach quality material. This was due to the limited nature of the available contract data which typically only includes channel quantities for before dredge and after dredge conditions, as well as the overdepth volume. Overdepth volume is material dredged beyond the authorized channel template and is subtracted from the volume calculated based on the before dredge and after dredge surveys. This final pay quantity was used as the basis for developing the average annual dredging rates for historic dredging.

Methods and Results: Actual pay volume quantities were organized into one of the six regions described above by survey date. Due to the variability of the number of dredging events for each reach and the time between surveys, an average was computed for both the dredge volume and duration between events. These average values were then used to compute the average annual dredging rate by dividing the average volume dredged by the average duration between dredging events. A summary of the results is shown in Table 1.

To make comparisons between the shoaling rate and the average annual dredging rate calculations, ranges for the survey based shoaling rates had to be combined into the six ranges used in the dredging rate analysis. The last column in Table 1 shows the substantial difference in the two calculation methods. There are multiple explanations for the differences observed between the two methods. The first reason for the difference is that the average annual dredging rate does not include material dredged from outside the channel template as a result of it being based on pay quantities only. Secondly, material that shoals into the navigation channel during the dredging process is unaccounted for in the pay quantities. The period of time that a contractor occupies a section of the navigation channel for dredging varies, but can range between four to eight weeks for a typical section. Since contracts are typically paid based on material removed between after dredge and before dredge surveys, the contractor must remove the amount specified in the construction contract and shoaling during construction as well. For example, an eight week dredging operation would remove roughly 15 percent of anticipated yearly shoaling which would not be represented in the final quantity. The third reason for shoaling rates to be higher than average annual dredging rates would be that previous dredging events may have not removed all shoaling within the channel. Shoaling that occurs within the channel, but does not restrict navigation may not be removed until such point that it becomes a navigational issue. Also, shoaling has occurred in areas such as the Shackleford Banks spit at the intersection of Range A and the Cutoff where the typical hopper dredging plant is unable to dredge the navigation channel to its full alignment. Lastly, maintenance of the project is frequently limited by funding.

Given these differences, the most reliable tool to predict shoaling volumes within the channel would be the survey based shoaling rates applied over the anticipated period between dredging events.


East Leg
Northwest Leg
West Leg
Station 17+00
Range C
Range B
Marsh
Cutoff
Range A
Channel Areas
Cutoff
East Leg
Northwest Leg
Range A
Range B
Range C
West Leg
Station 110+00
August 2009 Photography
2,000 1,000 0 2,000 Feet

Figure 1

	Shoaling Rates Based on Survey Comparison (AD, BD, and Condition Surveys 2000-2007)				Average Annual Dredging Rates (1997 - 2008)		
Range	Representative Shoaling Rate (C.Y./Year)	Shoaling Rate (C.Y./day)	Combined Shoaling Rate (C.Y./Year)	Combined by Range (C.Y./Day)	Representative Dredging Rate (C.Y./Year)	Dredging Rate (C.Y./day)	% Difference
Range A Suitable	630,500	1,727					
Range A Unsuitable	118,500	325	749,000	2,052	547,600	1,500	-26.89%
Range B	170,000	466	170,000	466	45,400	124	-73.29%
Cutoff	324,500	889	324,500	889	182,500	500	-43.76%
Range C Eastleg Suitable	80,500	221					
Range C Eastleg Unsuitable	86,000	236	166,500	456	138,200	379	-17.00%
West Leg	28,000	77	28,000	77	23,200	64	-17.14%
Northwest Leg	80,000	219	80,000	219	60,900	167	-23.88%

Table 1

Reference:

Carvalho, Alexandra, Ph.D. and Edward Albada, P.E., 2006. “Morehead City Harbor DMS Data Manager Application Carteret County, North Carolina”, Taylor Engineering, Jacksonville, FL.

APPENDIX B

GEOTECHNICAL ENGINEERING

GEOTECHNICAL ENGINEERING

General.

The project site is located in the lower Atlantic Coastal Plain physiographic province along the central coast of North Carolina. More specifically, the channel passes through Beaufort Inlet between the barrier islands of Shackleford Banks and Bogue Banks and continues inland to the mainland at Morehead City and Beaufort, North Carolina. The channel is flanked by shoals of the ebb-tidal delta seaward of the inlet and by those of the flood-tidal delta landward along Back Sound on the east. Further inland, the channel is flanked by Bogue Sound on the west. The Newport River empties into Morehead City harbor at the head of the channel, i.e., the northern most end of the harbor. The project site encompasses depositional environments that include nearshore littoral settings, an active coastal inlet, barrier islands, and a shallow, back-barrier lagoonal complex of sounds and channels. The prominent geographical feature of the region is Cape Lookout which is composed of a lobate sand body ranging up to 90 feet in thickness and covering an area of approximately 100 square miles. The western edge of the Cape Lookout shoal lies immediately east of the entrance channel. Shackleford Banks is a Holocene age barrier island that is underlain by extensive deposits of inlet-fill sediments along its entire length. Historically, an inlet or inlets have opened and closed along the full length of the island, while displaying an overall westward lateral movement to the present-day Beaufort Inlet location. Back Sound, landward of Shackleford Banks, is underlain by stacked sequences of flood-tidal delta deposits which stratigraphically compliment the inlet-fill sequences under the island. Bogue Banks, to the west of the channel, is underlain by Holocene age shoreface deposits. The barrier sands of the island are prograding seaward over these deposits at present. Bogue Sound, landward of this island, is underlain by a back-barrier lagoonal sequence of sediments having a greater abundance of clays than Back Sound to the east. The entire sequence of barrier/back-barrier sediments in the area represents several transgressive/regressive ocean events that occurred during Pleistocene and Holocene time.

Soils and Geology.

Sediments within the project scope (reach and depth) range from Pliocene to Holocene in age. The Pliocene sediments are from the Yorktown formation and are only found in limited areas, i.e., the turning basin and possibly along portions of Ranges "C" and "B". The top of the Yorktown sediments range between -45 and -50 Mean Sea Level in the inner harbor area and to about -65 msl at Beaufort Inlet. These sediments consist of bluish to greenish-gray, clayey sands and interbedded clay and sandy clay, all of which have abundant fossil debris. Generally, the Yorktown is more indurated than the overlying sediments. The Pleistocene sediments are from the Core Creek Sand. Within the inlet, these sediments are at approximately -50 to -54 feet msl. Beneath Bogue Banks and Shackleford Banks, the Pleistocene varies from -45 msl to -55 msl, respectively. In the landward direction, the top of the, Core Creek Sand rises along dip such that it is only 15 to 20 feet below mean sea level. Pleistocene deposits from the Beaufort Sand form a ridge along the mainland at the rear of Back and Bogue Sounds, as part of the Core Creek Plain (Pamlico Plain of Stephenson, 1912). This plain is a shallow, seaward dipping surface which lies east and south of the Suffolk Scarp. In general, the Pleistocene sediments in the project area are representative of back-barrier and nearshore or shoreface deposits consisting of interbedded clays, silts and fine sands, and poorly graded fine to medium sands and shelly sands, respectively. Holocene sediments are undifferentiated. They are the uppermost sediments at the site. Within the inner harbor, they consist of some reworked clays and silts but are predominately very fine to fine sands that are derived from Bogue and Back Sounds and the Newport River. Coarser sediments are concentrated in the channels. Holocene deposits at the inlet and entrance channel consist of fine to medium and some coarse sands containing quartz and abundant shell fragments. These deposits are derived from the ongoing reworking of older sediments along the nearshore seabed and the Cape Lookout sand body. Deposits in each of the stratigraphic units are interbedded vertically and interfinger horizontally(facies changes) as the environments of deposition changed across the project area.

Subsurface Investigations.

1972 Harbor Investigation.
Forty (40) Vibracore borings, designated through 40, were completed in 1972 between the ocean bar at the entrance to the channel and the head of the harbor. The borings were performed in Range A, the Cutoff, Range B, Range C, and the East Leg. Grain size analysis was not conducted on these cores. All vibracore borings were made using a 20 foot corer. Borings penetrated sediments from as shallow as -24.2 feet to as deep as -62.4 feet Mean Low Water(mlw). All borings penetrated to a minimum depth of -45 mlw, except No. 33 which stopped at -44.2 mlw. All drill sites were within the channel or harbor prism. The authorized depth of the project at the time the borings were performed was -40 mlw.

1990 Harbor Investigation
In 1990 a subsurface investigation was performed, consisting of 10 borings designated MHC-90-#. Although 18 borings were planned, only 10 borings were actually drilled. These borings were MHC-90-5, 7, 9, 11, 12, 13, 15, 16, 17, and 18. A modified splitspooning technique was used to obtain samples for visual and laboratory analysis. The samples were taken with a 5 foot splitspoon which was driven with a 300 pound hammer. No n value was kept as using this equipment for sampling does not meet the requirement in ASTM for the standard splitspoon test. Sieve analyses were conducted on representative samples to determine if the soils are suitable for disposal on adjoining beaches. Twenty-four of the twenty six samples recovered were grain size tested in accordance with ASTM D 422. The sieves used in the grain size testing were the 1", ¾", ½", 3/8", #4, #10, #20 #40 #60, #100, #200 sieves.

1992 Harbor Investigation
In 1992 a subsurface investigation was performed, consisting of 12 borings designated MH-92-#. The borings were performed in Range B, Range C, and the East Leg. The

borings were performed from the USACE multi-purpose vessel SNELL using a 20' vibracore. Fifty four of the sixty seven samples recovered were grain size tested in accordance with ASTM D 422. The sieves used in the grain size testing were the 1½", 1", ¾", ½", 3/8", #4, #7, #10, #14 #18 #25 #35 #45 #60 #, #230 sieves.

<u>2003 Harbor Investigation</u>
In 2003 a subsurface investigation was performed, consisting of 21 borings designated MIH-03- V-#. The borings were performed in Range C, the West Leg, the East Leg, and the Northwest Leg, on shoals to be removed in the next maintenance dredging contract. The borings were performed from the SNELL using a 20' vibracore. Samples recovered which were within the dredging prism were grain size tested in accordance with ASTM D 422. The sieves used in the grain size testing were the 3/4", 3/8", #4, #7, #10, #14, #18, #25, #35, #45, #60, #80, #120, #170, #200 sieves.

<u>2005 Harbor Investigations</u>
In 2005 a subsurface investigation was performed, consisting of 8 borings designated MIH-05-V-#. The borings were performed in Range C, the West Leg, the East Leg, and the Northwest Leg, on shoals to be removed in the next maintenance dredging contract. The borings were performed from the SNELL using a 20' vibracore. Samples recovered which were within the dredging prism were grain size tested in accordance with ASTM D 422. The sieves used in the grain size testing were the 3/4", 3/8", #4, #7, #10, #14, #18, #25, #35, #45, #60, #80, #120, #170, #200 sieves.
Later in 2005 another subsurface investigation was performed, consisting of 15 borings designated MOB-05-V-#. The borings were performed in Range A, on shoals to be removed in the next maintenance dredging contract. The borings were performed from the SNELL using a 20' vibracore. Samples recovered which were within the dredging prism were grain size tested in accordance with ASTM D 422. The sieves used in the grain size testing were the 3/4", 3/8", #4, #7, #10, #14, #18, #25, #35, #45, #60, #80, #120, #170, #200 sieves.

<u>2006 Harbor Investigation</u>
In 2006 a subsurface investigation was performed, consisting of 30 borings designated MHC-06-V-#. The borings were performed in Range C, the West Leg, the East Leg, and the Northwest Leg, on shoals to be removed in the next maintenance dredging contract. The borings were performed from the SNELL using a 20' vibracore. Samples recovered which were within the dredging prism were grain size tested in accordance with ASTM D 422. The sieves used in the grain size testing were the 3/4", 3/8", #4, #7, #10, #14, #18, #25, #35, #45, #60, #80, #120, #170, #200 sieves.

<u>2007 Harbor Investigation</u>
In 2007 a subsurface investigation was performed, consisting of 11 borings designated MHCOB-07 V-#. The borings were performed in Range A, on shoals to be removed in the next maintenance dredging contract. The borings were performed from the SNELL using a 20' vibracore. Samples recovered which were within the dredging prism were grain size tested in accordance with ASTM D 422. The sieves used in the grain size

testing were the 3/4”, 3/8”, #4, #7, #10, #14, #18, #25, #35, #45, #60, #80, #120, #170, #200, #230 sieves.

2008 Harbor Investigation
Borings designated MHC-08-V-# are vibracore borings performed in 2008. These sixty one borings are located throughout the Morehead City Harbor in Range A, the Cutoff, Range B, Range C, the West Leg, the East Leg, and the Northwest Leg. They represent the most comprehensive set of borings performed to date for the identification of material to be dredged. The samples from these borings were visually classified and all samples within the dredging prism were grain size tested in accordance with ASTM D 422. The sieves used in the grain size testing were the 3/4”, 3/8”, #4, #7, #10, #14, #18, #25, #35, #45, #60, #80, #120, #170, #200, and #230 sieves.

Borings that were performed from the SNELL from 2003 to the present were drilled using a 3 7/8 inch diameter, 20 foot long, Alpine vibracore drill machine. The sampler consists of a metal barrel in which a plastic cylinder is inserted. After the plastic tube was inserted, a metal shoe was screwed onto the plastic tube and then the metal barrel. The shoe provided a cutting edge for the sampler and retained the plastic tube. An air-powered vibrator was mounted at the upper-most end of the vibracore barrel, and the vibrator and the vibracore barrel were mounted to a stand. This stand was lowered to the ocean floor by the SNELL’s crane; the vibrator was activated and vibrated the vibracore barrel into the ocean sediment. The sediment sample is retained in the plastic cylinder. All borings were drilled to a depth of 20 feet below the ocean floor, unless vibracore refusal was encountered. Vibracore refusal was defined as a penetration rate of less than 0.1 feet in 10 seconds.

2009 Brandt Island Investigation
A comprehensive subsurface investigation was performed along the proposed dike alignment in 2009. This subsurface investigation is described in detail beginning on page B-14.

HARBOR SEDIMENT MATERIAL

The purpose of these sediment analyses was to determine the material types in the Morehead City Harbor and to delineate areas within the Harbor for the proper disposal location of the harbor dredge material. It is important to designate the sand material properly in order to place this valuable resource in the most appropriate location. The amount of the fine grained material in the harbor sediments will determine if the sediment is beach compatible or if it must be placed in the ODMDS or a confined disposal facility.

As described above and shown on Figure B-1, numerous borings have been performed in the Morehead City Harbor over the years. Many of those borings were for purposes other than to determine the suitability of disposal and therefore do not have the grain size testing that would be required to make a disposal decision. This analysis only uses the borings which have enough grain size data to make a determination of proper disposal.

For this analysis, five sets of borings with lab testing were used. These borings were performed between 2005 and 2008.

Borings designated MIH-05-V-# are vibracore borings performed in 2005. These borings are located in Range C. Borings designated MOB-05-V-# are vibracore borings also performed in 2005. These borings are located in Range A. Borings designated MHC-06-# are vibracore borings performed in 2006. These borings are located in Range C. Borings designated MHCOB-07-V-# are vibracore borings performed in 2007. These borings are located in Range A. All samples obtained from these borings within the channel were lab tested.

Borings designated MHC-08-V-# are vibracore borings performed in 2008. These borings are located throughout the Morehead City Harbor from range C to Range A. They represent the most comprehensive set of borings performed to date for the identification of material to be dredged.

Borings were performed from the USACE vessel SNELL using a 3 7/8 inch diameter, 20 foot long, Alpine vibracore drill machine. The SNELL is a 104-foot long multi-purpose vessel with a crane that lifts the vibracore machine. The crane is rated at 70 tons and is capable of lifting up to 35 tons. The sampler consists of a metal barrel in which a plastic cylinder is inserted. After the plastic tube was inserted, a metal shoe was screwed onto the plastic tube and then the metal barrel. The shoe provided a cutting edge for the sampler and retained the plastic tube. An air-powered vibrator was mounted at the upper-most end of the vibracore barrel, and the vibrator and the vibracore barrel were mounted to a stand. This stand was lowered to the ocean floor by the SNELL's crane; the vibrator was activated and vibrated the vibracore barrel into the ocean sediment. The sediment sample is retained in the plastic cylinder. All borings were drilled to a depth of 20 feet below the ocean floor, unless vibracore refusal was encountered. Vibracore refusal was defined as a penetration rate of less than 0.1 feet in 10 seconds.

All samples within the channel limits were tested in accordance with ASTM D 422. The sieves typically used in the testing were the 3/4", 3/8", #4, #7, #10, #14, #18, #25, #35, #45, #60, #80, #120, #170, #200, and #230 sieves.

The borings were broken into three categories, green, yellow and red. The "green" borings contain 10% or less fine grained material. The "yellow" borings contain less that 20% fine grained material but more than 10%. Finally the "red" borings contain greater than 20% fine grained material. The percentage of fine grained material was determined from the grain size testing and the percent passing the #200 sieve.

The Harbor areas are grouped based on the amount of sand and fine grained material contained in the sediment to be dredged. There are a few isolated areas which may contain material which is not consistent with the predominate material, but it is believed that these areas are anomalies and do not change the overall material types.

Based on the information available at the present time, there are three distinct areas within the Morehead City Harbor. They are the western portion of the West Leg (West Leg 1), the Northwest Leg, the East Leg, and Range A from station 117+00 out to the end of Range A is the first area. This portion of the harbor consists predominantly of silt, silty sand, sandy silt and some clean sand. The material in this area contains less than 80% sand which is too much fine grained material to meet the beach or nearshore placement requirements and should be placed upland in the Brandt Island confined disposal area or in the ODMDS.

The second area is the eastern portion of the West Leg (West Leg 2), the northern portion of Range C, and Range A from station 117+00 to Station 100+00. This portion of the harbor consists of slightly silty sand, and clean sand. The material in this area contains between 80% and 90% sand and may be placed in the Nearshore East or Nearshore West placement areas, the ODMDS, or upland in the Brandt Island confined disposal area.

The third area is the southern portion of Range C, all of Range B, all of the Cutoff, and Range A out to station 110+00. This portion of the Harbor consists of slightly silty sand, and clean sand. The material in this area contains greater than 90% sand and meets the requirement for beach or nearshore placement. Some of this coarse grained material may be placed in the ODMDS when inclement weather hinders hopper dredge placement in the nearshore areas.

Brandt Island

HISTORY. Brandt Island is approximately 168 acres in size and located south of the existing Port of Morehead City, across the Morehead City Channel. The island has been used as a disposal area since 1955 and is divided from the Bogue Banks barrier island by the narrow Fishing Creek. Immediately to the southeast is a US Coast Guard facility and Fort Macon State Park.

Brandt Island is owned and has previously been used as a sand-recycling site by the NCSPA and dedicated for the purpose of dredged material disposal. Brandt Island has a present capacity of about 3 million cubic yards, which can be increased by about 1 million cubic yards by reworking the dikes every four to five years. In 1986, 1994, and 2005 approximately 3.9 million, 2.5 million, and 2.9 million cubic yards of dredged material were pumped out of Brandt Island and placed on the beaches of Bogue Banks from Fort Macon State Park to Atlantic Beach, respectively.

Brandt Island has historically received material that is both suitable and unsuitable for beach disposal. In 2005 a cross dike was constructed inside Brandt Island at elevation 14 for purposes of segregating the unsuitable material from the suitable beach quality material. As Brandt Island is the only upland facility available for receipt of non- beach quality material, the cell for receipt of unsuitable material has reached capacity for the current dike height. Pump out of the beach quality material remaining in Brandt Island will be difficult due to the amount of non-beach disposal material presently inside the confined disposal facility. The difficulty will be trying to avoid the non-beach quality material and keeping it from mixing with the beach quality material.

EXISTING DIKE. The existing dike encompasses approximately 64 acres and has a controlling top of dike elevation of approximately 37 feet (Figure B-2). It is assumed that 2 feet of freeboard will be required at all times during disposal operations and water and dredged material will not be allowed above elevation 35 feet within the disposal area. The existing available storage volume below elevation 35 feet is approximately 3 million cubic yards. The existing dredged material capacity is approximately 1.5 million cubic yards assuming a bulking factor of 2. The dredge material capacity is the volume of the in place material in the channel.

ALTERNATIVES. Various alternatives of the Brandt Island Dike were considered for use to confine material disposed of from the Morehead City Harbor. Two alignments of the dike were considered. The first alignment considered is to keep the dike alignment approximately the same as the present dike. The second alignment considered is to expand the dike as much as possible without encroaching on wetlands or private property (Figure B-3).

The proposed dike is assumed to have a 15 foot top width and 3 horizontal to 1 vertical side slopes. The dike alignment will be adjusted as needed to minimize the amount of fill required. The toe of the expanded dike alignment will be fitted to avoid wetlands and private property, and to also allow a construction buffer to allow for a work area adjacent to the toe.

Table B-1, below, shows the amount of fill needed to raise the Brandt Island dike along an existing alignment and Table B-2 shows the fill needed to raise the Brandt Island Dike along the expanded alignment and the total dredged material capacity resulting from each proposed dike raise. It should be noted that numbers below include the current remaining storage volume of 3 million cubic yards.

Existing Dike Alignment		
Dike Height (el)	**Dike Fill Volume (CY)**	**Total Storage Volume (CY) (assumes dike fill comes from interior of diked area)**
42	62,000	3,482,000
47	191,000	3,854,000
52	398,000	4,142,000
55	582,000	4,244,000

Table B-1. Proposed Brandt Island Dike Raises Along the Existing Alignment

Expanded Dike Alignment		
Dike Height (el)	**Dike Fill Volume (CY)**	**Total Storage Volume (CY) (assumes dike fill comes from interior of diked area)**
42	442,000	4,668,000
47	657,000	5,484,000
52	917,000	6,278,000
55	1,088,000	6,749,000

Table B-2. Proposed Brandt Island Dike Raises Along an Expanded Alignment

Four dike heights were investigated to determine if it is economical to raise the existing dike. Dike heights investigated included elevations 42 feet, along with elevations 47, 52, and 55 feet. The amount of fill needed to construct these dike heights along the existing alignment are approximately 64,000 cubic yards (CY), 191,000 CY, 398,000 CY, and 582,000 CY respectively. The storage capacity for each of these heights is approximately 3,482,000 CY, 3,854,000 CY, 4,142,000 CY, and 4,244,000 CY respectively.

The amount of fill needed to construct these dike heights along the expanded alignment are approximately 442,000 CY, 657,000 CY, 917,000 CY, and 1,088,000 CY respectively. The storage capacity for each of these heights for the expanded dike is approximately 4,668,000 CY, 5,484,000 CY, 6,278,000 CY, and 6,749,000 CY respectively.

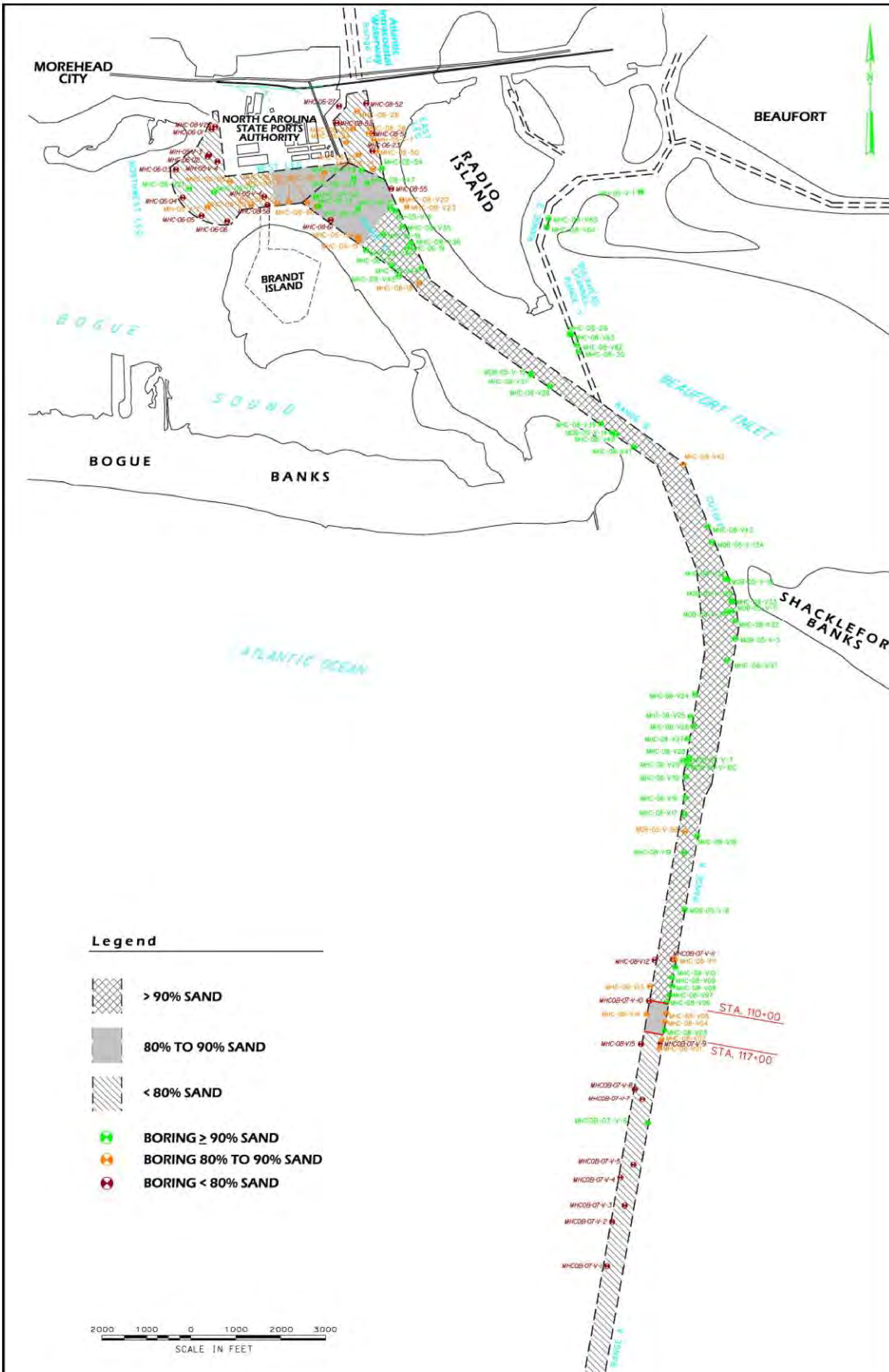


Figure B-1. Morehead City Harbor Channel Sediment Characterization Boring Locations

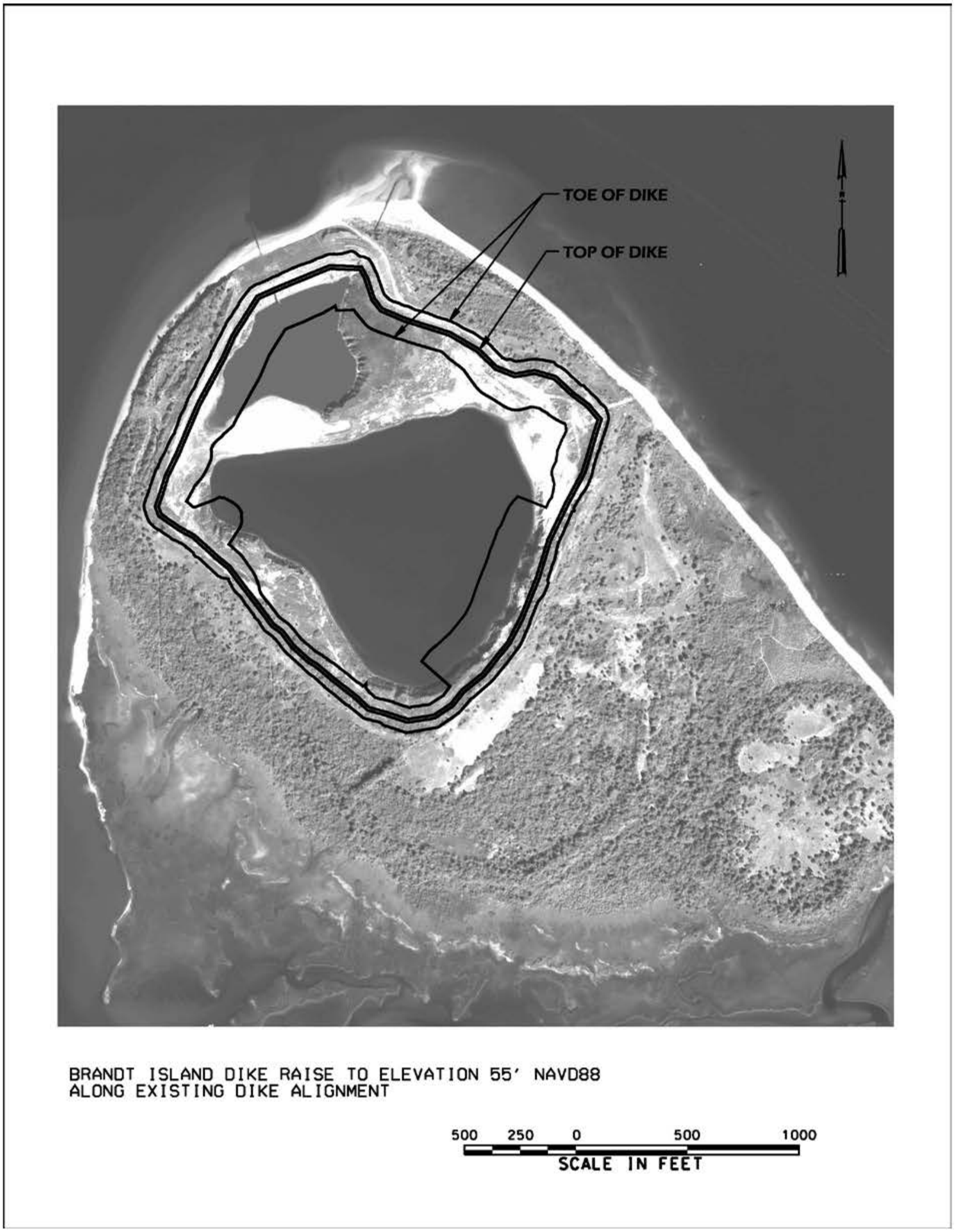


Figure B-2. Existing Alignment of Brandt Island Dike with Dike Raise to Elevation 55'

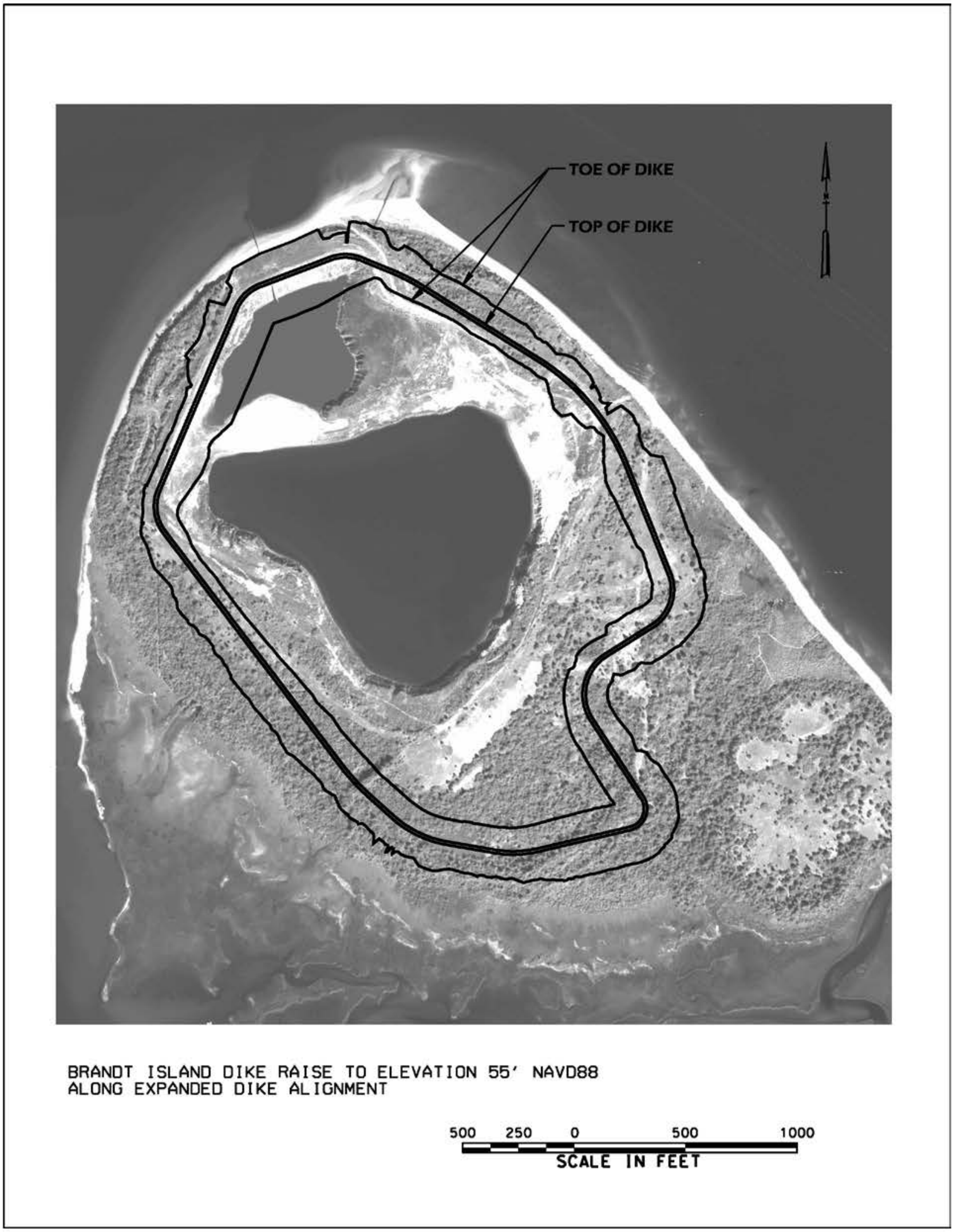


Figure B-3. Proposed Expansion of Brandt Island Dike with Dike Raise to Elevation 55'

SUBSURFACE INVESTIGATION. A comprehensive subsurface investigation was performed along the proposed dike alignment in 2009. The drilling program consisted of performing eighteen Standard Penetration Test (SPT) borings reaching depths of 51 to 78 feet along the proposed dike alignments. The SPT borings were performed using the general methodology outlined in ASTM Standard D 1586 (Figures B-4 and B-5).

The standard penetration test is a widely accepted test method of *in situ* testing of foundation soils (ASTM D 1586). A 2-foot long, 2-inch outside diameter split-barrel sampler attached to the end of a string of drilling rods is driven 18 inches into the ground by successive blows of a 140-pound hammer freely dropping 30 inches. The number of blows needed for each 6 inches of penetration is recorded. The sum of the blows required for penetration of the second and third 6-inch increments of penetration constitute the test result or N-value. After the test, the sampler is extracted from the ground and opened to allow visual examination and classification of the retained soil sample. The N-value has been empirically correlated with various soil properties allowing a conservative estimate of the behavior of soils under load. The tests are usually performed at 5-foot intervals. However, more frequent or continuous testing was done by the drilling AE through depths where a more accurate definition of the soils is required. The test holes are advanced to the test elevations by rotary drilling with a cutting bit, using circulating fluid to remove the cuttings and hold the fine grains in suspension. The circulating fluid, which is a bentonitic drilling mud, is also used to keep the boring open below the water table by maintaining an excess hydrostatic pressure inside the hole. Representative split-spoon samples from the soils at every 5 feet of drilled depth and from every different stratum are brought to the laboratory in air-tight jars for further evaluation and testing, if necessary. After completion of a test boring, the hole is kept open until a steady state groundwater level is recorded. The hole is then sealed, if necessary, and backfilled.

The borings were advanced using a CME 45 Mud Bug drilling equipment. Field logs for each boring were prepared by an Ardaman & Associates, Inc., field geologist. These logs included visual classifications of the material encountered during drilling. Soil samples were obtained continuously from the ground surface to the termination depth of the boreholes. The soil samples were visually classified in general accordance with the Unified Soil Classification System (ASTM D 2487). In cohesive and semi-cohesive soils, undisturbed soil samples were secured using three inch diameter thin-walled tube in accordance with ASTM Standard D 1587 (Shelby tube sampler). The Shelby tube was retrieved, plugged and sealed by the field personnel on site. All soil samples recovered during the drilling program were brought back to the Ardaman & Associates, Inc. laboratory in Orlando, Florida for additional classification and testing. All laboratory tests, where applicable, were performed in general accordance with ASTM standards. The laboratory testing program was conducted in our USACE approved laboratory in Orlando, Florida on selected samples from the field exploration. The program included visual classification, moisture content, particle-size distribution and Atterberg limits determinations on selected samples. In addition, twelve consolidation tests, nine unconsolidated undrained triaxial compression (UU) tests, and one laboratory vane shear test were performed on undisturbed soil samples.

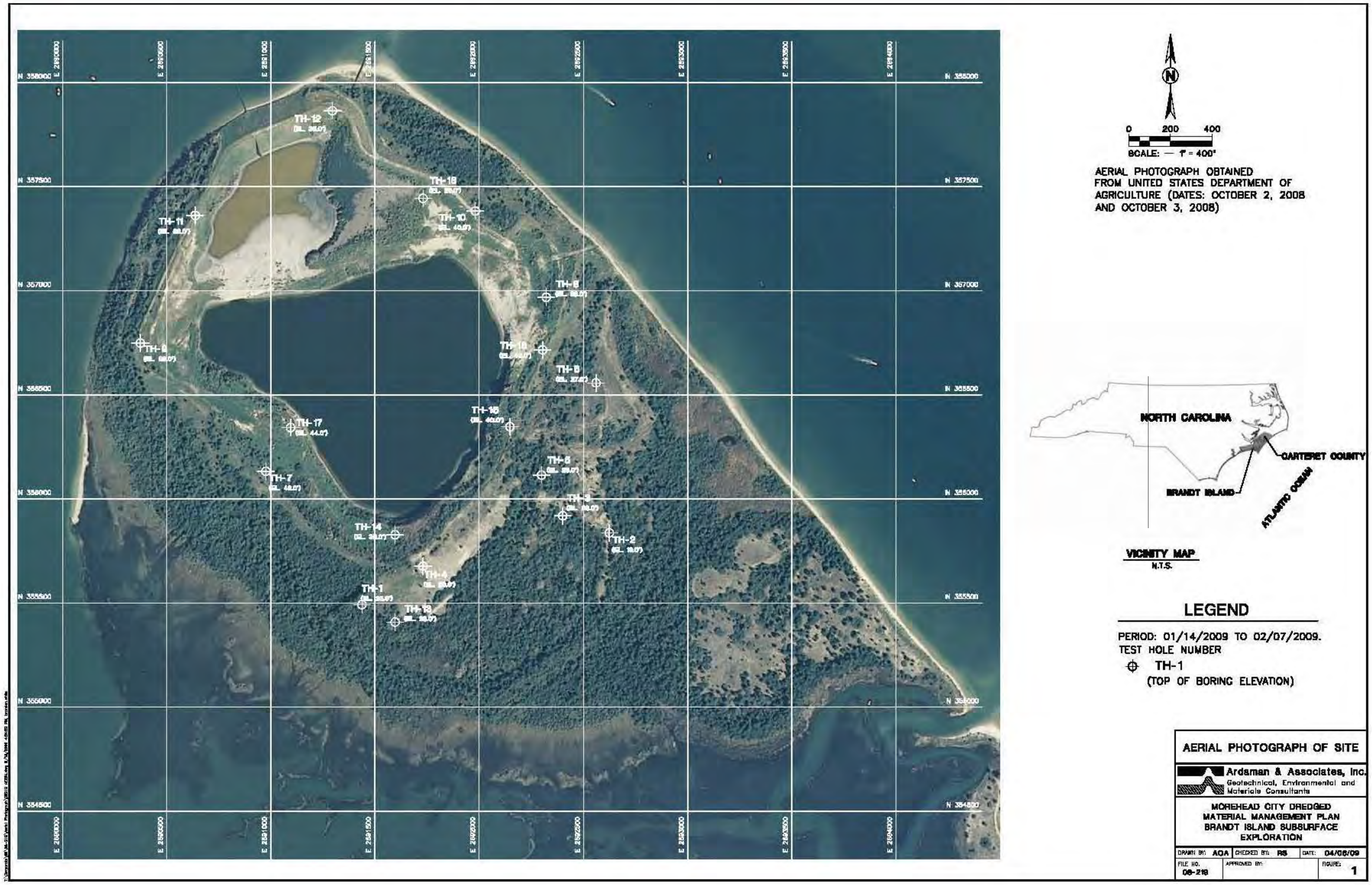


Figure B-4. Brandt Island Soil Boring Locations

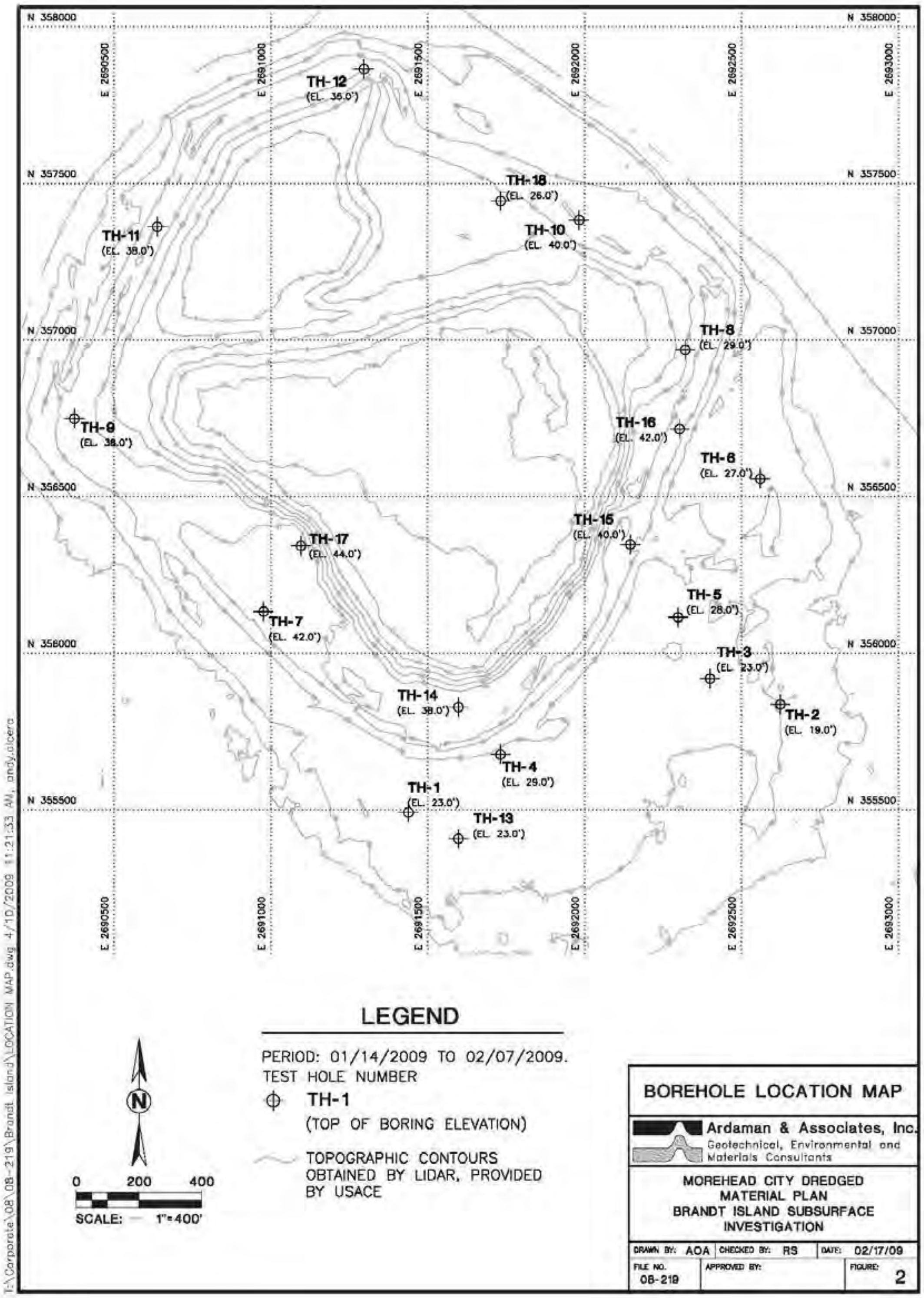


Figure B-5. Soil Boring Locations (with Topographic Contours)

SUBSURFACE CONDITIONS. Based on the boring data, the site consists predominately of sands with interbedded layers of silt. The existing dike material is almost exclusively fine sand material. The foundation below the existing dike is predominately sand, but some areas have layers of silt interbedded throughout the foundation. These silt layers vary in thickness and in strength. There are generally three different foundation conditions at the site.

Conditions encountered at each boring location are indicated on the individual boring logs. Based on the results of the borings, the following three general subsurface conditions exist at the site.

The soil profile at borings TH-2, TH-5, TH-15 and TH16 consist of sands (SP), sands with silt (SP-SM) and silty sands (SM) from ground surface to the termination depths of the borings. Clay was not encountered within these borings except for a thin ½ inch (TH-2 at 8.5'), 2 inch (TH-5 at 5.5') and 2 inch (TH-16 at 29.0') thick seams at the locations.

The soil profile at borings TH-3 and TH-12 consist of sands (SP) and sands with silt (SP-SM) from ground surface to the termination depth of the borings except a thin 6 inch thick layer of very soft fat (CH) clay at depths of 22.5 feet (Elevation 1.5 feet MSL) and 21 feet (Elevation 11.0 feet MSL), respectively.

Twelve of the borings (TH-1, TH-4, TH-6 through TH-11, TH-13, TH-14, TH-17, and TH-18) encountered one or more layers in excess of 1 foot thick of very soft (N<2 blows/foot) to soft (N of 2 to 4 blows/foot) lean (CL) to fat (CH) clay or very loose (N < 4 blows /foot) to loose (N of 4 to 10 blows/foot) clayey sand (SC) within a profile otherwise comprised of sands (SP) to silty sands (SM). The clays and clayey sands typically occurred as 1 to 4.5-foot thick layers within the upper portion of the borings above elevation 14 feet (MSL) or typically below elevation -5 feet (MSL) as 1 to 6-foot thick layers.

The depth to groundwater at boreholes TH-2, TH-3, TH-5, TH-6, TH-7, TH-9, TH-11, TH-14, TH-17 and TH-18 was estimated based on visual observation of the moisture content of the jar samples. The depth to groundwater was measured in borings TH-1, TH-4, TH-8, TH-10, TH-12, TH-13, TH-15 and TH-16 at depths in the range of 3.0 to 12.5 feet below existing ground surface. The specific groundwater depths indicated on the boring logs represent the groundwater surface encountered during drilling on the date shown on the logs. It must be noted that fluctuations in groundwater level will occur due to variations in rainfall, tidal fluctuation, and other factors which may vary from the time the test borings were performed

STABILITY ANALYSIS. A stability analysis is a way to quantify, with a factor of safety, the hazard that a sliding or overturning failure will occur. Specific engineering criteria for the stability analysis dictate the minimum factor of safety, which is typically between 1.3 and 1.5 depending on the case.

A stability analysis was performed on the Brandt Island Dike at the crest elevation of 55 feet.

The software used to perform the analysis was the UTEXAS4 program. UTEXAS4 is a general-purpose software program for limit equilibrium slope stability computations. UTEXAS4 computes a factor of safety, F, with respect to shear strength. The method of analysis used to determine the factor of safety for Brandt Island is Spencer's procedure (Spencer 1967, Wright 1970). Spencer's procedure fully satisfies static equilibrium for each slice within the failure area. Both circular and non-circular failure surfaces are analyzed by the UTEXAS4 software program.

The areas of the alignment were grouped into similar foundations based on the soils data. Three foundation areas were determined based on the subsurface investigation results. Soil properties and strengths were assigned to the foundation layers based on the lab testing results from the subsurface investigation and for areas not tested, and good engineering practice. The soil strength properties for the critical section are show in Table B-3. The stability analysis was performed only on the dike height of elevation 55'. As long as this height is stable, it is assumed that all lower dikes will also be stable. The stability analysis was performed using the Spencer method, which is the preferred method of the USACE, per EM 1110-2-1902 Engineering and Design – Slope Stability. Both circular and wedge failures for each of the three foundation groups were analyzed. Based on the stability analysis results, the dike in the area of boring TH-11 has the weakest foundation and ability to support the dike. Based on the UTEXAS4 stability analysis, the minimum factor of safety for the Brandt Island dike is 1.37. This minimum factor of safety exceeds the minimum required in EM 1110-2-1902 Engineering and Design – Slope Stability criteria of 1.3 for the end of construction case and is acceptable for the elevation 55' dike design. Based on the results of the Stability analysis of the Brandt Island Dike, staged construction will not be required. Using good engineering practice the dikes should be raised no more than 5 feet at a time. By raising the dike in 5 foot intervals the settlement and risk of a stability failure will be minimized.

LAYER	SOIL TYPE	LOCATION	C[1] (psf)	φ[2]	γ[3] (pcf)
1	Sand	Embankment	0	28	100
2	Sand	Embankment	0	28	100
3	Sand	Embankment	0	30	115
4	Sand	Foundation	0	32	120
5	Sand	Foundation	0	28	115
6	Sand	Foundation	0	32	120
7	Silt	Foundation	800	0	105
8	Sand	Foundation	0	28	110
9	Sand	Foundation	0	30	115
10	Sand	Foundation	0	32	120
11	Silt	Foundation	1300	0	110
12	Sand	Foundation	0	30	115
13	Silt	Foundation	500	0	110
14	Sand	Base	0	32	120

[1]C - Cohesive Strength (psf)
[2]φ - Angle of Internal Friction
[3]γ - Unit Weight (pcf)

Table B-3. Soil Strength Properties for the Critical Section

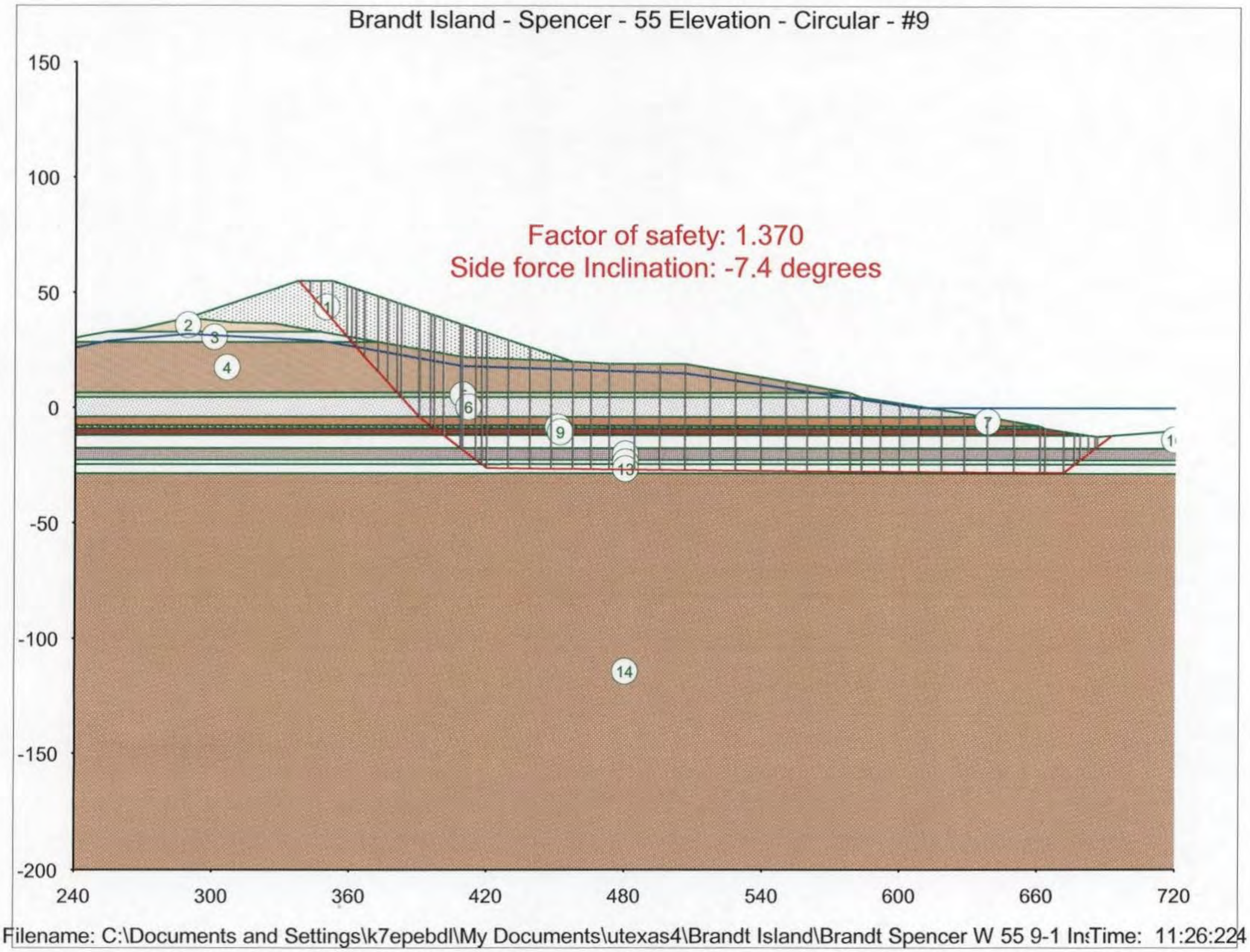


Figure B-6. Stability Analysis Critical Section

New Nearshore Placement Area Soil Analysis

Expansion of the Nearshore West placement area and a new Nearshore East placement area are proposed to provide an additional location for placement of harbor material with up to 20 percent silt/clay. As part of the environmental and cultural investigation performed on the ebb tide delta, 48 soil grab samples were taken on each ebb tide delta, for a total of 96 soil samples were collected in August of 2009. The purpose of these samples was to determine the distribution of the silt content of the ebb tide delta. The samples collected were tested for grain size distribution in accordance with ASTM D 422. The sieves typically used in the testing were the 3/4", 3/8", #4, #7, #10, #14, #18, #25, #35, #45, #60, #80, #120, #170, #200, and #230 sieves. The shell content of each sieve size fraction of each sample was visually estimated to the nearest 5 percent. The estimated total shell content of each sample was calculated using the visually estimated shell content retained on each sieve, the percent dry mass of the sample retained on the sieve, and calculating the weighted average of the full sample. The qualitative amount of shell was described as trace (< 5%), few (5 to 10%), little (15 to 25%), and some (30 to 45%) in accordance with ASTM Standard D 2488. The individual sample test results can be found following this main body of this appendix.

The lowest silt/clay content of a sample was 2A which contained 0.4 percent silt/clay, and the highest silt content in a sample was 90A which contained 61.0 percent silt/clay. The silt/clay content is defined as the percentage of material, by weight, passing the #200 sieve. Out of the 96 sites sampled (USACE 2010b), 21.8 % of the sites contained 10.3 % to 61.0 % silt/clay, and 42.7 %had a low silt/clay content (<2 % silt/clay). Areas of high silt/clay content (>10 % and <61.0 %) were found with one large group of sites occurring principally offshore of Shackleford Banks and several smaller areas offshore of Bogue Banks, in water depths ranging from ~20 to 49 ft. Areas of low silt/clay content (less than <2 % silt/clan content) predominantly were found along the ebb tide delta and along the nearshore of Bogue and Shackleford Banks. A grouping of these stations also occurs offshore in ~40 ft of water. Three large groups of medium silt/clay content (>2 and <10 % silt/clay content) occurred in the mid to nearshore of Shackleford Banks, offshore of the ebb tide delta, and in the mid to nearshore of Bogue Banks.

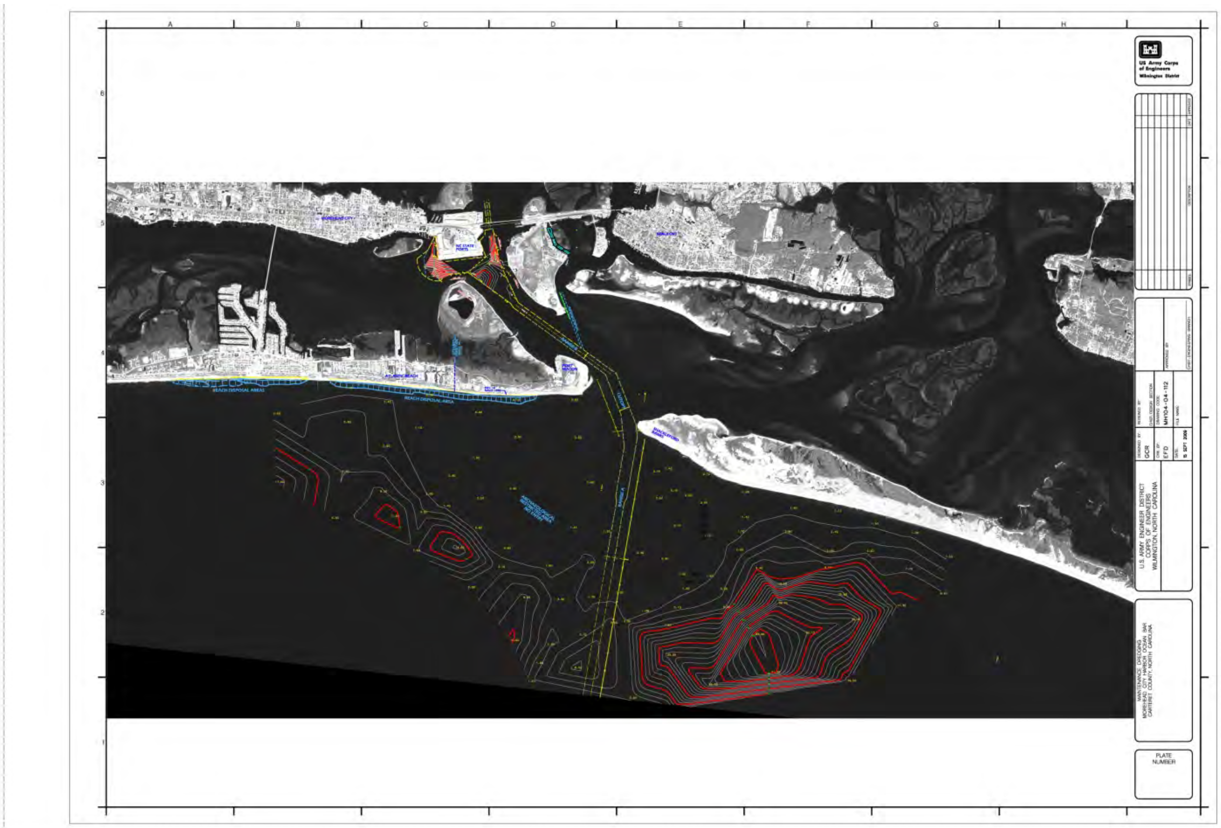


Figure B-7. Nearshore grab sample locations and silt/clay content contours

As shown in Figure B-7, the silt/clay content typically increases from the ebb tide delta to the offshore areas in deeper water depths. The ebb tide delta contains material that is greater than 20 percent silt/clay, and placement of material in this area is expected to redistribute the material to its natural silt/clay content. It is therefore acceptable to place material of 80 percent or greater sand in the nearshore areas.

The primary reasons for the placement of sandy material that is 80 percent or greater sand in both the new nearshore placement areas are as follows:

a. Generally speaking, sediments on the eastern side of the navigation channel have a lower sand content than sediments on the western side, making this side of the channel a more natural fit for sediment with slightly higher silt content.

b. It is the opinion of the USACE, based upon dredging experience, that silt content of dredged material will decrease (and sand content will, as a result increase) as it is placed in a nearshore area and becomes subject to wave and current action.

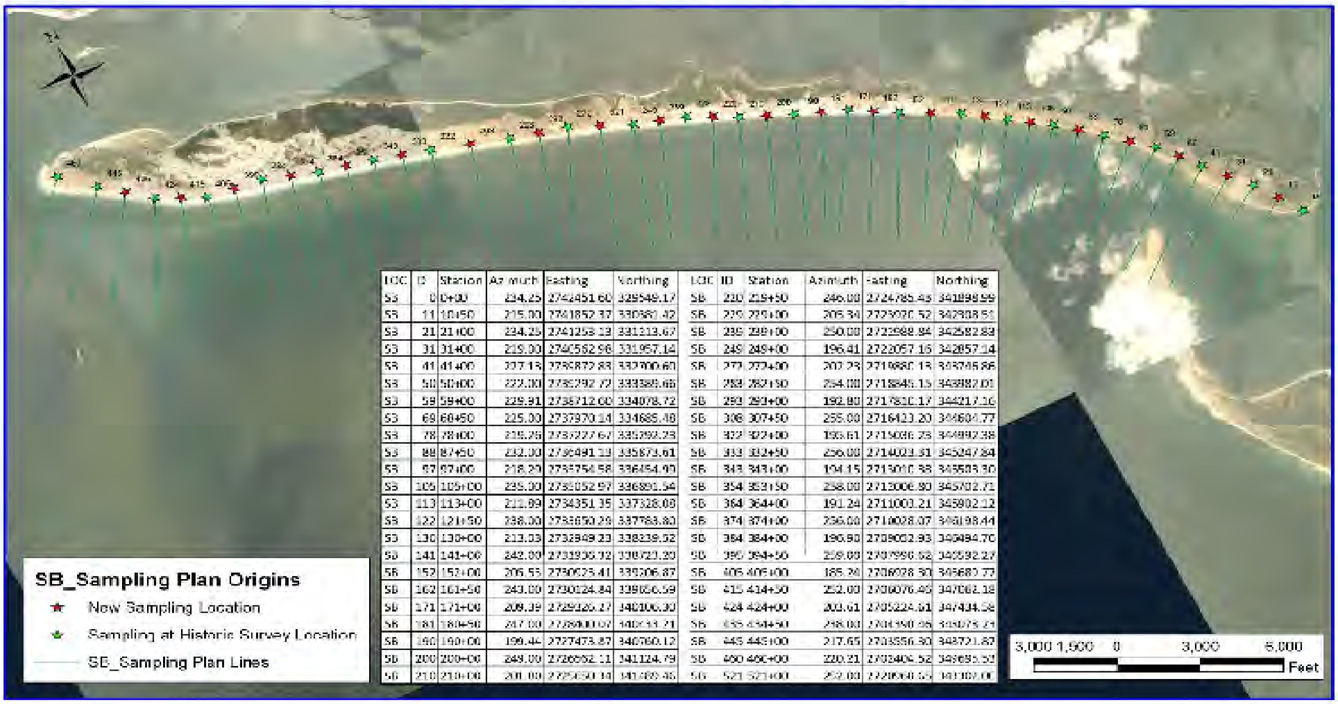
c. From 1995 to the present, the material placed by the USACE in the existing Nearshore West has been at least 90 percent sand. As the USACE monitors material movement on both sides of the channel in the upcoming years, placing only material that is at least 90 percent sand in the Nearshore West will allow for the incorporation of the monitoring that has been conducted from 1995 to the present, and allow meaningful comparisons to be drawn between the two placement areas and their performance. This segregation would also facilitate and more accurate assessment of the health of benthic communities in the vicinity of this placement area.

Creation of a New Disposal Area on Shackleford Banks

The Morehead City Harbor DMMP is considering the disposal of maintenance dredged sediment on the beach of Shackleford Banks. Sampling of Shackleford Banks was performed to document the qualitative values of the native beach prior the disposal of dredged material on the beach. An analysis of the material in the Harbor compared to the native material on Shackleford Banks was performed to assure that the Harbor material is acceptable for disposal on the Shackleford Banks beach.

The sampling locations consisted of 46 transects along the entire length of the beach as shown in Figure B-8. The transects were located at each of the historic survey locations. Additional transects were spaced equally between the historic survey locations so that the spacing is approximately 1000’ between the transects. Fourteen samples were taken along each transect. The sample locations are the dune, dune toe, berm crest, MHW, MSL, MLW, trough, bar crest, -6 MLW, -10 MLW, -12 MLW, -18 MLW, -24 MLW, and -30 MLW as shown on Figure B-9. The sieves used in the grain size testing were the 3/4”, 3/8”, #4, #7, #10, #14, #18, #25, #35, #45, #60, #80, #120, #170, #200, and #230 sieves. An analysis was performed with the grain size results of the samples taken on Shackleford Banks. The % shell content of each sample was determined by estimating visually the amount of shell on each sieve, during the sieve procedure, to determine the overall sample shell content. The color of all samples, both moist and dry, was determined by the Munsell Color System. Key criteria were determined through this analysis. The analysis determined the % coarser than then #4 sieve, the % coarser than then #10 sieve, the % finer than then #200 sieve, the % finer than then #230 sieve, the visual % shell content of the native beach, and the overfill ratio.

Shackleford Banks Sampling Plan Locations



LOC	ID	Station	Azimuth	Easting	Northing	LOC	ID	Station	Azimuth	Easting	Northing
SB	0	0+00	234.25	2742451.60	329549.17	SB	220	219+50	246.00	2724785.43	341898.99
SB	11	10+50	215.00	2741852.37	330381.42	SB	229	229+00	205.34	2723920.52	342308.51
SB	21	21+00	234.25	2741253.13	331213.67	SB	239	239+00	250.00	2722988.84	342582.83
SB	31	31+00	219.00	2740562.96	331957.14	SB	249	249+00	196.41	2722057.16	342857.14
SB	41	41+00	227.13	2739872.83	332700.60	SB	272	272+00	207.23	2719880.13	343745.86
SB	50	50+00	222.00	2739292.72	333389.66	SB	283	282+50	254.00	2718845.15	343982.01
SB	59	59+00	229.91	2738712.00	334078.72	SB	293	293+00	192.80	2717810.17	344217.16
SB	69	68+50	225.00	2737970.14	334685.48	SB	308	307+50	255.00	2716423.20	344604.77
SB	78	78+00	215.26	2737227.67	335292.23	SB	322	322+00	193.61	2715036.23	344992.38
SB	88	87+50	232.00	2736491.13	335873.61	SB	333	332+50	256.00	2714023.31	345247.84
SB	97	97+00	218.29	2735754.58	336454.99	SB	343	343+00	194.15	2713010.38	345503.30
SB	105	105+00	235.00	2735052.97	336891.54	SB	354	353+50	258.00	2712006.80	345702.71
SB	113	113+00	211.89	2734351.35	337328.08	SB	364	364+00	191.24	2711003.21	345902.12
SB	122	121+50	238.00	2733650.29	337783.80	SB	374	374+00	236.00	2710028.07	346198.44
SB	130	130+00	213.03	2732949.23	338239.52	SB	384	384+00	190.90	2709052.93	346494.70
SB	141	141+00	242.00	2731936.32	338723.20	SB	395	394+50	259.00	2707996.62	346592.27
SB	152	152+00	206.55	2730925.41	339206.87	SB	405	405+00	185.24	2706928.30	346680.77
SB	162	161+50	243.00	2730124.84	339656.59	SB	415	414+50	252.00	2706076.46	347062.18
SB	171	171+00	209.39	2729326.27	340106.30	SB	424	424+00	203.61	2705224.61	347434.58
SB	181	180+50	247.00	2728400.07	340433.21	SB	435	434+50	248.00	2704390.46	348078.21
SB	190	190+00	199.44	2727473.87	340760.12	SB	445	445+00	217.65	2703556.30	348721.87
SB	200	200+00	249.00	2726562.11	341124.79	SB	460	460+00	220.21	2702404.52	349695.53
SB	210	210+00	201.00	2725650.34	341489.46	SB	521	521+00	252.00	2720964.55	[illegible]

Figure B-8. Shackleford Banks Sample Locations

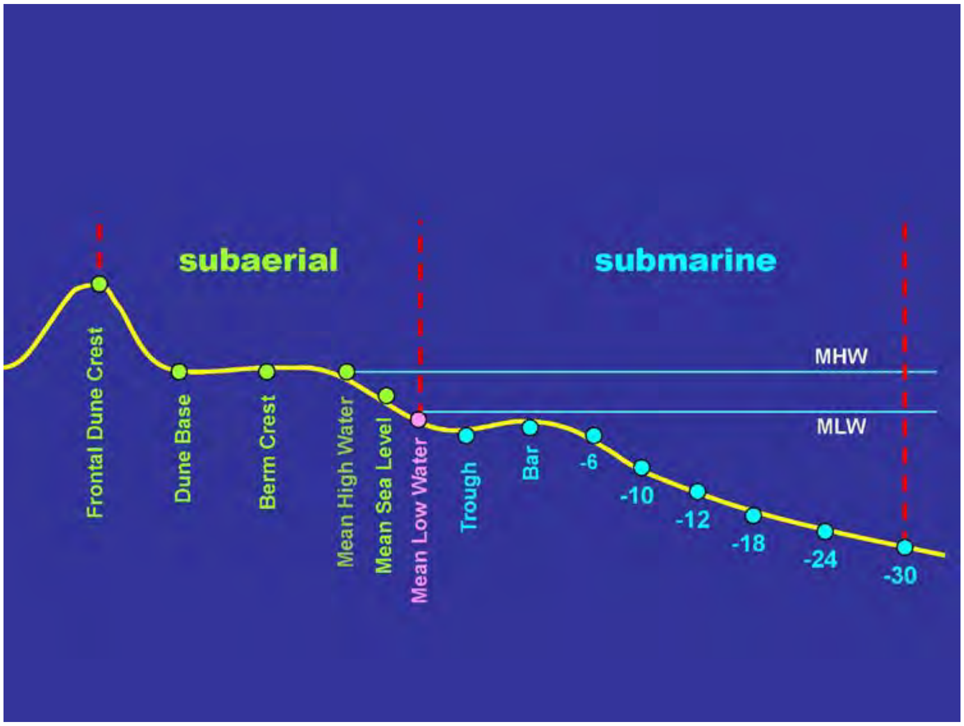


Figure B-9. Shackleford Banks Grab Sample Locations Along Beach Transect

The Shackleford Banks beach was divided into 4 groupings for the grain size analysis. The 4 groupings used in the analysis are the dune to a depth of -24 ft offshore (the approximate depth of closure to wave impact); the dune base to -24 ft; the dune base to MLW; and the beach trough to -24 ft. These groups were chosen for comparison to the Harbor material. The group from the dune to -24 is the condition that most matches the criteria for the "native beach." The results of the composite analysis were determined by averaging the samples from each grouping.

Between 2005 and 2008 numerous vibracore borings were performed in the Morehead City Harbor Channel to determine the characteristics of dredged materials considered for beach disposal. The Morehead City Harbor ranges where sediments were collected for beach disposal were Ranges A, B, C, and the Cutoff.

Borings designated MIH-05-V-# and MOB-05-V# were vibracore borings performed in 2005. Borings designated MHC-06- # are vibracore borings performed in 2006. These borings are located in Range C. Borings designated MHCOB-07-V-# are vibracore borings performed in 2007. Borings designated MHC-08-V-# are vibracore borings performed in 2008. These borings are located throughout the Morehead City Harbor Channel from range C to Range A. They represent the most comprehensive set of borings performed to date for the identification of material to be dredged. All borings were drilled to a depth below the dredging depth unless vibracore refusal was encountered. Vibracore refusal was defined as a penetration rate of less than 0.1 feet in 10 seconds. Sediment samples taken below the project depth were not included in the analyses.

In all, 130 sediment samples were included in the analyses as described below. All samples within the channel limits to overdepth were tested in accordance with ASTM D 422. The sieves typically used in the testing were the 3/4”, 3/8”, #4, #7, #10, #14, #18, #25, #35, #45, #60, #80, #120, #170, #200, and #230 sieves. Hydrometer analyses were not performed on materials passing the #230 sieve. The results from the analysis of the harbor material were determined by the weighted average of each sample distributed over the length that the samples represents.

The color of the sediment from the Morehead City Harbor channel was not documented to a standard test procedure. However, during the winter of 2010 and 2011, dredged sediment from the Morehead City Outer Harbor was placed on the beaches of Fort Macon State Park to the Town of Atlantic Beach. On April 2011, Wilmington District staff walked the beach disposal areas and determined the color of the sediment by the Munsell Color System. Eighteen (18) transects were sampled from Fort Macon State Park to the circle in the Town of Atlantic Beach. Spacing between transects was about 1,000 feet and 3 dry sediment samples per transect (from the MHW contour, berm crest, and toe of dune) were color coded.

Specific grain size analysis categories and composite approaches are required by the NC Sediment Criteria - Technical Standards for Beach Fill Projects. The categories used in the NC Sediment Criteria are the material less than 0.0625 millimeters, greater than or equal to 0.0625 millimeters and less than 2 millimeters, greater than or equal to 2 millimeters and less than 4.76 millimeters, and greater than or equal to 4.76 millimeters and less than 76 millimeters. The determination of these parameters was performed as part of the analysis to compare the harbor material to the Shackleford Banks beach material. The use of this criteria is a detailed way to determine if the harbor material is suitable for disposal on Shackleford Banks.

The NC Technical Standards indicate that sediment is compatible for use as beach fill if the following five criteria are met:

a. Fine grained (less than 0.0625 mm) sediment is less than 10%,

b. The average percentage of fine grained (less than 0.0625 mm) sediment is less than 5% greater than that of the recipient beach, and

c. The average percentage of calcium carbonate (% shell) does not exceed 15% of the recipient beach.

d. The average percentage by weight of granular sediment (greater than or equal to 2 mm and less equal to 4.76 mm) in a borrow site shall not exceed the average percentage by weight of coarse sand sediment of the recipient beach characterization plus 5%.

e. The average percentage by weight of gravel (greater than or equal to 4.76 mm) in a borrow site shall not exceed the average percentage by weight of gravel sized sediment for the recipient beach characterization plus 5%.

Based on the analysis of the grain sizes of the sediments of the Morehead City Harbor sediments and the Shackleford Banks sediments, the following is a comparison of the NC Sediment Criteria categories:

a. and b. The Morehead City Harbor sediments contain 3.6% fine grained soil compared to Shackleford Banks sediment containing 1.0% fine-grained soil (passing the #230 sieve (0.063 mm)). The Harbor sediments contain less than 10% fine grain soils and less than 5% greater fine grain sediment compared to the Shackleford Banks sediments. (i.e., 3.6% is less than 6% (1% plus 5% = 6%)).

c. The Morehead City harbor sediment contains 16.0% visual shell. The Shackleford composite (recipient beach) contained 13.9% visual shell. The harbor sediment does not exceed 15% of the recipient beach (i.e., 16.0% is less than 28.9% (13.9% + 15% = 28.9%)).

d. Sediment which is greater (coarser) than or equal to 2 mm and less (finer) than 4.76 mm is the difference between that retained by the # 10 sieve (2.0 mm) and the #4 sieve (4.76 mm). For the Morehead City Harbor sediment the percent passing #4 sieve is 98.1% and passing #10 is 95.4%, a difference of 2.7%. For Shackleford Banks the percent passing the #4 sieve is 96.6% and passing the #10 sieve is 92.5%, a difference of 4.1%. The harbor sediment is LESS THAN 5% of the Shackleford sediment (i.e., 2.7% is less than 9.1% (4.1% plus 5% = 9.1%)).

e. The sieve size of gravel (greater than or equal to 4.76 mm) is greater than the #4 sieve. The Morehead City Harbor sediment percent passing the #4 sieve is 98.1 and Shackleford Banks is 96.6%. That means that the Harbor sediment is 1.9% gravel (100 - 98.1 = 1.9%). Shackleford Banks is 3.4% gravel (100 - 96.6 = 3.4%). Again the harbor sediment is less than 5% of the Shackleford sediment (i.e., 1.9% is less than 8.4% (3.4% plus 5% or 8.4%).

Table B-4 below summarizes information applicable to the NC Sediment Criteria. This table also includes the comparison of the mean and standard deviation of the sediment of the Morehead City Harbor and the sediment of Shackleford Banks. Again the Shackleford Banks Dune to -24 is considered to be the condition that most matches the criteria for the “native beach.”

The mean and standard deviation was calculated in phi units for the Morehead City Harbor sediments and the Shackleford Banks beach sediments. The Morehead City

Harbor sediments' mean was calculated as 1.90 phi (.27 mm). The Shackleford Banks Beach sediments' mean was calculated as 1.56 phi (.34 mm). This shows that the Morehead City Harbor sediment is slightly finer than the Shackleford Banks beach sediment. The standard deviation of the Morehead City Harbor sediments was calculated as .84 phi and the standard deviation of the Shackleford Banks sediments was calculated as 1.13 phi. See Table B-1.

Based on the sediment analysis, the Morehead City Harbor maintenance sediment meets the North Carolina compatibility criteria for disposal on Shackleford Banks. The histogram in Figure B-10 compares the distribution of the 4 groups of Shackleford Banks sediments to the Morehead City Harbor sediments.

	SAMPLES	MEAN (phi)	STD DEV (phi)	% PASSING #4	%PASSING #10	% PASSING #200	% PASSING #230	% VISUAL SHELL
	-	-	-	-	-	-	-	-
Morehead City Outer Harbor	**130**	**1.90**	**0.84**	**98.1**	**95.4**	**3.6**	**3.6**	**16.0**
Shackleford Banks Native Data DN to -24	**598**	**1.56**	**1.13**	**96.6**	**92.5**	**1.2**	**1.0**	**13.0**
Shackleford Banks Native Data DB to -24	**552**	**1.54**	**1.20**	**96.3**	**91.9**	**1.3**	**1.0**	**13.9**
Shackleford Banks Native Data DB to MLW	**230**	**0.91**	**1.29**	**94.2**	**87.1**	**0.4**	**0.4**	**22.2**
Shackleford Banks Native Data TR to -24	**322**	**2.00**	**0.88**	**97.8**	**95.3**	**1.9**	**1.5**	**8.0**

Table B-4. Grain Size Comparison of NC Sediment Criteria Results

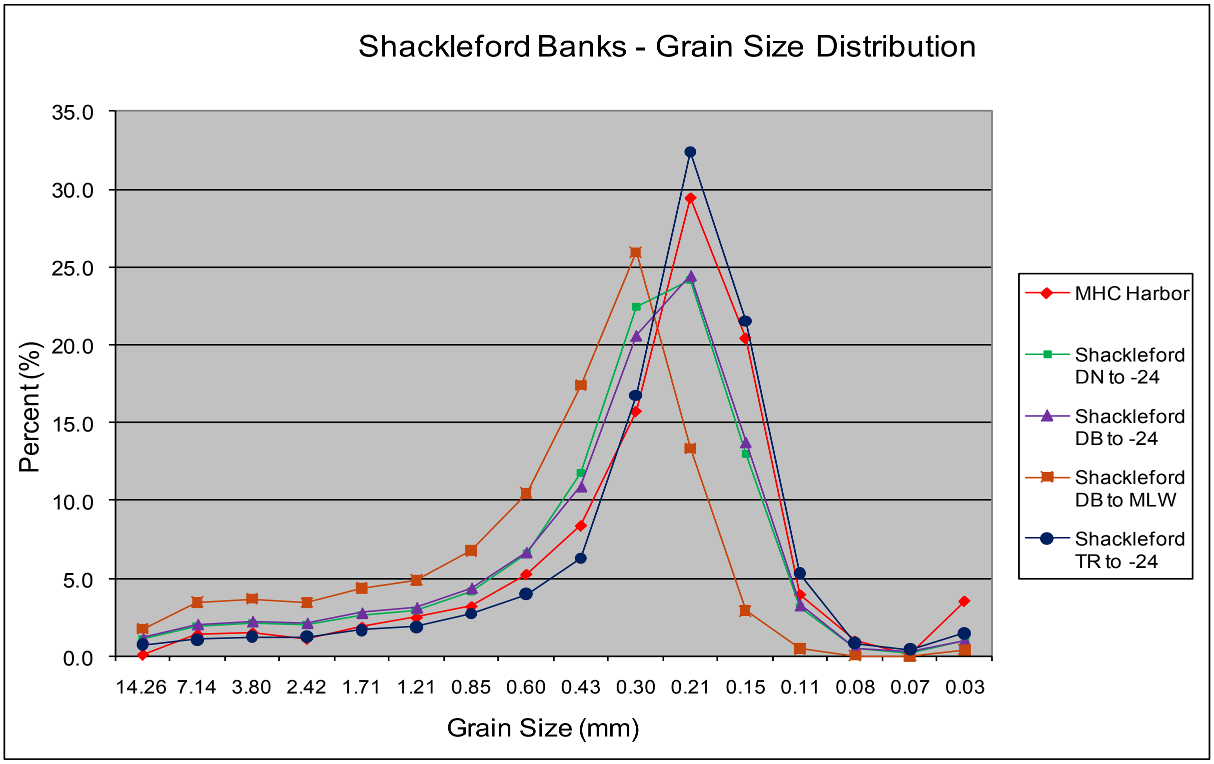


Figure B-10. Grain Size Distribution for Shackleford Banks and Harbor Soils

The suitability of the borrow material for disposal on the beach is based on the overfill ratio. The overfill ratio is computed by numerically comparing the size distribution characteristics of the native beach sand with that in the borrow area and includes an adjustment for the percent of fines in the borrow area. The overfill ratio is primarily based on the assumption that the borrow material will undergo sorting and winnowing once exposed to waves and currents in the littoral zone, with the resulting sorted distribution approaching that of the native sand. Since borrow material will rarely match the native material exactly, the amount of borrow material needed to result in a net cubic yard of beach fill material will generally be greater than one cubic yard. The excess material needed to yield one net cubic yard of material in place on the beach profile is the overfill ratio. The overfill ratio is defined as the ratio of the volume of borrow material needed to yield one net cubic yard of fill material. For example, if 1.5 cubic yards of fill material is needed to yield one net yard in place, the overfill factor would equal 1.5. (SPM)

The overfill criteria developed by James (1975) is the method used in the Automated Coastal Engineering System (ACES). The procedure is also described in the U.S. Army Coastal Engineering Manual (CEM) EM-1110-2-1100 Part V (July 2003).

The Dean’s equilibrium method (Dean, 1991) determines the volume of recharged sand of a given grain size to increase the width of dry beach by a given amount. Dean proposed that beach profiles develop a characteristic parabolic equilibrium profile. (CEDD)

The equilibrium slope method by Pilarczyk, van Overeem and Bakker (1986) bases the recharged profile on the present native profile. However, if the grain size of the fill material is different from the native material, the profile steepness is altered. (CEDD)

The Krumbein and James Method is only applicable if the native material is better sorted than the fill material. If the fill material is better sorted than the native material, this method simply does not apply. Secondly, the Krumbein and James Method assumes that the portion of the fill material retained on the beach after sorting by waves and current will have exactly the same size distribution of the native material. This implies that both the fine and coarse portion of the fill will be lost. This feature is not consistent with the knowledge of sediment transport process as the coarser portion of the fill will likely remain on the beach without being carried away by waves and currents (Dean, 1974; also Dean and Dalrymple, 2002). The overfill ratio by the Krumbein and James Method will tend to be overestimated. Dean (1974) addressed the above shortcomings by assuming that only the finer portion of the fill will be winnowed away by prevailing wave condition leaving the mean diameter of altered distribution of fill material to be at least as large as the mean diameter of native material. Dean defines the overfill ratio as the required replacement volume of fill material to obtain one unit of compatible beach material and uses the 'phi' unit to describe the size of sand particle. (CEDD)

Krumbein and James (1965) established a method for estimating the additional quantity of fill material required if the fill and native sediment are dissimilar. The method involved multiplying the required volume of beach material, assuming a natural grading, by a critical overfill ratio R_{crit} to determine the quantity of fill material over and above that required by the absolute dimensions of the proposed nourishment works. (CEDD)

The overfill ratio for the Shackleford Banks Beach compared to the Morehead City Inner Harbor material was calculated by all 5 methods. The group from the dune to -24 is the most condition that most matches the criteria for the "native beach." For the overfill calculation results, see Table B-5 below. The Equilibrium Profile Method (EPM) is considered to be the most accurate method base in it taking into consideration the shape of the fill and the significant wave height. Based on the EPM, the overfill ratio for is 1.22. Any value of less that 1.5 is considered acceptable for use as beach renourishment. It should be pointed out that this is not a renourishment project, but that the material meets the stringent requirements for soils to be used for a renourishment project.

	MEAN (phi)	STD DEV (phi)	Overfill Ratio Assumed: Berm Height=6' Berm Width=150' Significant Wave Height=6.2' ACES	EPM	ESM	Dean Method	K and J Method
Morehead City Outer Harbor	-1.90	-0.84	NA	NA	NA	NA	NA
Shackleford Banks Native Data DN to -24	-1.56	-1.13	2.353	1.22	1.49	1.1	0.672

ACES - Automated Coastal Engineering System
EPM - Equilibrium Profile Method
ESM - Equilibrium Slope Method
K and J - Krumbein and James Method

Table B-5. Shackleford Banks Overfill Ratios

REFERENCES

JAMES, W.R., "Techniques in Evaluating Suitability of Borrow Material for Beach Nourishment," TM-60, Coastal Engineering Research Center, U. S. Army Engineer Waterways Experiment Station, Vicksburg, Miss., Dec. 1975.

CIRIA (1996). Report 153 – Beach Management Manual. Construction Industry Research and Information Association, United Kingdom, 448p.

Dean, R.G. (1974). Compatibility of Borrow Material for Beach Fills. Proceedings of the 14th International Conference on Coastal Engineering, ASCE, Copenhagen, pp. 1319-1333.

Dean, R.G. (1991). Equilibrium beach profiles : Characteristics and applications. Journal of Coastal Research, Volume 7, No. 1, pp. 53-84.

Dean, R.G. and R.A. Dalrymple (2002). Coastal Processes with Engineering Applications. Cambridge University Press, 475p.

Krumbein, W.C. and James, W.R. (1965). A log-normal size distribution model for estimating stability of beach fill material. Technical Memorandum No. 16, Coastal Research Centre, US Army Corps of Engineers.

Pilarczyk, K.W., Van Overeem, J. and Bakker, W.T. (1986). Design of beach nourishment scheme. Proceedings 20th International Conference on Coastal Engineering, Taiwan.

APPENDIX C

SHOALING ANALYSIS

Historic Shoaling Rates

Purpose: The purpose of the shoaling analysis section of this report is to determine the average amount of material that is shoaling into the navigation channel at Morehead City Harbor on an annual basis. The Morehead City Harbor navigation channel is broken into six major ranges as follows:

- Range A
- Cutoff
- Range B
- Range C / East Leg
- West Leg
- Northwest Leg

These ranges are then separated based on the quality of material contained within each area (figure 1). Ranges that contain coarse-grained (≥90 percent sand) which is suitable for beach disposal include: Range A out to station 110+00; the Cutoff; Range B; and a portion of Range C/East Leg from the seaward extent through station 17+00. Ranges containing fine-grained (<90 percent sand) material include: Range A from station 110+00 seaward; Range C/East Leg from station 17+00 landward; the West Leg; and the Northwest Leg. Beach compatibility is based on the most recent boring log information taken from each range and is discussed in detail within the Geotechnical Appendix of this report.

Shoaling rates for the given ranges can be used to estimate several future needs with regard to disposal/placement areas, to include ensuring sufficient volume is available for the estimated disposal quantities. Also, the rates can be used to determine disposal island pumpout frequencies as well as estimate quantities available for beach disposal of acceptable sand material.

Historical Data: The basis for the shoaling study is the historical surveys collected and maintained by the Wilmington District Navigation section. The entrance channel, ocean bar, and inner harbor are surveyed on a regular basis to ensure proper depth is maintained. In addition to these condition surveys, the channel is also surveyed just prior to and immediately after dredging events. These historic surveys were collected and imported into a new diagnostic modeling tool as part of a demonstration project by Taylor Engineering (Carvalho and Albada, 2006). The focus of the tool is to provide a useful way to monitor shoal rates within navigation channels. As part of the demonstration project, surveys were processed through 2005. The remainder of the surveys through 2007 were collected and processed by the Wilmington District Coastal Engineering section as part of this shoaling calculation effort.

Assumptions: Several assumptions were made for the calculation of channel shoal rates prior to beginning the work. They are as follows:

- First, the analysis is based on a comparison of bathymetric surveys only. Due to time constraints, a comparison of the surveys to the dredging template was not made.
- Partial surveys were included in the comparison with the assumption that the survey covered all areas within the channel that may have shoaled. Surveys that were very small in coverage area were excluded.
- All comparisons were made within the lateral bounding limits of the channel polygon. Any dredging that may have occurred outside the authorized channel lateral limits was not considered. Dredging volume that occurred within the lateral limits of the authorized channel that was below the authorized depth was included in the analysis.
- Shoaling rates were generally limited to between the years 2000 and 2007 due to funding and time limitations.

Methods and Results: As discussed earlier, the Diagnostic Modeling System ESRI extension was used to compute volumetric changes between surveys. Change values were computed between surveys and categorized four ways: condition survey to before dredge survey; after dredge to before dredge survey; after dredge to condition survey; and before dredge to after dredge survey. In the absence of a valid before or after dredge survey for a given time period, the condition survey closest to the date of the missing survey would be used as a substitute to measure trends.

Once volume differences were computed between survey events they were sorted to group similar survey dates. Survey comparisons between common dates, i.e. two different condition surveys compared to the same before dredge survey, would have their individual shoal rates averaged to produce one shoal rate that represented this time period. Once all shoal rates were computed the average shoal rate for the type of comparison, i.e. after dredge to condition, would be computed. This would ultimately produce three shoal rates, one each for the after dredge to condition, the condition to before dredge, and the after dredge to before dredge. These three rates would then be averaged into what is used as the representative shoal rate for a particular section of the channel. Final shoaling rates for each section of the navigation channel are shown in Table 1.

Historic Dredge Volumes:

Purpose: In an attempt to correlate the newly developed shoaling rates with the amount of material historically dredged from the channel, an average annual dredging rate was developed based on the historic dredge volumes.

Historic Data: The navigation channel and inner harbor was broken into six regions based on historic dredging contracts between 1997 and 2008, as follows:

- Range A
- Cutoff

- Range B
- Range C / East Leg
- West Leg
- Northwest Leg

Unlike shoaling rates developed previously using the actual survey data, these data were not separated into beach quality material and non-beach quality material. This was due to the limited nature of the available contract data which typically only includes channel quantities for before dredge and after dredge conditions, as well as the overdepth volume. Overdepth volume is material dredged beyond the authorized channel template and is subtracted from the volume calculated based on the before dredge and after dredge surveys. This final pay quantity was used as the basis for developing the average annual dredging rates for historic dredging.

<u>Methods and Results:</u> Actual pay volume quantities were organized into one of the six regions described above by survey date. Due to the variability of the number of dredging events for each reach and the time between surveys, an average was computed for both the dredge volume and duration between events. These average values were then used to compute the average annual dredging rate by dividing the average volume dredged by the average duration between dredging events. A summary of the results is shown in table 1.

To make comparisons between the shoaling rate and the average annual dredging rate calculations, ranges for the survey based shoaling rates had to be combined into the six ranges used in the dredging rate analysis. The last column in table 1 shows the substantial difference in the two calculation methods. There are multiple explanations for the differences observed between the two methods. The first reason for the difference is that the average annual dredging rate does not include material dredged from outside the channel template as a result of it being based on pay quantities only. Secondly, material that shoals into the navigation channel during the dredging process is unaccounted for in the pay quantities. The period of time that a contractor occupies a section of the navigation channel for dredging varies, but can range between four to eight weeks for a typical section. Since contracts are typically paid based on material removed between after dredge and before dredge surveys, the contractor must remove the amount specified in the construction contract and shoaling during construction as well. For example, an eight week dredging operation would remove roughly 17 percent of anticipated yearly shoaling which would not be represented in the final quantity. The third reason for shoaling rates to be higher than average annual dredging rates would be that previous dredging events may have not removed all shoaling within the channel. Shoaling that occurs within the channel, but does not restrict navigation may not be removed until such point that it becomes a navigational issue. Also, shoaling has occurred in areas such as the Shackleford Banks spit at the intersection of Range A and the Cutoff where the typical hopper dredging plant is unable to dredge the navigation channel to its full alignment. Lastly, maintenance of the project is frequently limited by funding.

Given these differences, the most reliable tool to predict shoaling volumes within the channel would be the survey based shoaling rates applied over the anticipated period between dredging events.

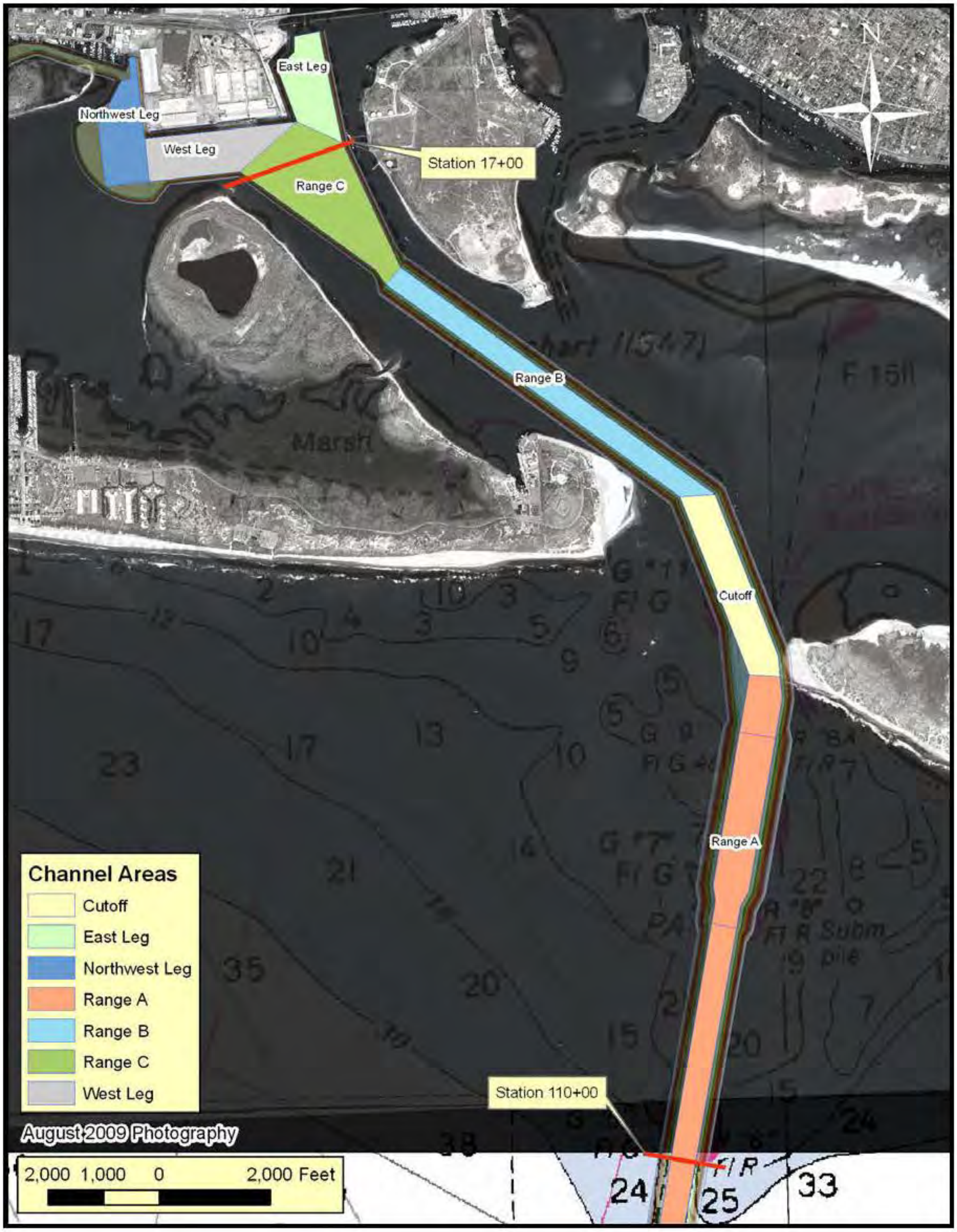


Figure 2

	Shoaling Rates Based on Survey Comparison (AD, BD, and Condition Surveys 2000-2007)				Average Annual Dredging Rates (1997 - 2008)		
Range	Representative Shoaling Rate (C.Y./Year)	Shoaling Rate (C.Y./day)	Combined Shoaling Rate (C.Y./Year)	Combined by Range (C.Y./Day)	Representative Dredging Rate (C.Y./Year)	Dredging Rate (C.Y./day)	% Difference
Range A Suitable	630,500	1,727					
Range A Unsuitable	118,500	325	749,000	2,052	547,600	1,500	-26.89%
Range B	170,000	466	170,000	466	45,400	124	-73.29%
Cutoff	324,500	889	324,500	889	182,500	500	-43.76%
Range C Eastleg Suitable	80,500	221					
Range C Eastleg Unsuitable	86,000	236	166,500	456	138,200	379	-17.00%
West Leg	28,000	77	28,000	77	23,200	64	-17.14%
Northwest Leg	80,000	219	80,000	219	60,900	167	-23.88%

Table 1

Reference:

Carvalho, Alexandra, Ph.D. and Edward Albada, P.E., 2006. “Morehead City Harbor DMS Data Manager Application Carteret County, North Carolina”, Taylor Engineering, Jacksonville, FL.

APPENDIX D

PUBLIC AND AGENCY CORRESPONDENCE

November 26, 2007

Environmental Resources Section

Dear Sir or Madam:

The U.S. Army Corps of Engineers, Wilmington District, is initiating work on the Morehead City Harbor Dredged Material Management Plan (DMMP). The purpose of the DMMP is to address long-term (20-year) management of the dredged material from Morehead City Harbor, (see enclosed map). The DMMP studies will involve data collection, compilation, analyses, evaluations, surveys, mapping, coordination, and management necessary to address the major alternatives and to coordinate a DMMP report. We plan on completing the DMMP process in two years.

At this time we are inviting your participation in project planning through the scoping process and are requesting comments from agencies, interest groups, and the public to identify significant resources, issues of concern, and recommendations for studies considered necessary. Comments received during the scoping process will be considered as we conduct our studies and identify dredged material disposal alternatives and evaluate them from engineering, economic, and environmental perspectives. These items will be addressed in the DMMP and likely in a National Environmental Policy Act (NEPA) document. The document, if necessary will be prepared in accordance with the Council on Environmental Quality and the Corps of Engineers regulations for implementing the National Environmental Policy Act of 1969, as amended. The purpose of the NEPA document is to ensure that the environmental consequences of managing the disposal of dredged material removed from the navigational channels are considered and environmental and project information is available to the public.

A scoping meeting is planned for a later date in Morehead City, North Carolina. We will present the Morehead City Harbor DMMP objectives and elaborate on measures being considered.

Written comments are presently requested to help us identify significant issues that should be addressed during the preparation of the DMMP and any associated NEPA document. Please provide your comments within 45 days from the date of this letter so that they may be considered during our evaluations and decisions process. Early identification of issues will facilitate our ability to address them in our studies. Comments should be addressed as follows:

U.S. Army Corps of Engineers,
Wilmington District
Attention: Mr. Stacy Samuelson (CESAW-TS-PE)
Post Office Box 1890
Wilmington, North Carolina 28402-1890

CESAW-TS-PE/Samuelson

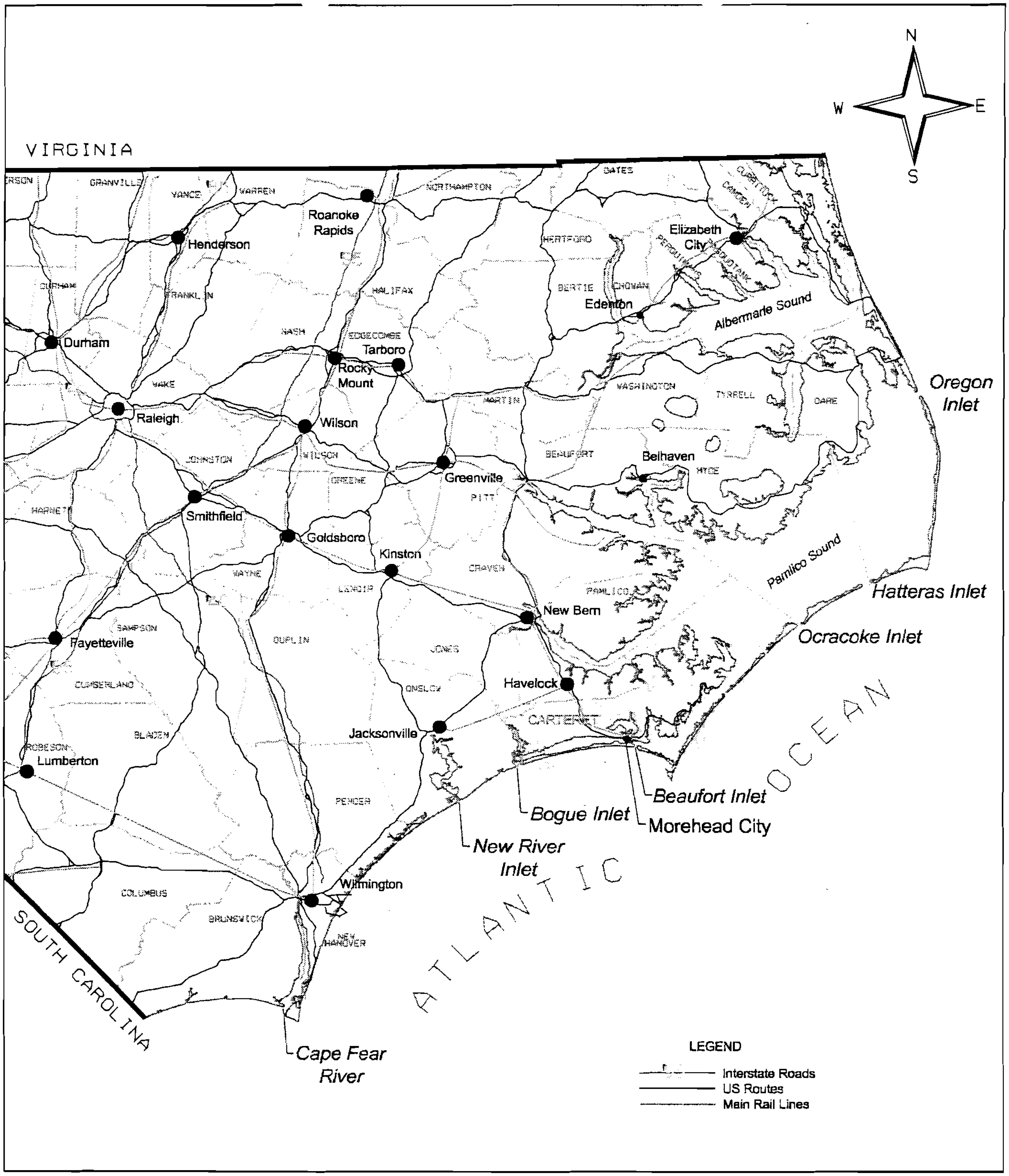
If you have any questions concerning this matter, please call Mr. Stacy Samuelson, Environmental Resources Section, at (910) 251-4480 or email Stacy.D.Samuelson@usace.army.mil. If you would like to be informed of the date and location of the scoping meeting please let Mr. Samuelson know so that we can provide the pertinent information.

Sincerely,

W. Coleman Long
Chief, Planning and Environmental Branch

Enclosure

CESAW-TS-PE/Samuelson
CESAW-TS-PE/Payonk
CESAW-PM-Blount
CESAW-OC/McCorcle
CESAW-TS-P/Long/s
Return to Brenda Willett
Mail
Mailing List will be EIS Standard, Carteret County



0 15 30 MILES

SCALE: 1" = 30 MILES

EXHIBIT 1.1
LOCATION MAP

MOREHEAD CITY VICINITY

North Carolina
Department of Administration

Michael F. Easley, Governor | Britt Cobb, Secretary

November 30, 2007

Mr. W. Coleman Long
U.S. Army - Corp of Engineers
Wilmington District
P.O. Box 1890
Wilmington NC 28402-1890

Dear Mr. Long:

Subject: Scoping - Development of the Morehead City Harbor Dredging Material Management Plan (DMMP) to address long-term (20-year) management of the dredged material from Morehead City Harbor in Carteret County.

The N. C. State Clearinghouse has received the above project for intergovernmental review. This project has been assigned State Application Number 08-E-0000-0157. Please use this number with all inquiries or correspondence with this office.

Review of this project should be completed on or before 01/14/2008 . Should you have any questions, please call (919)807-2425.

Sincerely,

Chrys Baggett

Ms. Chrys Baggett
Environmental Policy Act Coordinator

cc: Mr. Stacy Samuelson

Mailing Address:
1301 Mail Service Center
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Location Address:
116 West Jones Street
Raleigh, North Carolina

NCDENR
North Carolina Department of Environment and Natural Resources
Division of Marine Fisheries
Michael F. Easley, Governor
William G. Ross Jr., Secretary
Dr. Louis B. Daniel III, Director

December 20, 2007

US Army Corps of Engineers
Wilmington District
Attention: Mr. Stacy Samuelson (CESAW-TS-PE)
PO Box 1890
Wilmington, NC 28402-1890

Dear Mr. Samuelson:

The North Carolina Division of Marine Fisheries (DMF) would like to offer the following comments concerning development of the Morehead City Harbor Dredged Material Management Plan (DMMP).

The North Carolina Coastal Habitat Protection Plan (CHPP) which was developed through the efforts of staff from DMF, NC Division of Coastal Management, NC Division of Water Quality, NC Wildlife Resources Commission, and NC Division of Environmental Health and adopted by the NC Marine Fisheries Commission, NC Environmental Management Commission and NC Coastal Resources Commission makes the following recommendations concerning studies necessary for the proper use of dredge material for beach renourishment:

1. Identify more specific minimum and maximum sediment grain sizes to minimize biological impacts to the intertidal beach community.

2. Determine the minimum distance required between undisturbed areas within/bordering the renourishment project to provide adequate sources of intertidal organism for recolonization and food for fish.

3. Determine the time interval between projects to allow full recovery of benthic communities based on project season/duration, compatibility of sediment size and other parameters.

The CHPP also contains the following recommendations concerning beach renourishment projects:

1. Restrict beach nourishment projects to winter months to minimize mortality of infauna and enhance recovery rates of intertidal benthic organisms.

2. Conduct adequate monitoring of the effects of beach nourishment on the soft bottom community and associated surf fish populations.

The NC Marine Fisheries Commission has also established the following general policies related to large-scale beach dredge-and-fill projects:

1. Projects should fulfill the Commission's general habitat policy by avoiding, minimizing and offsetting damage to the marine and estuarine resources of North Carolina;

2. Projects should provide detailed analyses of possible impacts to each type of essential Fish habitat (EFH), with careful detailed analyses of possible impacts to Habitat Areas of Particular Concern (HAPC) and Critical Habitat Areas (CHA), including short and long term, and population and ecosystem scale effects;

3. Projects should provide a full range of alternatives, along with assessments of the relative impacts of each on each type of EFH, HAPC, and CHA;

4. Projects should avoid impacts on EFH, HAPCs and CHAs that are shown to be avoidable through the alternative analysis, and minimize impacts that are not;

5. Projects should include assessments of potential unavoidable damage to marine resources, using conservative assumptions;

6. Projects should be conditioned on the avoidance of avoidable impacts, and should include compensatory mitigation for all reasonably predictable impacts to the marine and estuarine resources of North Carolina, taking into account uncertainty about these effects. Mitigation should be local, up-front and in-kind wherever possible;

7. Projects should include baseline and project-related monitoring adequate to document pre-project conditions and impacts of the projects on the marine and estuarine resources of North Carolina;

8. All assessments should be based upon the best available science, and be appropriately conservative so as to be prudent and precautionary; and

9. All assessments should take into account the cumulative impacts associated with other beach dredge and-fill projects in North Carolina and adjacent states, and other large–scale coastal engineering projects that are ecologically related.

Thank you for the opportunity to comment on development of the DMMP. Please inform DMF of the date and location of the scoping meeting.

Sincerely,

Michael D. Marshall

Michael D. Marshall
Central District Manager

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 4
ATLANTA FEDERAL CENTER
61 FORSYTH STREET
ATLANTA, GEORGIA 30303-8960

DEC 1 3 2007

Mr. Stacy Samuelson (CESAW-TS-PE)
U.S. Army Corps of Engineers
Wilmington District
P.O. Box 1890
Wilmington, North Carolina 28402-1890

Dear Mr. Samuelson:

This letter is in response to your request for comments to the initiation of work on the Morehead City Harbor Dredged Material Management Plan (DMMP), dated November 26, 2007. The U.S. Environmental Protection Agency (EPA), Region 4 wants to ensure that throughout the development of the DMMP, all matters related to ocean disposal of dredged material and proper management and monitoring of the Morehead City Ocean Dredged Material Disposal Site (ODMDS) are adequately addressed and coordinated with EPA.

Should you have any questions or reach the point where ocean dumping specifics need to be identified, please contact Mr. Gary Collins of my staff at 404/562-9395. I ask that you also inform Mr. Collins of the date and location of the scoping meeting, as well as any other important meetings related to this matter.

Sincerely,

Thomas C. Welborn, Chief
Wetlands, Coastal and Nonpoint Source Branch

NCDENR

North Carolina Department of Environment and Natural Resources

Division of Parks and Recreation

Michael F. Easley, Governor | William G. Ross Jr., Secretary | Lewis R. Ledford, Director

January 28, 2008

U.S. Army Corps of Engineers,
Wilmington District
Attention: Mr. Stacy Samuelson (CESAW-TS-PE)
Post Office Box 1890
Wilmington, North Carolina 28402-1890

Dear Mr. Samuelson:

It is good to hear that the U.S. Corp of Engineers will be completing a Morehead City Harbor Dredged Material Management Plan (DMMP) within the next two years. This type of study is needed, and I hope Fort Macon can have some input into the plan.

As you may know, Fort Macon State Park has started receiving material from the Morehead City Inner Harbor, and it has been placed on the shoreline of Ft. Macon State Park in the vicinity of the bathhouse structures. We hope to continue to receive this placement of material in the future. Please keep me informed of any meetings that are planned for the DMMP.

Sincerely,

Jody Merritt

Jody Merritt, Park Superintendent
Fort Macon State Park
PO Box 127
Atlantic Beach, NC 28512

NORTH CAROLINA STATE PARKS
1916 Naturally Wonderful 2006

Samuelson, Stacy D SAW

From: Bouchard, Jennifer A LT CNRMA [jennifer.bouchard@navy.mil]

Sent: Monday, December 10, 2007 12:12 PM

To: Samuelson, Stacy D SAW

Subject: Morehead City Harbor DMMP

Mr. Samuelson,

Good afternoon, Sir. I have just recently taken over as Officer in Charge, Navy Port Control in Morehead City. This morning I received an email with the complaint filed against the US Army Corps of Engineers by Carteret County. Of course our concern is the future inability of Navy Ships to enter the harbor safely for Marine on load and off load if the dredging is not able to be conducted. If possible I would like to attend the scoping meeting. Will you send me the date, time, and location of the meeting. Thank you for your assistance.

Very Respectfully,

LTJG Jennifer Bouchard
OIC Navy Port Control Morehead City, NC
113 Arendell St #114 Morehead City, NC 28557
Office: (252) 726-1976 Cell: (252) 241-8498 Fax: (252) 726-7693
NIPR E-mail: jennifer.bouchard@navy.mil
SIPR E-mail: mowreywc@2mawcp.usmc.smil.mil
gutierrezgd@2mawcp.usmc.smil.mil

United States Department of Agriculture

NRCS

Natural Resources Conservation Service
4405 Bland Road, Suite 205
Raleigh, North Carolina 27609

Phone: (919) 873-2134
Fax: (919) 873-2154
Email: mike.hinton@nc.usda.gov

December 4, 2007

Mr. Stacy Samuelson
CESAW-TS-PE
USACOE-Wilmington District
P. O. Box 1890
Wilmington, NC 28402-1890

Dear Mr. Samuelson:

Thank you for the opportunity to provide comments on Morehead City Harbor Dredged Material Management Plan (DMMP), Carteret County, North Carolina.

The Natural Resources Conservation Service does not have any comments at this time.

If you need additional information, please feel free to contact me at (919) 873-2134.

Sincerely,

Michael J. Hinton
Planning Specialist

North Carolina Department of Cultural Resources
State Historic Preservation Office
Peter B. Sandbeck, Administrator

Michael F. Easley, Governor
Lisbeth C. Evans, Secretary
Jeffrey J. Crow, Deputy Secretary

Office of Archives and History
Division of Historical Resources
David Brook, Director

February 1, 2008

Stacy Samuelson
US Army Corps of Engineers
PO Box 1890
Wilmington, NC 28402-1890

Re: Morehead City Harbor Dredging Materials Management Plan, Morehead City, Carteret County, CH 07-2621

Dear Mr. Samuelson:

Thank you for your letter of November 30, 2007, concerning the above project.

There are numerous National Register-listed properties within the project area described in your scoping letter. These need to be considered for inclusion in your report.

Furthermore, the Dredging and Disposal of Materials from Morehead City Harbor has potential to impact the National Register Historic Property, Queen Anne's Revenge, 31CR314, as well as known and unknown sites in the vicinity. These properties and potential impacts should be considered throughout the planning stage.

The above comments are made pursuant to Section 106 of the National Historic Preservation Act and the Advisory Council on Historic Preservation's Regulations for Compliance with Section 106 codified at 36 CFR Part 800.

Thank you for your cooperation and consideration. If you have questions concerning the above comment, contact Renee Gledhill-Earley, environmental review coordinator, at 919-807-6579. In all future communication concerning this project, please cite the above referenced tracking number.

Sincerely,

Renee Gledhill-Earley

Peter Sandbeck

cc: State Clearinghouse

MOREHEAD CITY
NORTH CAROLINA PORTS
WILMINGTON

Rex Edwards
Director of Operations
Port of Morehead City

January 3, 2008

Mr. Stacy Samuelson (CESA W-TS-PE)
Wilmington District, U.S. Army Corps of Engineers
P.O. Box 1890
Wilmington, NC 28402-1890

Dear Mr. Samuelson:

The North Carolina State Ports Authority submits the comments below in response to your letter dated November 26, 2007, requesting comments and recommendations on initiation of a Morehead City Harbor Dredged Material Management Plan (DMMP) and studies considered necessary to identify and evaluate dredged material disposal alternatives. The Authority's position focuses on the economic benefits that the Port provides to the Morehead City community, the State of North Carolina, and the United States, while expressing support for incorporation of beneficial use of dredge materials in the Corps' policy and practices.

1. The Authority is deeply concerned about any action that would prevent dredging projects required to maintain the Morehead City Harbor navigation channel from safely accommodating transit by commercial vessels that use the state Port of Morehead City, vessels that serve the interests of national defense, and other craft used in maritime related business and recreational activities to the benefit of businesses, industry, and the citizens of North Carolina.

2. Failure to maintain full project channel dimensions in Morehead City would seriously jeopardize the Authority's ability to serve our current customer base, as well as hamper our efforts to secure new business. Cargo handling activities at the state Port support nearly 13,000 statewide jobs and $49 million dollars in local and state tax revenues that would be in jeopardy.

3. The Port of Morehead City partners with the Department of Defense, serving as one of the nation's 15 strategic ports for national defense – providing a platform for wartime and peacetime overseas military deployment of military personnel and equipment used to support our national defense efforts.

North Carolina State Ports Authority
113 Arendell Street • Morehead City, NC 28557
Tel: (252) 808-4205 • Fax: (252) 726-1190 • Email: rex_edwards@ncports.com • http://www.ncports.com

4. The Authority supports regional dredged material management. A DMMP and supporting studies are essential tools for demonstrating alternatives, risks, and benefits within a watershed.

5. The Authority fully supports development of a DMMP for Morehead City Harbor and any funding needed to expedite this plan.

6. The Port of Morehead City serves as a gateway to world markets for North Carolina's businesses, industries, and citizens. Products handled at the Port include phosphate used for fertilizers, lumber, natural rubber, scrap metal, and ore used to fabricate fiberglass. These commodities come from or are shipped throughout the world, particularly India, Venezuela, Brazil, China, and Indonesia.

7. Examples of regional and statewide economic benefits are:
   a. Morehead City's longtime and highly valued customer, PCS Phosphate, depends on the Port to sell fertilizer products throughout the world – fertilizer that is mined at the PCS mine in Aurora, NC.
   b. Fencing material is delivered from Morehead City to locations throughout North Carolina (such as Salisbury, Henderson, Elizabeth City, and Weldon) and to the East and Gulf Coast regions. Products handled at the Port of Morehead City impact thousands of North Carolinians who earn their living at plants and mills.
   c. The natural rubber from Indonesia is used at the Bridgestone Firestone plant in Wilson and the Goodyear plant in Fayetteville. The Port of Morehead City is the second-largest port in the nation for natural rubber imports.
   d. The scrap steel imported via Morehead City goes to the Nucor mill in Tunis and is used in recycled steel plates.

8. Examples of local economic impacts associated with maritime industry are:
   a. The Authority directly employs 75 people with an annual payroll in excess of $3.5 million.
   b. Related businesses and service providers such as the International Longshoremen's Association, harbor pilots, tug companies, shipping agents, stevedores, surveyors and marine equipment suppliers provide an estimated 250 additional jobs, salaries and revenues to the local economy.
   c. Approximately 1,000 additional induced jobs that include those who work at the stores, restaurants, hospitals, and schools used by port workers.

North Carolina State Ports Authority
113 Arendell Street • Morehead City, NC 28557
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9. The Authority supports and advocates beneficial use of dredge material at each of North Carolina's deepwater ports while ensuring full project dimensions at these ports. We have worked successfully with the NC Division of Water Resources and the U.S. Army Corps of Engineers to place maintenance dredge material on Bogue Banks beaches.

10. The Authority supports efforts to alter the law and policies that require "least cost disposal" by the Corps of Engineers to allow the benefits of beach disposal as positive attributes of a Corps of Engineers' maintenance-dredging project.

11. The beneficial use of a limited resource should be a significant decision making factor in the formulation of a DMMP. Placement of beach quality sand on adjacent public beaches and the resulting regional benefits should be Project accountable. Claiming the benefits from a positive use of a dredged material resource should be used in calculating project justification and the cost benefit ratio. Examples of such benefits are:
    a. Federal and State tax base protection;
    b. Tourism industry protection;
    c. Municipal infrastructure protection;
    d. Potential deferral of FEMA outlays; and,
    e. Environmental restoration.

12. The Authority supports efforts to bolster the Corps of Engineers budget to enable beneficial use of dredge material.

Please feel free to contact me at any time with additional questions or concerns.

Sincerely,

Rex Edwards
Director of Operations, Port of Morehead City

North Carolina State Ports Authority
113 Arendell Street • Morehead City, NC 28557
• Tel: (252) 808-4205 • Fax: (252) 726-1190 • Email: rex_edwards@ncports.com • http://www.ncports.com

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Raleigh Field Office
Post Office Box 33726
Raleigh, North Carolina 27636-3726

January 22, 2008

Mr. Stacy Samuelson
Environmental Resources Section
Wilmington District, U. S. Army Corps of Engineers
P. O. Box 1890
Wilmington, North Carolina 28402-1890

Subject: Morehead City Harbor Dredged Material Management Plan

Dear Mr. Samuelson:

This letter provides scoping comments of the U. S. Fish and Wildlife Service (Service) on the proposed Morehead City Harbor Dredged Material Management Plan (DMMP) Project which was briefly outlined in a letter, dated November 26, 2007, from Coleman Long. That letter stated that the Wilmington Corps District (Corps) was initiating work on plans for the long-term (20-years) management of the material dredged from the Morehead City Harbor, Carteret County, North Carolina. The letter also stated that the project would involve data collection, compilation, analyses, evaluations, surveys, mapping, coordination, and management necessary to address the major alternatives and coordinate a DMMP report. Development of the DMMP is expected to be completed in two years.

These comments are submitted in accordance with the Fish and Wildlife Coordination Act (FWCA) (48 Stat. 401, as amended; 16 U.S.C. 661-667d). The FWCA mandates that wildlife conservation shall receive equal consideration and be coordinated with other factors of water-resource development programs through effectual and harmonious planning, development, maintenance, and coordination of wildlife conservation and rehabilitation. The FWCA essentially establishes fish and wildlife conservation as a coequal purpose or objective of federally funded or permitted water resources development projects. Additional comments are provided pursuant to section 7 of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531-1543).

The disposition of dredge material from the Morehead City navigation channel over a 20 year period has the potential to impact important fish and wildlife resources in the project area. However, conservation measures are available to minimize the environmental impacts of both the sediment removal and disposition. The Service recommends the following measures be considered in the development of the DMMP:

1. The plan should include a sampling program to determine the physical characteristics of sediment to be removed. These physical characteristics include sand grain size,

density, shear resistance, color, heavy mineral content, calcium carbonate content, and moisture content.

2. The planning process should identify the range of potential disposal locations. Such sites as area beaches, upland disposal areas, and offshore disposal sites should be described and the fish and wildlife resources using each area should be discussed.

3. Based on the physical characteristics of the sediment to be removed, standards should be established for material which would be placed in the various disposal locations. Careful analysis should be used for directing dredge material to oceanfront beaches. Any material to be used as beach fill should have a high degree of compatibility with the native beach. The North Carolina Sediment Criteria Rule, contained in the Technical Standards for Beach Fill Projects (15A NCAC 07H .0312), should be used in regard to grain size and percent weight of calcium carbonate. In addition, compatibility should be established for other important characteristics such as organic content, heavy mineral content, and color. Any beach fill should have a color similar to the natural beach. While sediment compatibility standards may be lower for beach disposal operations than for formal beach construction projects, the Service recommends that all material used for beach fill should have a high degree of compatibility. Any beach disposal resulting from the DMMP should use the same standards of sediment compatibility as those applied to civil works beach construction projects.

4. Sediment removal and disposal should be scheduled during the least sensitive period of the year for the organisms dependent on the habitats to be affected. Dredged material disposal on ocean beaches requires consideration of nesting by federally protected sea turtles as well as the use of these areas by the federally threatened piping plover (*Charadrius melodus*) for nesting, overwintering, and migratory stopovers. Due to the potential harm to these federally protect species, the Service has recommended that dredging and disposal be prohibited during the combined period of sea turtle/piping plover reproductive activities, April 1 through November 15.

5. Project planning should consider the life cycle of beach invertebrates in the scheduling of any beach disposal. Peterson et al. (2000) documented invertebrate populations following disposal of dredge spoil from the Atlantic Intracoastal Waterway in Bogue Sound on the beaches of Bogue Banks during March through May 1990. Populations of important beach invertebrates were reduced by 86-99% (compared to control beaches) five to ten weeks following fill placement. The authors conclude that "failure of *Emerita* [mole crabs] and *Donax* [coquina clams] to recover from nourishment by mid summer when they serve as a primary prey base for important surf fishes, ghost crabs, and some shorebirds may be a consequence of the poor match in grain size and high shell content of source sediments and/or extension of the project too far into the warm season" (Peterson et al. 2000, p. 368, abstract). Scheduling beach disposal outside the larval recruitment period of beach invertebrates will ensure better recovery of these species. Peterson et al. (2000, p. 376) recommend that future sand placements should be designed to end before the onset of the warm season (April or May in North Carolina) when *Donax* and *Emerita* return to the intertidal beach. Therefore, planning for the DMMP should seek to end all

beach disposal operations by March 31 or, at the latest, by April 30 to conserve these invertebrates that form an important food resource for shorebirds and coastal fisheries.

6. Project plans should include measures to avoid adverse impacts associated with placement of the sediment pipeline and measures to monitor and mitigate any spills from the pipeline. Any overland sediment pipeline should be aligned to avoid potential shorebird nesting habitat around inlets and sparsely vegetated, undeveloped sandy flats. Overland pipeline routes should be coordinated with state and federal resource agencies to minimize adverse impacts to shorebirds. In-water pipeline placement should avoid all hardbottom areas, submerged aquatic vegetation (SAV), and areas used by shellfish. There should be a plan to monitor pipelines for leaks and an established plan of action to contain any pipeline spills and to remove sediment resulting from a pipeline spill.

7. The Corps should ensure that no hardbottom habitats are affected by sedimentation produced by the project, either as a result of dredging or sediment washing off the beach.

8. While the use of highly compatible fill material for beach fill would minimize turbidity and sedimentation due to runoff from the disposal area, small inclusions of mud and silt pose a risk to nearshore hardbottoms. Project planning should establish a program to monitor the location, areal extent, and major organisms of nearshore hardbottoms prior to implementation of the DMMP. These areas should be surveyed after each beach disposal operation to determine if any adverse sedimentation or changes in the biological community occurred. If it is determined that nearshore hardbottoms are being covered by sediment moving off beach disposal areas, the monitoring program should determine the overall loss of exposed hardbottoms. The DMMP should include a protocol for developing and implementing appropriate mitigation measures for any loss of nearshore hardbottoms. Mitigation measures could include a reduction in the amount of beach fill near vulnerable hardbottoms.

9. Project plans should include measures to ensure that no SAV is adversely affected by either dredging or disposal activities. These measures should include mapping of existing SAV areas prior to implementation of the DMMP and periodic assessment of SAV areas throughout the 20 years of the plan. If dredging or sediment disposal (e.g., runoff of muddy water from a confined disposal facility) results in the loss of SAV, the Corps should coordinate with state and federal resource agencies to develop a mitigation strategy.

10. All beach disposal operations should include surveys for seabeach amaranth (*Amaranthus pumilus*) both before placement and for three years after disposal to avoid direct burial and to monitor recovery of the plant. If data indicate a declining trend in the presence of this federally threatened species, the development of mitigation measures should be part of the DMMP. If beach vitex (*Vitex rotundifolia*), a harmful invasive foreign plant, occurs on any of the beaches to be maintained by disposal operations, the Corps should considering establishing a program to monitor the species and develop efforts to eradicate the plant.

11. Piping plovers are especially susceptible to human disturbance during territory establishment, early nesting attempts, and after the chicks have hatched. Therefore, the work on each beach disposal event should start in less developed areas, such as near an inlet, and progress toward more developed areas over the winter months. For example, a disposal operation starting in December on the eastern end of Bogue Banks should start near the inlet at Fort Macon State Park and move westward toward Atlantic Beach. This order of disposal would result in sediment disposal during late winter and early spring in the more developed parts of the island which are less likely to be used for shorebird nesting.

12. Nesting by sea turtles will benefit from high sediment compatibility standards and work schedules that avoid the nesting season. All beach disposals should occur outside the recognized nesting and incubation season of May 1 through November 15. However, artificial beaches pose additional risks to sea turtle nesting due to: (1) sediment compaction; (2) escarpment formation; and, (3) altered sand temperature which may occur as a result of a change in sediment color. To mitigate sediment compaction, the Service recommends that compaction monitoring should occur after each construction event and for three subsequent years. However, compaction monitoring would not be required if the sediment used to construct the beach is completely washed away. Beach tilling to correct beach compaction should only be performed as a result of an identified compaction problem and not performed routinely in place of compaction monitoring. Similarly, visual surveys for escarpments should be made along the constructed beach immediately after completion of the sediment placement and prior to May 1. Additional surveys should be made for three years following initial construction. Survey results should be submitted to the Service prior to any action being taken. After discussion with the Service, escarpments that interfere with sea turtle nesting or exceed 18 inches in height for a distance of 100 feet should be leveled to the natural beach contour by May 1. The Service should be contacted immediately if new escarpments that interfere with sea turtle nesting or exceed 18 inches in height for a distance of 100 feet form during the nesting and hatching season to determine the appropriate action to be taken. If it is determined that escarpment leveling is required during the nesting or hatching season, the Service will provide a brief written authorization that describes methods to be used to reduce the likelihood of impacting existing nests.

13. During any beach disposal operation, the DMMP should include a program for detecting and securing appropriate care for stranded sea turtles. In many beach communities, private conservation groups consisting of state-approved volunteers already provide a means for recovering stranded sea turtles and a protocol for ensuring that care is made available for those turtles that can be retuned to the ocean.

13. While the West Indian manatee is not likely to be in the project area during a work period from mid-November through April 30, protective measures should be in place to safeguard this endangered species. Corps plans call for the implementation of the Service's "Precautions for General Construction in Areas Which May Be Used by the West Indian Manatee in North Carolina." These guidelines should provide adequate protection for this species.

14. With regard to all federally protected species, the Corps should prepare a Biological Assessment (BA) in accordance with section 7 of the ESA. The BA should describe the potential impacts of the DMMP on each listed species which is likely to occur in the project area. The BA should discuss the conservation measures for the species that will be part of the plan and provide a determination of the extent to which each species will be affected over the entire course of the project.

15. While routine maintenance dredging can be planned based on historic rates of sediment accumulation, emergency situations may arise as a result of hurricanes or other unpredictable events. In emergency situations which threaten navigation, dredge spoil will be generated and the DMMP should address the disposal of this material. The DMMP should define the conditions that would require emergency dredging. The DMMP should clearly state whether emergency dredging will be initiated solely for navigation purposes or as a result of excessive shoreline recession which threatens structures near the beach. That is, the plan should state whether emergency dredging could be initiated solely on the basis of a need for beach fill when there was no threat to navigation.

A thorough consideration of these issues in the development of the Morehead City Harbor DMMP would reduce the adverse environmental impacts that could arise during the 20 years of the plan. The Service appreciates the opportunity to provide these comments and we look forward to continued involvement with the Corps on this project. Please keep this office informed on progress in the planning process. The Service would like to be informed of any scoping meetings for the plan. Any questions regarding these comments should be directed to Howard Hall at 919-856-4520, ext 27, or by e-mail at < howard_hall@fws.gov >.

Sincerely,

John S. Hammond

for Pete Benjamin
Field Supervisor

Literature cited

Peterson, C. H., D. H. M. Hickerson, and G. G. Johnson. 2000. Short-term consequences of nourishment and bulldozing on the dominant large invertebrates of a sandy beach. Journal of Coastal Research. 16:368-378.

cc:

Ron Sechler, National Marine Fisheries Service, Beaufort, NC

Fritz Rohde, NC Division of Marine Fisheries, Wilmington, NC
Stephen Rynas, NC Division of Coastal Management, Morehead City, NC
Maria Dunn, NC Wildlife Resources Commission, Washington, NC
Susan Cameron, NC Wildlife Resources Commission, Stella, NC
Matthew Godfrey, Wildlife Resources Commission, Beaufort, NC

North Carolina
Department of Administration

Michael F. Easley, Governor | Britt Cobb, Secretary

January 17, 2008

U.S. Army - Corps of Engineers
Wilmington District
Attention: Mr. Stacy Samuelson (CESAW-TS-PE)
P.O. Box 1890
Wilmington, NC 28402-1890

Dear Mr.Samuelson:

Re: SCH File # 08-E-0000-0157; Scoping; Development of the Morehead City Harbor Dredging Material Management Plan (DMMP) to address long-term (20-year) management of the dredged material from Morehead City Harbor in Carteret County.

The above referenced environmental impact information has been submitted to the State Clearinghouse under the provisions of the National Environmental Policy Act. According to G.S. 113A-10, when a state agency is required to prepare an environmental document under the provisions of federal law, the environmental document meets the provisions of the State Environmental Policy Act. Attached to this letter for your consideration are the comments made by agencies in the course of this review.

If any further environmental review documents are prepared for this project, they should be forwarded to this office for intergovernmental review.

Should you have any questions, please do not hesitate to call.

Sincerely,

Chrys Baggett/SJG

Ms. Chrys Baggett
Environmental Policy Act Coordinator

Attachments

cc: Region P
Mr. W. Coleman Long, U.S. Army Corps of Engineers

Mailing Address:
1301 Mail Service Center
Raleigh, NC 27699-1301

Telephone: (919)807-2425
Fax (919)733-9571
State Courier #51-01-00
e-mail Chrys.Baggett@ncmail.net

Location Address:
116 West Jones Street
Raleigh, North Carolina

NCDENR
North Carolina Department of Environment and Natural Resources

Michael F. Easley, Governor William G. Ross Jr., Secretary

JAN 2008
RECEIVED
Secretary's Office
DOA

MEMORANDUM

TO: Chrys Baggett
State Clearinghouse

FROM: Melba McGee
Project Review Coordinator

RE: 08-0157 Scoping, Morehead City Harbor Dredged Material Management Plan, Carteret County

DATE: January 15, 2008

The Department of Environment and Natural Resources has reviewed the proposed project. The attached comments are a result of this review. More specific comments will be provided during the environmental review process.

Thank you for the opportunity to respond. If during the preparation of the environmental document, additional information is needed, the applicant is encouraged to notify our respective divisions.

Attachment

1601 Mail Service Center, Raleigh, North Carolina 27699-1601
Phone: 919-733-4984 \ FAX: 919-715-3060 \ Internet: www.enr.state.nc.us/ENR/

NCDENR

North Carolina Department of Environment and Natural Resources
Division of Marine Fisheries

Michael F. Easley, Governor
William G. Ross Jr., Secretary

Dr. Louis B. Daniel III, Director

December 20, 2007

US Army Corps of Engineers
Wilmington District
Attention: Mr. Stacy Samuelson (CESAW-TS-PE)
PO Box 1890
Wilmington, NC 28402-1890

Dear Mr. Samuelson:

The North Carolina Division of Marine Fisheries (DMF) would like to offer the following comments concerning development of the Morehead City Harbor Dredged Material Management Plan (DMMP).

The North Carolina Coastal Habitat Protection Plan (CHPP) which was developed through the efforts of staff from DMF, NC Division of Coastal Management, NC Division of Water Quality, NC Wildlife Resources Commission, and NC Division of Environmental Health and adopted by the NC Marine Fisheries Commission, NC Environmental Management Commission and NC Coastal Resources Commission makes the following recommendations concerning studies necessary for the proper use of dredge material for beach renourishment:

1. Identify more specific minimum and maximum sediment grain sizes to minimize biological impacts to the intertidal beach community.

2. Determine the minimum distance required between undisturbed areas within/bordering the renourishment project to provide adequate sources of intertidal organism for recolonization and food for fish.

3. Determine the time interval between projects to allow full recovery of benthic communities based on project season/duration, compatibility of sediment size and other parameters.

The CHPP also contains the following recommendations concerning beach renourishment projects:

1. Restrict beach nourishment projects to winter months to minimize mortality of infauna and enhance recovery rates of intertidal benthic organisms.

2. Conduct adequate monitoring of the effects of beach nourishment on the soft bottom community and associated surf fish populations.

The NC Marine Fisheries Commission has also established the following general policies related to large-scale beach dredge-and-fill projects:

1. Projects should fulfill the Commission's general habitat policy by avoiding, minimizing and offsetting damage to the marine and estuarine resources of North Carolina;

2. Projects should provide detailed analyses of possible impacts to each type of essential Fish habitat (EFH), with careful detailed analyses of possible impacts to Habitat Areas of Particular Concern (HAPC) and Critical Habitat Areas (CHA), including short and long term, and population and ecosystem scale effects;

3. Projects should provide a full range of alternatives, along with assessments of the relative impacts of each on each type of EFH, HAPC, and CHA;

4. Projects should avoid impacts on EFH, HAPCs and CHAs that are shown to be avoidable through the alternative analysis, and minimize impacts that are not;

5. Projects should include assessments of potential unavoidable damage to marine resources, using conservative assumptions;

6. Projects should be conditioned on the avoidance of avoidable impacts, and should include compensatory mitigation for all reasonably predictable impacts to the marine and estuarine resources of North Carolina, taking into account uncertainty about these effects. Mitigation should be local, up-front and in-kind wherever possible;

7. Projects should include baseline and project-related monitoring adequate to document pre-project conditions and impacts of the projects on the marine and estuarine resources of North Carolina;

8. All assessments should be based upon the best available science, and be appropriately conservative so as to be prudent and precautionary; and

9. All assessments should take into account the cumulative impacts associated with other beach dredge and-fill projects in North Carolina and adjacent states, and other large--scale coastal engineering projects that are ecologically related.

Thank you for the opportunity to comment on development of the DMMP. Please inform DMF of the date and location of the scoping meeting.

Sincerely,

Michael D. Marshall
Central District Manager

NCDENR
North Carolina Department of Environment and Natural Resources
Division of Coastal Management
Michael F. Easley, Governor **James H. Gregson, Director** William G. Ross Jr., Secretary

January 8, 2008

Melba McGee
Environmental Coordinator
Office of Legislative & Intergovernmental Affairs
Department of Environment and Natural Resources
1601 Main Service Center
Raleigh, NC 27699-0001

SUBJECT: Proposed Morehead City Harbor Dredged Material Management Plan, Carteret County, North Carolina (SCH#08-0157, and DCM#20070122)

Dear Ms. McGee:

Thank you for the opportunity to review the letter from the US Army Corps of Engineers (Corps) requesting comments on the environmental issues that should be incorporated into the proposed Morehead City Harbor Dredged Material Management Plan (DMMP). The DMMP proposes to address long-term (20-year) management of the dredged material from Morehead City Harbor. The DMMP studies will involve a variety of activities such as: data collection, analysis, evaluations, mapping, coordination, and management actions necessary to implement the DMMP. Below are the comments by the Division of Coastal Management (DCM).

- The DMMP (proposed project) will require consistency review and concurrence by DCM before the DMMP can be implemented. Since this proposed management plan involves dredging, the State's Dredge and Fill Law, a component of the State's coastal management program, also constitutes some of the relevant enforceable policies. DCM recommends that the DMMP comply with the information requirements of 15 CFR 930.39.
- In developing the DMMP, DCM recommends that 15A NCAC 07H .0312 be consulted regarding the technical standards for beach fill projects. Additionally 15A NCAC 07H .0308(a)(3) requires that sand used for beach nourishment be compatible with existing grain size and type of the receiving beach.
- DCM recommends that the DMMP incorporate the requirements of Section (h2) of the State's Dredge and Fill Law which requires that clean beach quality material dredged from navigational channels or inlet shoal systems be deposited onto ocean beaches.
- DCM recommends that the DMMP incorporate the standard that sand used for beach nourishment shall be taken only from those areas where the resulting environmental impacts will be minimal.
- DCM recommends that the capability of Brandt Island (or any other dredge disposal island) to accept dredged material over the operational life of the DMMP be evaluated.

- DCM recommends the DMMP review all moratorium periods and equipment operating limitations. For example, side cast dredging is not recommend in areas where SAV beds occur. DCM encourages the DMMP to specify the types of dredging equipment that may be used and to identify periods when dredging operations may not be conducted due to environmental constraints.
- DCM recommends that the disposal of dredged material in offshore locations be segregated by whether the material is beach quality or not beach quality. Segregating the material in this manner could allow for more rapid retrieval of beach quality sand should it be needed.
- DCM and the North Carolina Division of Water Resources (NCDWR) are working on a Comprehensive Beach And Inlet Management Plan (BIMP). DCM recommends that the Corps, in developing the DMMP, collaborate with this effort and incorporate Regional Sediment Management Plan (RSM) findings. It is our understanding that the Corps is authorized under the Water Resources and Development Act (WRDA) passed by Congress in November 2007 to participate in the RSM.
- DCM recommends that the Corps collaborate with DCM, NCDWR, and other relevant State agencies to integrate the DMMP with the State's BIMP.
- It is our understanding the Corps' Wilmington District is working with the Corps' Mobile District in developing an "eCoastal Enterprise GIS Framework". DCM recommends that the feasibility of incorporating the eCoastal Enterprise GIS Framework system to the DMMP be explored.
- Carteret County has developed an online database containing all of their relevant data related to beach nourishment and storm protection (shorelines, aerial photos, monitoring surveys, volume calculations, etc.). DCM recommends that the Corps contact Carteret County to investigate how this information can be incorporated into the DMMP.
- The DMMP consistency review, potentially involves two types of consistency reviews by DCM. The first type of concurrence would be with the management plan itself. The second type of concurrence would involve review of actual dredging and disposal operations. To minimize the number of concurrence reviews, the Corps may make a combined consistency submission. A combined consistency submission would require explicit plans for proposed dredging and disposal operations.
- DCM recognizes that certain dredging operations are conducted for a variety of purposes. As such, the disposal of disposal of beach quality material onto the beach may or may not be within the scope of a proposed dredging operation. Nevertheless, the State's coastal management program encourages the placement of beach quality material onto the beach. To the extent practicable[1] DCM encourages that the Corps comply[2] with the State's coastal management program mandate to place beach quality sand onto the beach.
- To assure the efficient management of dredged material from dredging to disposal, DCM suggests that the DMMP be integrated with "*real-time*" dredging operations. To express this differently, DCM recommends that the DMMP not simply focus on the management of

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1 The term "*consistent to the maximum extent practicable*" is defined in 15 CFR 930.32 and means "*fully consistent with the enforceable policies of management programs unless full consistency is prohibited by existing law applicable to the Federal agency.*"

2 In discussing funding issues and compliance with a State's coastal management program 15 CFR 930.32 states "***Federal agencies shall not use a general claim of a lack of funding** or insufficient appropriated funds or failure to include the cost of being fully consistent in Federal budget and planning process **as a basis for being consistent to the maximum extent practicable with an enforceable policy of a management program**. The only circumstance where a Federal agency may rely on a lack of funding as a limitation on being fully consistent with an enforceable policy is the Presidential exemption described in section 307(c)(1)(B) of the Act (16 USC 1456(c)(1)(B). In Cases where the cost of being consistent with the enforceable policies of a management program was not included in the Federal agency's budget and planning processes, **the Federal agency should determine the amount of funds needed and seek additional federal funds**.*" (emphasis added)

material following its storage at dredge disposal locations such as Brandt Island. Instead DCM recommends that the DMMP focus on how material that is dredged can be immediately moved to a disposal location, such as a beach, to minimize the necessity for intermediate storage. DCM acknowledges that in certain situations intermediate storage may provide future benefits such as the immediate availability of beach quality sand for emergency beach disposal resulting from an unexpected erosion event.

- Emergency dredging operations have been an ongoing concern. DCM acknowledges that the ocean environment is complex and unpredictable, and that storm events can trigger the unexpected need for emergency dredging. Nevertheless, many proposals for emergency dredging have been the result of operational issues such as unavailability of equipment, equipment breakdowns, and funding constraints. DCM suggests that the DMMP incorporate separate operational protocols for dealing with emergency dredging resulting from storm events and protocols concerning operational (equipment) issues that affect planned dredging operations.

Should you wish to discuss any of these recommendations further, please feel free to contact me at 252-808-2808. Thank you for your consideration of the North Carolina Coastal Management Program.

Sincerely,

Stephen Rynas, AICP
Federal Consistency Coordinator

cc: Jim Gregson, Division of Coastal Management
Doug Huggett, Division of Coastal Management
Terc Barrett, Division of Coastal Management
Jeff Warren, Division of Coastal Management

M E M O R A N D U M

DIVISION OF WATER QUALITY

TO: **Melba McGee, Environmental Coordinator**

FROM: **Joanne Steenhuis, Senior Environmental Specialist** JHS 12/5/07

THROUGH: **Edward Beck, Surface Water Protection Regional Supervisor** EB

DATE: **December 5, 2007**

SUBJECT: **Morehead City Harbor Dredged Material Management Plan (DMMP)**

PROJECT: **Morehead City Harbor Dredged Material Management Plan (DMMP)**
20-year management plan
Project No. 08-0157

COUNTY: **Carteret County**

The Wilmington Regional Office has reviewed the initiation letter for the scoping process for the Morehead City Harbor 20 year dredged material management plan. This Office is concerned with any potential contaminants that may be stirred into the water column during this process and the location or placement of the material for disposal (potential wetland fill).

Thank You

State of North Carolina
Department of Environment and Natural Resources

Reviewing Office: Wiro

INTERGOVERNMENTAL REVIEW - PROJECT COMMENTS

Project Number: 08-0157 Due Date: 1/9/08

After review of this project it has been determined that the ENR permit(s) and/or approvals indicated may need to be obtained in order for this project to comply with North Carolina Law. Questions regarding these permits should be addressed to the Regional Office indicated on the reverse of the form. All applications, information and guidelines relative to these plans and permits are available from the same Regional Office.

	PERMITS	SPECIAL APPLICATION PROCEDURES or REQUIREMENTS	Normal Process Time (statutory time limit)
☐	Permit to construct & operate wastewater treatment facilities, sewer system extensions & sewer systems not discharging into state surface waters.	Application 90 days before begin construction or award of construction contracts. On-site inspection. Post-application technical conference usual.	30 days (90 days)
☐	NPDES - permit to discharge into surface water and/or permit to operate and construct wastewater facilities discharging into state surface waters.	Application 180 days before begin activity. On-site inspection. Pre-application conference usual. Additionally, obtain permit to construct wastewater treatment facility-granted after NPDES. Reply time, 30 days after receipt of plans or issue of NPDES permit-whichever is later.	90-120 days (N/A)
☐	Water Use Permit	Pre-application technical conference usually necessary	30 days (N/A)
☐	Well Construction Permit	Complete application must be received and permit issued prior to the installation of a well.	7 days (15 days)
☐	Dredge and Fill Permit	Application copy must be served on each adjacent riparian property owner. On-site inspection. Pre-application conference usual. Filling may require Easement to Fill from N.C. Department of Administration and Federal Dredge and Fill Permit.	55 days (90 days)
☐	Permit to construct & operate Air Pollution Abatement facilities and/or Emission Sources as per 15 A NCAC (2Q.O100 thru 2Q.0300)	Application must be submitted and permit received prior to construction and operation of the source. If a permit is required in an area without local zoning, then there are additional requirements and timelines (2Q.0113).	90 days
☐	Permit to construct & operate Transportation Facility as per 15 A NCAC (2D.0800, 2Q.0601)	Application must be submitted at least 90 days prior to construction or modification of the source.	90 days
☐	Any open burning associated with subject proposal must be in compliance with 15 A NCAC 2D.1900	N/A	60 days (90 days)
☐	Demolition or renovations of structures containing asbestos material must be in compliance with 15 A NCAC 20.1110 (a) (1) which requires notification and removal prior to demolition. Contact Asbestos Control Group 919-707-5950.		
☐	Complex Source Permit required under 15 A NCAC 2D.0800		
☐	The Sedimentation Pollution Control Act of 1973 must be properly addressed for any land disturbing activity. An erosion & sedimentation control plan will be required if one or more acres to be disturbed. Plan filed with proper Regional Office (Land Quality Section) At least 30 days before beginning activity. A fee of **$65** for the first acre or any part of an acre. An express review option is available with additional fees.		20 days (30 days)
☐	Sedimentation and erosion control must be addressed in accordance with NCDOT's approved program. Particular attention should be given to design and installation of appropriate perimeter sediment trapping devices as well as stable stormwater conveyances and outlets.		(30 days)
☐	Mining Permit	On-site inspection usual. Surety bond filed with ENR Bond amount varies with type mine and number of acres of affected land. Any arc mined greater than one acre must be permitted. The appropriate bond must be received before the permit can be issued.	30 days (60 days)
☐	North Carolina Burning permit	On-site inspection by N.C. Division Forest Resources if permit exceeds 4 days	1 day (N/A)
☐	Special Ground Clearance Burning Permit - 22 counties in coastal N.C. with organic soils	On-site inspection by N.C. Division Forest Resources required "if more than five acres of ground clearing activities are involved. Inspections should be requested at least ten days before actual burn is planned."	1 day (N/A)
☐	Oil Refining Facilities	N/A	90-120 days (N/A)
☐	Dam Safety Permit	If permit required, application 60 days before begin construction. Applicant must hire N.C. qualified engineer to: prepare plans, inspect construction. certify construction is according to ENR approved plans. May also require permit under mosquito control program. And a 404 permit from Corps of Engineers. An inspection of site is necessary to verify Hazard Classification. A	30 days (60 days)

	PERMITS	SPECIAL APPLICATION PROCEDURES or REQUIREMENTS	Normal Process Time (statutory time limit)
☐	Permit to drill exploratory oil or gas well	File surety bond of $5,000 with ENR running to State of NC conditional that any well opened by drill operator shall, upon abandonment, be plugged according to ENR rules and regulations.	10 days N/A
☐	Geophysical Exploration Permit	Application filed with ENR at least 10 days prior to issue of permit. Application by letter. No standard application form.	10 days N/A
☐	State Lakes Construction Permit	Application fees based on structure size is charged. Must include descriptions & drawings of structure & proof of ownership of riparian property.	15-20 days N/A
☒	401 Water Quality Certification	N/A	60 days (130 days)
☐	CAMA Permit for MAJOR development	$250.00 fee must accompany application	55 days (150 days)
☐	CAMA Permit for MINOR development	$50.00 fee must accompany application	22 days (25 days)
☐	Several geodetic monuments are located in or near the project area. If any monument needs to be moved or destroyed, please notify: N.C. Geodetic Survey, Box 27687 Raleigh, NC 27611		
☐	Abandonment of any wells, if required must be in accordance with Title 15A. Subchapter 2C.0100.		
☐	Notification of the proper regional office is requested if "orphan" underground storage tanks (USTS) are discovered during any excavation operation.		
☐	Compliance with 15A NCAC 2H 1000 (Coastal Stormwater Rules) is required.		45 days (N/A)
☐	Tar Pamlico or Neuse Riparian Buffer Rules required.		
★	Other comments (attach additional pages as necessary, being certain to cite comment authority)		

REGIONAL OFFICES

Questions regarding these permits should be addressed to the Regional Office marked below.

☐ **Asheville Regional Office**
2090 US Highway 70
Swannanoa, NC 28778
(828) 296-4500

☐ **Mooresville Regional Office**
610 East Center Avenue, Suite 301
Mooresville, NC 28115
(704) 663-1699

☒ **Wilmington Regional Office**
127 Cardinal Drive Extension
Wilmington, NC 28405
(910) 796-7215

☐ **Fayetteville Regional Office**
225 North Green Street, Suite 714
Fayetteville, NC 28301-5043
(910) 433-3300

☐ **Raleigh Regional Office**
3800 Barrett Drive, Suite 101
Raleigh, NC 27609
(919) 791-4200

☐ **Winston-Salem Regional Office**
585 Waughtown Street
Winston-Salem, NC 27107
(336) 771-5000

☐ **Washington Regional Office**
943 Washington Square Mall
Washington, NC 27889

Water Quality Certification No. 3888

GENERAL CERTIFICATION FOR PROJECTS ELIGIBLE
FOR U.S. ARMY CORPS OF ENGINEERS NATIONWIDE PERMIT NUMBER 16
(RETURN WATER FROM UPLAND CONTAINED DISPOSAL AREAS)
AND RIPARIAN AREA PROTECTION RULES (BUFFER RULES)

Water Quality Certification Number 3888 is issued in conformity with the requirements of Section 401, Public Laws 92-500 and 95-217 of the United States and subject to the North Carolina Division of Water Quality Regulations in 15A NCAC 02H .0500 and 15A NCAC 02B .0200 for the discharge of fill material to waters and wetlands as described in 33 CFR 330 Appendix A (B) (16) and the Riparian Area Protection Rules (Buffer Rules) in 15A NCAC 02B .0200.

The category of activities shall include the discharge of return water from an upland, contained dredge disposal area.

The State of North Carolina certifies that the specified category of activity will not violate applicable portions of Sections 301, 302, 303, 306 and 307 of the Public Laws 92-500 and 95-217 if conducted in accordance with the conditions hereinafter set forth.

Activities meeting any one (1) of the following thresholds or circumstances require *written approval* for a 401 Water Quality Certification from the Division of Water Quality (the "Division"):

a) Proposed fill or modification of wetlands or waters, including streams; or
b) Any stream relocation; or
c) Any impact associated with a Notice of Violation or an enforcement action for violation(s) of DWQ Wetland Rules (15A NCAC 02H .0500), Isolated Wetland Rules (15A NCAC 02H .1300), DWQ Surface Water or Wetland Standards, or Riparian Buffer Rules (15A NCAC 02B .0200); or
d) Any impacts to streams and/or buffers in the Neuse, Tar-Pamlico, or Catawba River Basins or in the Randleman, Jordan or Goose Creek Watersheds (or any other basin or watershed with Riparian Area Protection Rules [Buffer Rules] in effect at the time of application) *unless* the activities are listed as "EXEMPT" from these rules or a Buffer Authorization Certificate is issued through N.C. Division of Coastal Management (DCM) delegation for "ALLOWABLE" activities.

In accordance with North Carolina General Statute 143-215.3D(e), written approval for a 401 Water Quality General Certification must include the appropriate fee. If a project also requires a CAMA Permit, then one payment to both agencies shall be submitted and will be the higher of the two fees.

Activities included in this General Certification that do not meet one of the thresholds listed above do not require written approval from the Division as long as they comply with the Conditions of Certification listed below. If any of these Conditions cannot be met, then written approval from the Division is required.

Conditions of Certification:

1. No Impacts Beyond those Authorized in the Written Approval or Beyond the Threshold of Use of this Certification

   No waste, spoil, solids, or fill of any kind shall occur in wetlands, waters, or riparian areas beyond the footprint of the impacts depicted in the Pre-Construction Notification, as authorized in the written approval from the Division or beyond the thresholds established for use of this Certification without written authorization, including incidental impacts. All construction activities, including the design, installation, operation, and maintenance of sediment and erosion control Best Management Practices shall be performed so that no violations of state water quality standards, statutes, or rules occur. Approved plans and specifications for this project are incorporated by reference and are enforceable parts of this permit.

2. Standard Erosion and Sediment Control Practices

Erosion and sediment control practices must be in full compliance with all specifications governing the proper design, installation and operation and maintenance of such Best Management Practices and if applicable, comply with the specific conditions and requirements of the NPDES Construction Stormwater Permit issued to the site:

a. Design, installation, operation, and maintenance of the sediment and erosion control measures must be such that they equal or exceed the requirements specified in the most recent version of the *North Carolina Sediment and Erosion Control Manual*. The devices shall be maintained on all construction sites, borrow sites, and waste pile (spoil) projects, including contractor-owned or leased borrow pits associated with the project.

b. For borrow pit sites, the erosion and sediment control measures must be designed, installed, operated, and maintained in accordance with the most recent version of the *North Carolina Surface Mining Manual*.

c. Reclamation measures and implementation must comply with the reclamation in accordance with the requirements of the Sedimentation Pollution Control Act and the Mining Act of 1971.

d. Sufficient materials required for stabilization and/or repair of erosion control measures and stormwater routing and treatment shall be on site at all times.

e. If the project occurs in waters or watersheds classified as Primary Nursery Areas (PNAs), SA, WS-I, WS-II, High Quality (HQW), or Outstanding Resource (ORW) waters, then the sedimentation and erosion control designs must comply with the requirements set forth in 15A NCAC 04B .0124, *Design Standards in Sensitive Watersheds*.

3. No Sediment and Erosion Control Measures in Wetlands or Waters

Sediment and erosion control measures shall not be placed in wetlands or waters. Exceptions to this condition require application submittal to and written approval by the Division. If placement of sediment and erosion control devices in wetlands and waters is unavoidable, then design and placement of temporary erosion control measures shall not be conducted in a manner that may result in dis-equilibrium of wetlands, stream beds, or banks, adjacent to or upstream and downstream of the above structures. All sediment and erosion control devices shall be removed and the natural grade restored within two (2) months of the date that the Division of Land Resources (DLR) or locally delegated program has released the specific area within the project.

4. Construction Stormwater Permit NCG010000

An NPDES Construction Stormwater Permit is required for construction projects that disturb one (1) or more acres of land. This Permit allows stormwater to be discharged during land disturbing construction activities as stipulated in the conditions of the permit. If your project is covered by this permit, full compliance with permit conditions including the erosion & sedimentation control plan, inspections and maintenance, self-monitoring, record keeping and reporting requirements is required. A copy of the general permit (NCG010000), inspection log sheets, and other information may be found at http://portal.ncdenr.org/web/wq/ws/su/npdessw#tab-w .

The North Carolina Department of Transportation (NCDOT) shall be required to be in full compliance with the conditions related to construction activities within the most recent version of their individual NPDES (NCS000250) stormwater permit.

5. Construction Moratoriums and Coordination

The timing of the dredging and discharge shall be addressed by the applicant in the Pre-construction Notification Application, in order to lessen impact on aquatic organisms and their reproduction. This timing shall comply with dredging windows established by the NC Wildlife Resources Commission, NC Division of Marine Fisheries, and/or the US Fish and Wildlife Service.

If activities must occur during periods of high biological activity (i.e. sea turtle nesting, fish spawning, or bird nesting), then biological monitoring may be required at the request of other state or federal agencies and coordinated with these activities.

All moratoriums on construction activities established by the NC Wildlife Resources Commission (WRC), US Fish and Wildlife Service (USFWS), NC Division of Marine Fisheries (DMF), or National Marine Fisheries Service (NMFS) to lessen impacts on trout, anadromous fish, larval/post-larval fishes and crustaceans, or other aquatic species of concern shall be implemented. Exceptions to this condition require written approval by the resource agency responsible for the given moratorium.

Work within the twenty-five (25) designated trout counties or identified state or federal endangered or threatened species habitat shall be coordinated with the appropriate WRC, USFWS, NMFS, and/or DMF personnel.

6. Work in the Dry

All work in or adjacent to stream waters shall be conducted so that the flowing stream does not come in contact with the disturbed area. Approved best management practices from the most current version of the NC Sediment and Erosion Control Manual, or the NC DOT Construction and Maintenance Activities Manual, such as sandbags, rock berms, cofferdams, and other diversion structures shall be used to minimize excavation in flowing water. Exceptions to this condition require application submittal to and written approval by the Division.

7. Riparian Area Protection (Buffer) Rules

Activities located in the protected riparian areas (whether jurisdictional wetlands or not), within the Neuse, Tar-Pamlico, or Catawba River Basins or in the Randleman, Jordan, or Goose Creek Watersheds (or any other basin or watershed with buffer rules) shall be limited to "uses" identified within and constructed in accordance with 15A NCAC 02B .0233, .0259, .0243, .0250, .0267 and .0605, and shall be located, designed, constructed, and maintained to have minimal disturbance to protect water quality to the maximum extent practicable through the use of best management practices. All buffer rule requirements, including diffuse flow requirements, must be met.

8. If concrete is used during the construction, then all necessary measures shall be taken to prevent direct contact between uncured or curing concrete and waters of the state. Water that inadvertently contacts uncured concrete shall not be discharged to waters of the state due to the potential for elevated pH and possible aquatic life/ fish kills.

9. The discharge shall not contain levels of toxic pollutants that would result in a violation of state water quality and wetland standards.

10. The terminal end of the pipeline from the dredge into the retention area shall be positioned at a maximum distance from spillways to allow adequate settling of suspended solids and a sufficient distance from any part of the dike so as to preclude dike erosion by the pipeline discharge. Effluent shall be released waterward of emergent marsh or tidal flats when located within these systems.

11. A water control structure shall be installed at the intake end of the effluent leading from the retention area in order to insure maximum settling of suspended solids and control of discharge volumes.

12. The flow from the diked retention area shall be contained by pipe, metal or wooden trough, or similar device to a point waterward of any emergent vegetation along the shoreline unless it can be clearly shown by the applicant that a different design will result in less environmental impact.

13. Sufficient freeboard shall be maintained within the diked disposal area during the dredging operation to assure the integrity of the dike structure and the containment of the dredged material.

14. Native forested vegetation shall be re-established in any construction access or other temporary impact area within the next growing season following construction of a project.

15. Hydraulic dredging in piedmont and mountain lakes (as well as some locations in the coastal plain when specified by the Division) which utilize an upland diked disposal basin with a return pipe for the return water shall utilize the "two basin" design, or have written approval from the Division to vary from this design.

16. The concentration of settleable solids in the effluent being discharged from the diked disposal area shall be no greater than 0.1 ml/l.

17. The appropriate turbidity water quality standard shall not be exceeded or be above ambient background levels (whichever is more stringent) beyond an appropriate mixing zone if one is established for a project by the Division.

18. The disposal area dikes shall be stabilized with vegetative cover within one (1) day after construction to minimize erosion.

19. If an environmental document is required under the National or State Environmental Policy Act (NEPA or SEPA), then this General Certification is not valid until a Finding of No Significant Impact (FONSI) or Record of Decision (ROD) is issued by the State Clearinghouse.

20. In the twenty (20) coastal counties, the appropriate DWQ Regional Office must be contacted to determine if Coastal Stormwater Regulations will be required.

21. This General Certification does not relieve the applicant of the responsibility to obtain all other required Federal, State, or Local approvals.

22. The applicant/permittee and their authorized agents shall conduct all activities in a manner consistent with State water quality standards (including any requirements resulting from compliance with §303(d) of the Clean Water Act), and any other appropriate requirements of State and Federal Law. If the Division determines that such standards or laws are not being met, including failure to sustain a designated or achieved use, or that State or Federal law is being violated, or that further conditions are necessary to assure compliance, then the Division may reevaluate and modify this General Water Quality Certification.

23. When written authorization is required for use of this certification, upon completion of all permitted impacts included within the approval and any subsequent modifications, the applicant shall be required to return the certificate of completion attached to the approval. One copy of the certificate shall be sent to the DWQ Central Office in Raleigh at 1650 Mail Service Center, Raleigh, NC, 27699-1650.

24. Additional site-specific conditions, including monitoring and/or modeling requirements, may be added to the written approval letter for projects proposed under this Water Quality Certification in order to ensure compliance with all applicable water quality and effluent standards.

25. This certification grants permission to the director, an authorized representative of the Director, or DENR staff, upon the presentation of proper credentials, to enter the property during normal business hours.

This General Certification shall expire on the same day as the expiration date of the corresponding Nationwide and/or Regional General Permit. The conditions in effect on the date of issuance of Certification for a specific project shall remain in effect for the life of the project, regardless of the expiration date of this Certification.

Non-compliance with or violation of the conditions herein set forth by a specific project may result in revocation of this General Certification for the project and may also result in criminal and/or civil penalties.

The Director of the North Carolina Division of Water Quality may require submission of a formal application for Individual Certification for any project in this category of activity if it is determined that the project is likely to have a significant adverse effect upon water quality, including state or federally listed endangered or threatened aquatic species, or degrade the waters so that existing uses of the wetland or downstream waters are precluded.

Public hearings may be held for specific applications or group of applications prior to a Certification decision if deemed in the public's best interest by the Director of the North Carolina Division of Water Quality.

Effective date March 19, 2012

DIVISION OF WATER QUALITY

By

Charles Wakild, P.E.

Director

History Note: Water Quality Certification (WQC) Number 3888 issued March 19, 2012, replaces WQC 3700 issued November 1, 2007; WQC Number 3629 issued March 19, 2007; WQC Number 3363 issued March 18, 2002; WQC Number 3105 issued February 11, 1997; WQC Number 2668 issued January 21, 1992; and WQC Number 1273 issued November 10, 1978. This General Certification is rescinded when the Corps of Engineers reauthorizes any of the corresponding Nationwide and/or Regional General Permits or when deemed appropriate by the Director of the Division of Water Quality.

Water Quality Certification No. 3908

GENERAL CERTIFICATION FOR PROJECTS ELIGIBLE FOR U.S. ARMY CORPS OF ENGINEERS REGIONAL GENERAL PERMIT 198000048 INVOLVING DISPOSAL OF DREDGED MATERIAL ON OCEAN BEACHES WITHIN NORTH CAROLINA

Water Quality Certification Number 3908 is issued in conformity with the requirements of Section 401, Public Laws 92-500 and 95-217 of the United States and subject to the North Carolina Division of Water Quality Regulations in 15 NCAC 02H .0500 and 15 NCAC 02B .0200 for the discharge of fill material to waters and wetland areas which are waters of the United States as described in the Wilmington District's Regional (General) Permit Number 198000048.

The State of North Carolina certifies that the specified category of activity will not violate applicable portions of Sections 301, 302, 303, 306 and 307 of the Public Laws 92-500 and 95-217 if conducted in accordance with the conditions hereinafter set forth.

Activities meeting any one (1) of the following thresholds or circumstances require *written approval* for a 401 Water Quality Certification from the Division of Water Quality (the "Division"):

a) Any proposed fill, dredging, excavation or other modification of waters or wetlands; or
b) Any stream relocation; or
c) Any impact associated with a Notice of Violation or an enforcement action for violation(s) of DWQ Wetland Rules (15A NCAC 02H .0500), Isolated Wetland Rules (15A NCAC 02H .1300), DWQ Surface Water or Wetland Standards, or Riparian Buffer Rules (15A NCAC 02B .0200); or
d) Any impacts to streams and/or buffers in the Neuse, Tar-Pamlico, or Catawba River Basins or in the Randleman, Jordan or Goose Creek Watersheds (or any other basin or watershed with Riparian Area Protection Rules [Buffer Rules] in effect at the time of application) *unless* the activities are listed as "EXEMPT" from these rules or a Buffer Authorization Certificate is issued through N.C. Division of Coastal Management (DCM) delegation for "ALLOWABLE" activities.

In accordance with North Carolina General Statute 143-215.3D(e), written approval for a 401 Water Quality General Certification must include the appropriate fee. If a project also requires a CAMA Permit, then one payment to both agencies shall be submitted and will be the higher of the two fees.

Activities included in this General Certification that do not meet one of the thresholds listed above do not require written approval from the Division as long as they comply with the Conditions of Certification listed below. If any of these Conditions cannot be met, then written approval from the Division is required.

Conditions of Certification:

1. No Impacts Beyond those Authorized in the Written Approval or Beyond the Threshold of Use of this Certification

   No waste, spoil, solids, or fill of any kind shall occur in wetlands, waters, or riparian areas beyond the footprint of the impacts depicted in the Pre-Construction Notification, as authorized in the written approval from the Division or beyond the thresholds established for use of this Certification without written authorization, including incidental impacts. All construction activities, including the design, installation, operation, and maintenance of sediment and erosion control Best Management Practices shall be performed so that no violations of state water quality standards, statutes, or rules occur. Approved plans and specifications for this project are incorporated by reference and are enforceable parts of this permit.

2. Standard Erosion and Sediment Control Practices

   Erosion and sediment control practices must be in full compliance with all specifications governing the proper design, installation and operation and maintenance of such Best Management Practices and if applicable, comply with the specific conditions and requirements of the NPDES Construction Stormwater Permit issued to the site:

   a. Design, installation, operation, and maintenance of the sediment and erosion control measures must be such that they equal or exceed the requirements specified in the most recent version of the *North Carolina Sediment and Erosion Control Manual*. The devices shall be maintained on all construction sites, borrow sites, and waste pile (spoil) projects, including contractor-owned or leased borrow pits associated with the project.

   b. For borrow pit sites, the erosion and sediment control measures must be designed, installed, operated, and maintained in accordance with the most recent version of the *North Carolina Surface Mining Manual*.

   c. Reclamation measures and implementation must comply with the reclamation in accordance with the requirements of the Sedimentation Pollution Control Act and the Mining Act of 1971.

   d. Sufficient materials required for stabilization and/or repair of erosion control measures and stormwater routing and treatment shall be on site at all times.

   e. If the project occurs in waters or watersheds classified as Primary Nursery Areas (PNAs), SA, WS-I, WS-II, High Quality (HQW), or Outstanding Resource (ORW) waters, then the sedimentation and erosion control designs must comply with the requirements set forth in 15A NCAC 04B .0124, *Design Standards in Sensitive Watersheds*.

3. No Sediment and Erosion Control Measures in Wetlands or Waters

   Sediment and erosion control measures shall not be placed in wetlands or waters. Exceptions to this condition require application submittal to and written approval by the Division. If placement of sediment and erosion control devices in wetlands and waters is unavoidable, then design and placement of temporary erosion control measures shall not be conducted in a manner that may result in dis-equilibrium of wetlands, stream beds, or banks, adjacent to or upstream and downstream of the above structures. All sediment and erosion control devices shall be removed and the natural grade restored within two (2) months of the date that the Division of Land Resources (DLR) or locally delegated program has released the specific area within the project.

4. Construction Stormwater Permit NCG010000

   An NPDES Construction Stormwater Permit is required for construction projects that disturb one (1) or more acres of land. This Permit allows stormwater to be discharged during land disturbing construction activities as stipulated in the conditions of the permit. If your project is covered by this permit, full compliance with permit conditions including the erosion & sedimentation control plan, inspections and maintenance, self-monitoring, record keeping and reporting requirements is required. A copy of the general permit (NCG010000), inspection log sheets, and other information may be found at http://portal.ncdenr.org/web/wq/ws/su/npdessw#tab-w .

   The North Carolina Department of Transportation (NCDOT) shall be required to be in full compliance with the conditions related to construction activities within the most recent version of their individual NPDES (NCS000250) stormwater permit.

5. The discharge shall not contain levels of toxic pollutants that would result in a violation of state water quality and wetland standards.

6. If concrete is used during the construction, then all necessary measures shall be taken to prevent direct contact between uncured or curing concrete and waters of the state. Water that inadvertently contacts uncured concrete shall not be discharged to waters of the state due to the potential for elevated pH and possible aquatic life/ fish kills.

7. Construction Moratoriums and Coordination

   If activities must occur during periods of high biological activity (i.e. sea turtle nesting, fish spawning, or bird nesting), then biological monitoring may be required at the request of other state or federal agencies and coordinated with these activities.

   All moratoriums on construction activities established by the NC Wildlife Resources Commission (WRC), US Fish and Wildlife Service (USFWS), NC Division of Marine Fisheries (DMF), or National Marine Fisheries Service (NMFS) to lessen impacts on trout, anadromous fish, larval/post-larval fishes and crustaceans, or other aquatic species of concern shall be implemented. Exceptions to this condition require written approval by the resource agency responsible for the given moratorium.

   Work within the twenty-five (25) designated trout counties or identified state or federal endangered or threatened species habitat shall be coordinated with the appropriate WRC, USFWS, NMFS, and/or DMF personnel.

8. If an environmental document is required under the National or State Environmental Policy Act (NEPA or SEPA), then this General Certification is not valid until a Finding of No Significant Impact (FONSI) or Record of Decision (ROD) is issued by the State Clearinghouse.

9. In the twenty (20) coastal counties, the appropriate DWQ Regional Office must be contacted to determine if Coastal Stormwater Regulations will be required.

10. This General Certification does not relieve the applicant of the responsibility to obtain all other required Federal, State, or Local approvals.

11. The applicant/permittee and their authorized agents shall conduct all activities in a manner consistent with State water quality standards (including any requirements resulting from compliance with §303(d) of the Clean Water Act), and any other appropriate requirements of State and Federal Law. If the Division determines that such standards or laws are not being met, including failure to sustain a designated or achieved use, or that State or Federal law is being violated, or that further conditions are necessary to assure compliance, then the Division may reevaluate and modify this General Water Quality Certification.

12. When written authorization is required for use of this certification, upon completion of all permitted impacts included within the approval and any subsequent modifications, the applicant shall be required to return the certificate of completion attached to the approval. One copy of the certificate shall be sent to the DWQ Central Office in Raleigh at 1650 Mail Service Center, Raleigh, NC, 27699-1650.

13. Additional site-specific conditions, including monitoring and/or modeling requirements, may be added to the written approval letter for projects proposed under this Water Quality Certification in order to ensure compliance with all applicable water quality and effluent standards.

Water Quality Certification No. 3908

14. This certification grants permission to the director, an authorized representative of the Director, or DENR staff, upon the presentation of proper credentials, to enter the property during normal business hours.

This General Certification shall expire on the same day as the expiration date of the corresponding Nationwide and/or Regional General Permit. The conditions in effect on the date of issuance of Certification for a specific project shall remain in effect for the life of the project, regardless of the expiration date of this Certification.

Non-compliance with or violation of the conditions herein set forth by a specific project may result in revocation of this General Certification for the project and may also result in criminal and/or civil penalties.

The Director of the North Carolina Division of Water Quality may require submission of a formal application for Individual Certification for any project in this category of activity if it is determined that the project is likely to have a significant adverse effect upon water quality, including state or federally listed endangered or threatened aquatic species, or degrade the waters so that existing uses of the wetland or downstream waters are precluded.

Public hearings may be held for specific applications or group of applications prior to a Certification decision if deemed in the public's best interest by the Director of the North Carolina Division of Water Quality.

Effective date: March 19, 2012

DIVISION OF WATER QUALITY

By

Matt Matthews for

Charles Wakild, P.E.

Director

History Note: Water Quality Certification (WQC) Number 3908 issued March 19, 2012 replaces WQC 3703 issued November 1, 2007; WQC 3640 issued March 2007; WQC 3493 issued December 2004; and WQC 3372 issued March 18, 2002. This General Certification is rescinded when the Corps of Engineers reauthorizes any of the corresponding Nationwide and/or Regional General Permits or when deemed appropriate by the Director of the Division of Water Quality.

KILPATRICK
STOCKTON LLP
Attorneys at Law

Suite 400 3737 Glenwood Avenue
Raleigh NC 27612
t 919 420 1700 f 919 420 1800
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Steven J. Levitas
direct dial 919 420 1707
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SLevitas@KilpatrickStockton.com

April 1, 2008

Via First Class Mail and Electronic-Mail

U.S. Army Corps of Engineers
Wilmington District
Attention: Stacy Samuelson (CESAW-TS-PE)
Post Office Box 1890
Wilmington, NC 28402-1890

Re: Comments Regarding Morehead City Harbor Dredged Material Management Plan

Dear Mr. Samuelson:

I am writing on behalf of Carteret County, North Carolina, in response to the United States Army Corps of Engineers' (the "Corps") request for comments regarding the scope of the Dredged Material Management Plan ("DMMP") for the Morehead City Harbor Project ("MCHP"). Carteret County believes that the DMMP should (i) ensure that maintenance dredging activities are performed in an environmentally acceptable manner, (ii) use sound engineering techniques, and (iii) address all dredged material disposal alternatives for the MCHP.

The Corps' current dredged material management practices for the MCHP are not in compliance with federal and state law. As the Corps has recognized, placement of beach-quality dredged material offshore is "neither environmentally acceptable, nor engineeringly sound," "poor management of a limited resource" and "is not consistent with North Carolina's Coastal Zone Management Act regulations." Further, with respect to the placement of dredged material in the nearshore berm, contrary to the Corps' expectation, the material has exhibited little landward movement. The Corps, therefore, must completely re-evaluate its dredged material management practices associated with the MCHP.

The DMMP for the MCHP should be developed using procedures that identify, evaluate, screen and recommend dredged material management alternatives to ensure that such activities are conducted in an environmentally sensitive manner. Specific dredged material management alternatives that must be evaluated include: (i) Brandt Island, (ii) beach disposal and replenishment, (iii) the nearshore berm, and (iv) the Ocean Dredged Material Disposal Site ("ODMDS"). Without fully evaluating each of these alternatives and their environmental impacts and benefits, the DMMP will be inadequate.

The DMMP should focus on new or innovative techniques or policies to meet the Corps' goals of increased beneficial use of dredged material and regional sediment management. The DMMP should encourage and give priority to innovative, non-traditional options that maximize the beneficial use of dredged material. Thus, in identifying dredged material management alternatives to be considered in the DMMP, practices that manage dredged material in a beneficial manner should be the preferred alternatives. Consistent with federal and North Carolina law, such practices include use of dredged material for beach replenishment and disposal in the active nearshore zone at appropriate depths that allow active transport of such material. The following rankings should be used to indicate the preference of each option:

1. Preferred Option. Options that beneficially use dredged material with positive impacts to the environment, including the beaches of Carteret County.

2. Least Preferred Option. Options that have either a low potential for beneficial use and/or potential for unacceptable impacts to the environment, including the beaches of Carteret County.

3. Non-Preferred Option. Options that have potentially unacceptable impacts to the environment or are technically infeasible or are inconsistent with federal or state law.

In evaluating the various dredged material management alternatives, cost may not be a factor in this selection process. Federal law clearly provides that cost or lack of funds is not a basis for failure to be consistent to the maximum extent practical with a state's enforceable policies under the Coastal Zone Management Act ("CZMA"). *See City of Sausalito v. O'Neil*, 386 F.3d 1186, 1223 (9th Cir. 2004)) ("lack of funds is explicitly forbidden as a criterion for finding consistency under 15 C.F.R. § 930.32(a)(3)"); 16 U.S.C. § 1456(c)(1)(B) ("[N]o such exemption shall be granted on the basis of a lack of appropriations unless the President has specifically requested such appropriations and Congress has failed to make them available."); 15 CFR § 930.32(a)(3) ("The only circumstance where a federal agency may rely on a lack of funding as a limitation on being fully consistent with an enforceable policy is the Presidential exemption."). North Carolina's approved Coastal Management Program ("CMP") includes a requirement that beach quality dredged material from navigation channels be used in a beneficial manner wherever practicable and be retained in littoral system to the maximum extent practicable. 15A NCAC §§ 07M.1101 and 07M.1102.

The development of the DMMP should consider federal, state, local and private interests. The DMMP should strive to have regional support from all the stakeholders and incorporate the findings of various other studies that may affect the recommended alternative.

Development of a DMMP, however, is not the end of the process. The potential environmental impacts and benefits of each of the dredged material management alternatives must be fully evaluated in accordance with the National Environmental Policy Act ("NEPA"). Such an analysis would provide widespread public review of the potential impacts of these alternative dredged material management practices. In addition, pursuant to the CZMA, a new consistency determination must be prepared for the recommended alternative. Finally, the DMMP should also be updated periodically to identify any changed conditions.

Carteret County looks forward to working with the Corps to develop an environmentally sound DMMP that not only protects the beaches of Carteret County, but also meets the needs of the Port of Morehead City.

With best wishes,

Sincerely yours,

KILPATRICK STOCKTON LLP

Steven J. Levitas

cc: Greg "Rudi" Rudolph
William "Buck" Fugate
The Honorable Douglas Harris

Samuelson, Stacy D SAW

From: Samuelson, Stacy D SAW

Sent: Friday, February 13, 2009 1:20 PM

To: Angela Mangiameli; 'Assistant County Manager'; 'Atlantic Beach Town Manager'; Bouchard, Jennifer A LT CNRMA; camerons@coastalnet.com; cyndi.karoly@ncmail.net; David Allen (allend@coastalnet.com); 'Don Hoss'; doug.huggett@ncmail.net; 'Gary Collins - EPA'; 'Greg Rudolph'; 'Gregory Case - Deputy Sector Commander USCG'; howard_hall@fws.gov; 'Janice Allen'; 'Jean Preston'; 'Jerry Schill'; joanne.steenhuis@ncmail.net; Jody Merritt (jody.merritt@ncmail.net); smtp-Sutherland, John; 'Katrina Marshall'; 'Linda Brickhouse'; Maria Dunn (maria.dunn@ncwildlife.org); 'Mark Ramsing'; Matthew Godfrey (godfreym@coastalnet.com); 'Mayor Morehead City'; Michael Marshall (mike.marshall@ncmail.net); smtp-Rikard, Michael; 'Morehead City Manager'; 'Pat McElraft'; 'Pete Benjamin - USFWS'; Rich Carpenter; 'Richard Lawrence'; 'Rick Luettich'; 'Roessler, Todd'; smtp-Sechler, Ron; smtp-Winslow, Sara; Stephen Rynas (stephen.rynas@ncmail.net); Todd Walton (todd_walton@ncports.com); 'Town Manager Beaufort'; 'Town Manager Emerald Isle'; 'Town Manager Swansboro'; 'Town of Atlantic Beach CAMA'; 'Tracy Barnes'; Trish Murphey (trish.murphey@ncmail.net); Walker Golder

Subject: FW: Morehead City Harbor Project Dredged Material Management Plan Meeting March 4, 2009

All,

My apologies for sending this twice, but it was brought to my attention that the subject line had the wrong date for the meeting. The meeting date is Wednesday March 4, 2009. Sorry about any confusion this may have caused.

Stacy Samuelson
Biologist
Environmental Resources Section
U.S. Army Corps of Engineers, Wilmington District
69 Darlington Avenue
Wilmington, North Carolina 28403
910-251-4480
910-251-4744(fax)

From: Samuelson, Stacy D SAW
Sent: Friday, February 13, 2009 12:06 PM
To: Angela Mangiameli; 'Assistant County Manager'; 'Atlantic Beach Town Manager'; Bouchard, Jennifer A LT CNRMA; camerons@coastalnet.com; cyndi.karoly@ncmail.net; David Allen (allend@coastalnet.com); 'Don Hoss'; doug.huggett@ncmail.net; 'Gary Collins - EPA'; 'Greg Rudolph'; 'Gregory Case - Deputy Sector Commander USCG'; howard_hall@fws.gov; 'Janice Allen'; 'Jean Preston'; 'Jerry Schill'; joanne.steenhuis@ncmail.net; Jody Merritt (jody.merritt@ncmail.net); smtp-Sutherland, John; 'Katrina Marshall'; 'Linda Brickhouse'; Maria Dunn (maria.dunn@ncwildlife.org); 'Mark Ramsing'; Matthew Godfrey (godfreym@coastalnet.com); 'Mayor Morehead City'; Michael Marshall (mike.marshall@ncmail.net); smtp-Rikard, Michael; 'Morehead City Manager'; 'Pat McElraft'; 'Pete Benjamin - USFWS'; Rich Carpenter; 'Richard Lawrence'; 'Rick Luettich'; 'Roessler, Todd'; smtp-Sechler, Ron; smtp-Winslow, Sara; Stephen Rynas (stephen.rynas@ncmail.net); Todd Walton (todd_walton@ncports.com); 'Town Manager Beaufort'; 'Town Manager Emerald Isle'; 'Town Manager Swansboro'; 'Town of Atlantic Beach CAMA'; 'Tracy Barnes'; Trish Murphey (trish.murphey@ncmail.net); Walker Golder
Cc: Owens, Jennifer L SAW; Payonk, Philip M SAW; Frabotta, Christopher C SAW; McCorcle, Justin P SAW
Subject: Morehead City Harbor Project Dredged Material Management Plan Meeting Feb. 25, 2009

All,

As you may be aware, the U.S. Army Corps of Engineers, Wilmington District, is initiating the process to develop the "Morehead City Harbor Dredged Material Management Plan". The 20-year plan will identify how dredge material, originating from the Morehead City Harbor Federal navigation project, will be managed in a least cost, environmentally acceptable and engineeringly sound manner.

The Wilmington District has performed a substantial amount of preliminary work, including: geotechnical sampling and analysis, determination of shoaling and dredging rates, etc. which should help with the identification of alternatives. This preliminary work will be utilized to develop and evaluate "disposal alternatives" for the plan.

We would like to meet with our Local, State and Federal agency partners to discuss the following:

- Provide a status briefing of the completed work and the ongoing work.
- Provide the major milestones of the project schedule.
- Request input from Local, State and Federal agencies on identification of potential alternatives.
- Request input from Local, State and Federal agencies on constraints or preferences that may affect choice of alternatives.

We have scheduled a meeting to discuss these items. Below is the proposed time and location:

Time / Date: 1300 - 1500 / 4 March 2009 (Wednesday)

Location: Carteret County Commissioners Boardroom, Courthouse Square, Beaufort, NC 28516

Please respond to Mr. Stacy Samuelson (stacy.d.samuelson@usace.army.mil) by 25 February 2009 if you plan to attend or have questions. Please forward this announcement to any additional interested parties as you see fit. Thank you in advance for your participation in this project.

V/R,

Mr. Stacy Samuelson
Biologist
Environmental Resources Section
U.S. Army Corps of Engineers, Wilmington District
69 Darlington Avenue
Wilmington, North Carolina 28403
910-251-4480
910-251-4744(fax)

DEPARTMENT OF THE ARMY
WILMINGTON DISTRICT, CORPS OF ENGINEERS
69 DARLINGTON AVENUE
WILMINGTON, NORTH CAROLINA 28403-1343

REPLY TO
ATTENTION OF:

July 31, 2009

Environmental Resources Section

Mr. Russell J. Wilson, Superintendent
Cape Lookout National Seashore
131 Charles Street
Harkers Island, North Carolina 28531

Dear Mr. Wilson:

The purpose of this letter is to request the position of your agency regarding the disposal of sediment associated with dredging of the navigation channels of the Morehead City Harbor Project (MCHP), which lies adjacent to Shackleford Banks, part of the Cape Lookout National Seashore (CALO), in Carteret County, North Carolina. Specifically, this agency is preparing a 20-year Dredged Material Management Plan (DMMP) to identify disposal locations that are cost-effective, engineeringly sound, and environmentally acceptable for material dredged from the project. We are now in the alternatives formulation phase of the DMMP process, and are considering a wide range of alternatives for dredged material disposal, some of which involve the placement of material on or near the beaches of Shackleford Banks. Before this agency advances any of these alternatives to a final grouping of probable or likely disposal locations, we would like to solicit the opinion of your agency regarding the compatibility of such disposal alternatives with the purposes of the National Seashore. Additionally, we would like to obtain from you a basic understanding of the criteria, data, or objectives that your agency would like to see considered as we evaluate alternatives, particularly those that may involve placement of material on or near the National Seashore.

The MHCP has been a continuously maintained Federal navigation project since 1911. Currently, the Corps of Engineers maintains a system of navigation channels that leads from the deep water of the Atlantic Ocean to the State Port of Morehead City and beyond. The project, as outlined in the enclosure 1, contains material with a range of grain sizes from 50 percent to 90 percent sand. The Corps is considering a wide range of disposal options for this material, including the beaches of Bogue and Shackleford Banks, the nearshore areas adjacent to both islands, and confined upland disposal areas that currently exist or may be developed. A goal of the dredged material disposal project is to, where practicable, counteract the erosive effects of channel maintenance, a major element of which is the deflation of the ebb tide delta of Beaufort Inlet.

Recent Corps analysis of Beaufort Inlet surveys indicates that between 1974 and 2009, the inlet's ebb tide delta has deflated by approximately 13,400,000 cubic yards (cy). As the enclosed elevation difference plot shows at enclosure 2, some of the most dramatic changes in depth have occurred on the smaller eastern side of the delta, adjacent to Shackleford Banks. As a result, the Corps is exploring the creation of a new nearshore disposal area for dredged material on the eastern side of the delta, with the expectation that such placement may counteract delta deflation. The proposed location for the disposal area is included as enclosure 3 to this letter, and measures approximately 413 acres adjacent to the western side of the island. The amounts of material placed, proposed grain size, and disposal interval are yet to be determined. Some further clarification of this proposed area, and the material proposed to be disposed in it, will be available following our sampling effort that will characterize the existing ebb tide delta substrate and benthos across a large portion of the delta.

In its initial Environmental Impact Statement for deepening of the MCHP in 1976, the Corps approached CALO regarding the potential for placement of material on Shackleford Banks to counteract anticipated erosion. At that time, your agency indicated that it did not desire dredged material disposal on Shackleford Banks. We would appreciate your current opinion on dredged material disposal on Shackelford Banks. As shown in enclosure 4, the Corps is currently developing an alternative that includes an area that begins approximately one mile east of Beaufort Inlet and terminates six miles east of the inlet. This area is within the westerly transport zone identified in the Corps' Section 111 report from June 2001. Proposed berm width and timing of placement is yet to be determined. If CALO prefers not to accept disposal of dredged material on Shackelford Banks, we would appreciate a written response to that effect, as development of this alternative may be resource intensive.

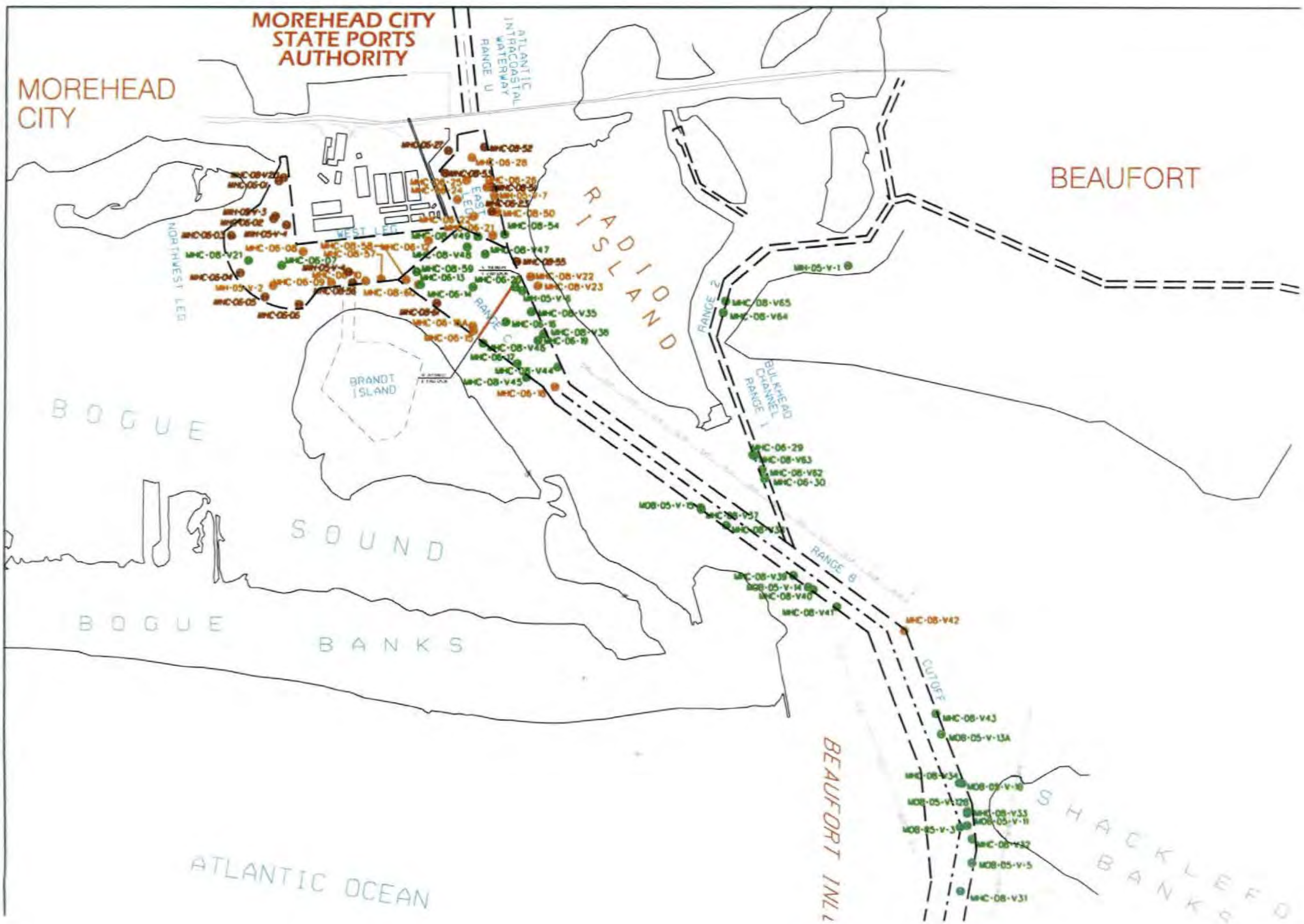
We would also like to obtain from you a basic understanding of the criteria, data, or objectives that your agency would like to see considered as we evaluate alternatives, particularly those that may involve placement of material on or near the National Seashore. We invite your active participation in this ongoing process, and invite you to attend our regular monthly meetings on the DMMP. For more information, or to clarify any matter herein, please contact Ms. Jenny Owens at (910) 251-4757. Thank you for your consideration, and I await your response.

Sincerely,

W. Coleman Long
Chief, Planning and Environmental Branch

Copy Furnished w/encl:

Mr. Michael Rikard
Cape Lookout National Seashore
131 Charles Street
Harkers Island, North Carolina 28531


MOREHEAD CITY STATE PORTS AUTHORITY
MOREHEAD CITY
ATLANTIC INTRACOASTAL WATERWAY RANGE U
BEAUFORT
RADIO ISLAND
NORTHWEST LEG
WEST LEG
EAST LEG
RANGE C
RANGE 2
BULKHEAD CHANNEL RANGE 1
RANGE B
CUTOFF
BRANDT ISLAND
BOGUE SOUND
BOGUE BANKS
ATLANTIC OCEAN
BEAUFORT INLET
SHACKLEFORD BANKS
MHC-08-V21
MHC-08-V22
MHC-08-V23
MHC-08-V35
MHC-08-V36
MHC-08-V45
MHC-08-V47
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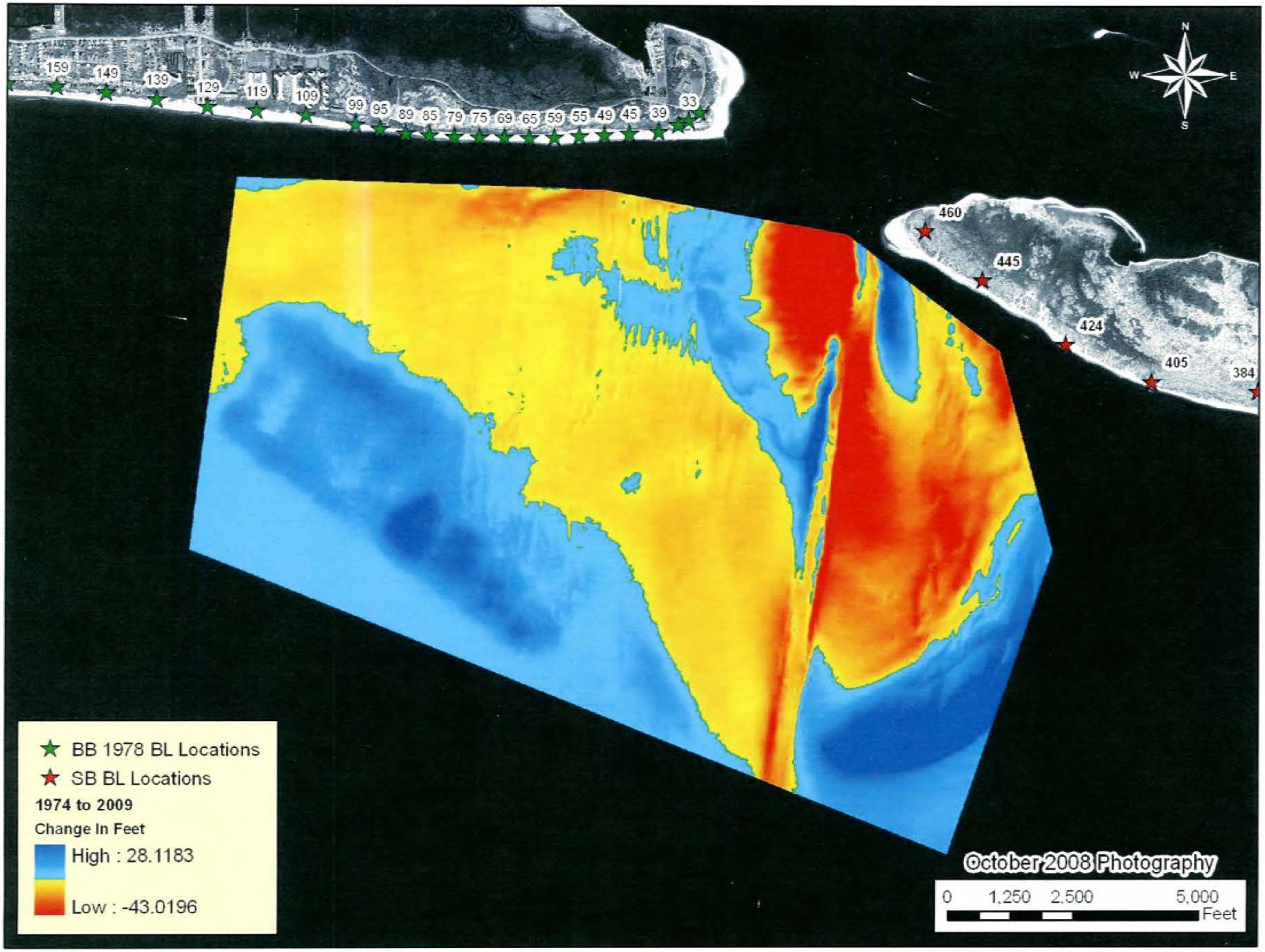
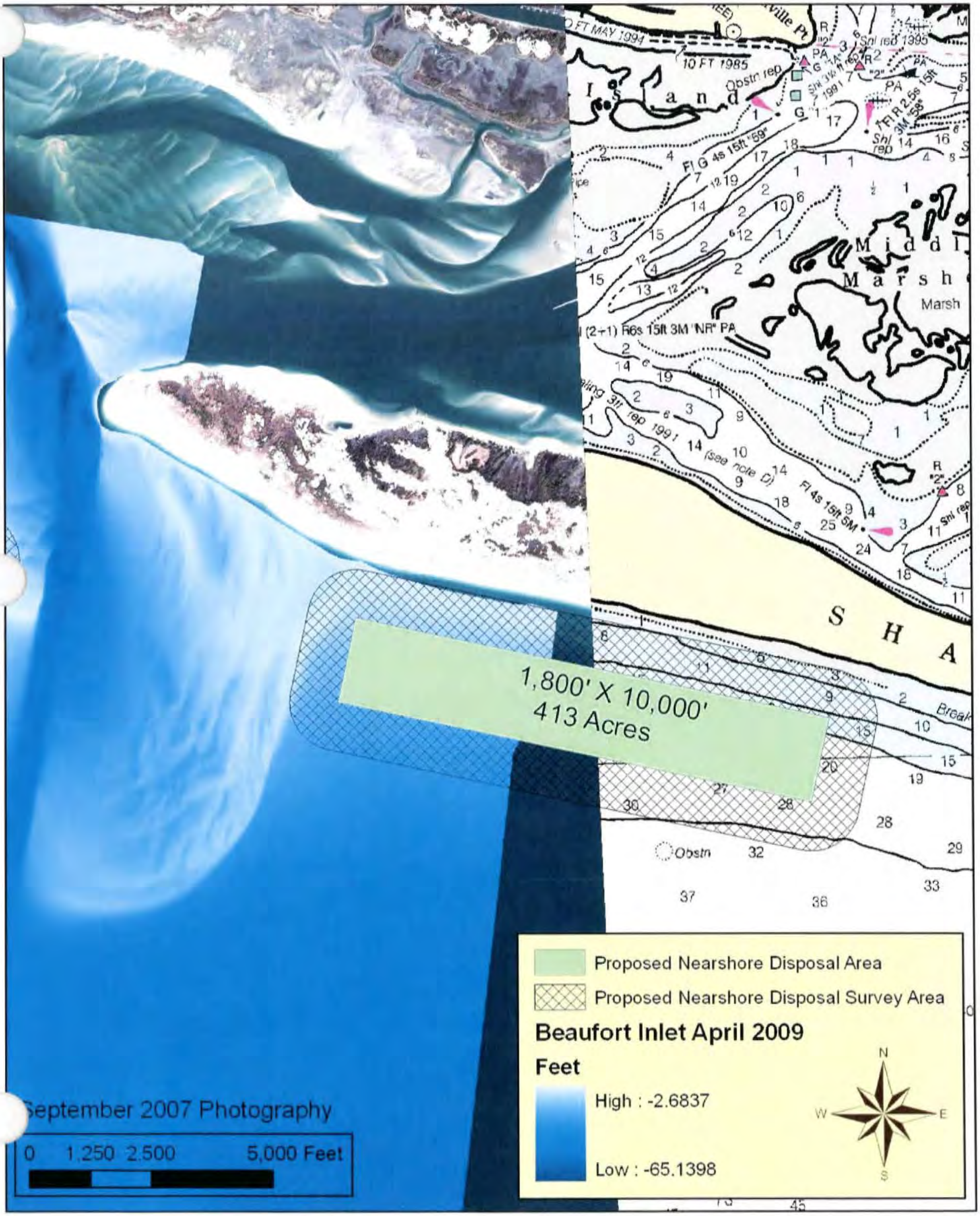
MHC-08-V63
MHC-08-V62
MHC-08-30
MHC-08-V42
MHC-08-V43
MOB-05-V-13A
MHC-08-V41
MHC-08-V31
MOB-05-V-5
MHC-08-V33
MHC-08-28
MHC-08-50
MHC-08-54
MHC-08-52
MHC-08-V44

1974 to 2009 Eleva n Difference Plot



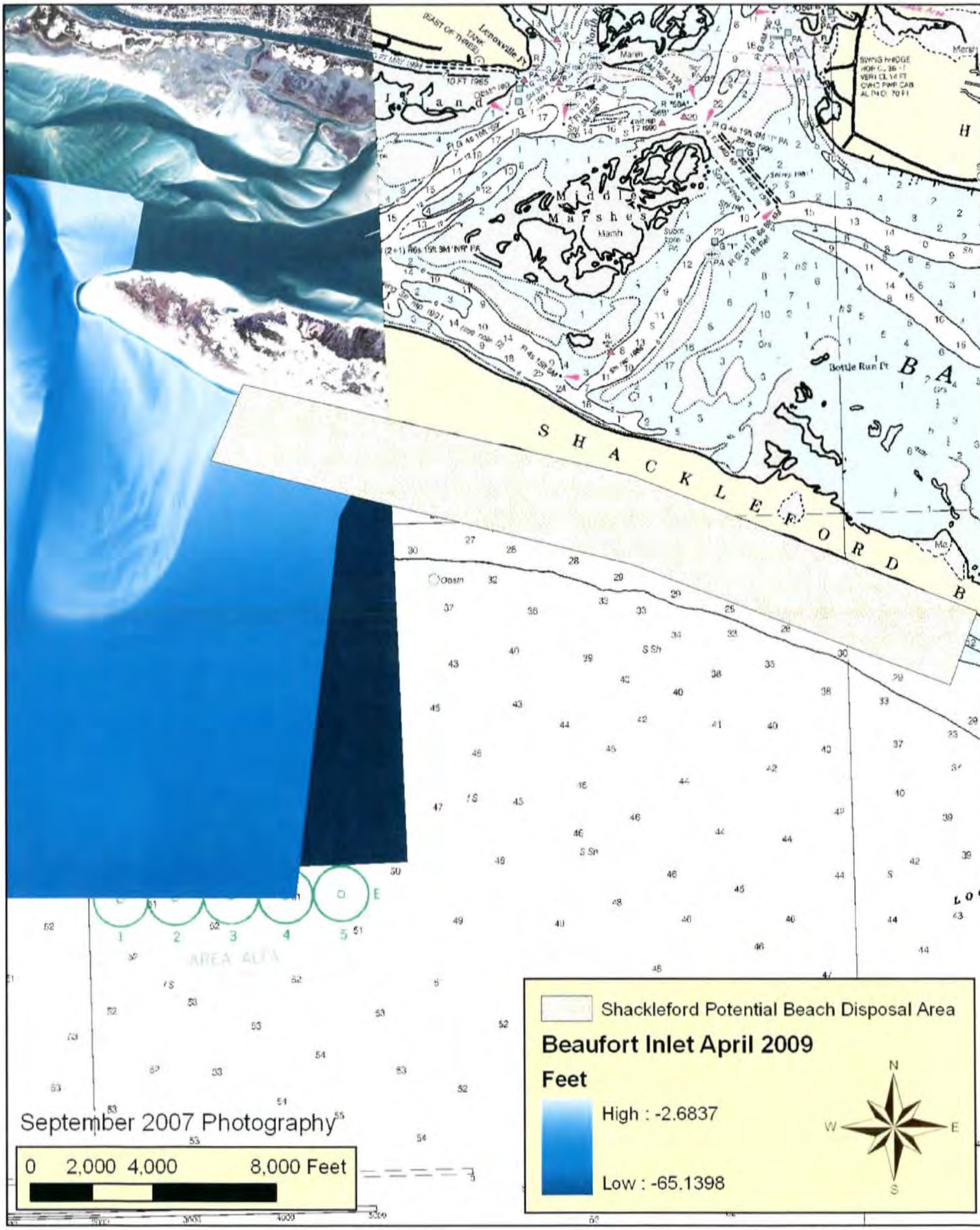
Enclosure 2

Proposed Nearshore Disposal Location



Enclosure 3

Potential Beach Disposal Location



Enclosure 4

United States Department of the Interior

National Park Service
Cape Lookout National Seashore
131 Charles Street
Harkers Island, North Carolina 28531

IN REPLY REFER TO:

A3815

September 24, 2009

Mr. W. Coleman Long
Chief, Planning and Environmental Branch
Department of the Army
Wilmington District, Corps of Engineers
69 Darlington Avenue
Wilmington, North Carolina 28403-1343

Dear Mr. Long:

Thank you for your letter of July 31, 2009, requesting information about the compatibility of sediment disposal with the purposes of Cape Lookout National Seashore (CALO). You also asked for the criteria, data, and objectives that the National Park Service (NPS) would like to see considered in the U.S. Army Corps of Engineers' evaluation of alternatives in the Morehead City Harbor Project Dredged Material Management Plan (MCHP DMMP).

We have addressed your two requests below. We are also requesting additional information from you about this project.

Compatibility with NPS Purposes

As you know, CALO is a unit of the National Park System. It is the policy of the National Park Service to protect natural processes in park units, such as shoreline change. Generally, the NPS disfavors any interference with those processes by actions such as sediment disposal (NPS Management Policies 2006, § 4.8.1 and § 4.8.1.1). Sediment disposal and other types of shoreline process interference are only permitted within national park units when:

Directed by Congress,

Necessary in emergencies that threaten human life and property,

There is no other feasible way to protect park natural resources, cultural resources, or park facilities, or necessary to restore or mitigate the impacts of human-caused activities.

Therefore, to be compatible with the park's purposes, any sediment disposal within CALO must meet one or more of the above requirements. This determination must be based on the results of scientific research, as required by 16 U.S.C. § 5936. Additionally, any sediment disposal within CALO would need to be carried out in accordance with a plan that is acceptable to the NPS and consistent with the park's purposes (see 16 U.S.C. § 459g-5), and a way that ensures that park resources and values remain unimpaired (see 16 U.S.C. § 1).

This NPS shoreline policy was applied at CALO in 2006 with the nourishment of the park beach in front of the historic buildings associated with the Cape Lookout Lighthouse. This beach was nourished to mitigate the erosion caused by the maintenance of Barden Inlet and to protect these important cultural resources.

Criteria, Data, and Objectives to be Considered in the MCHP DMMP Alternatives

The above-described NPS policy and mandates will serve as the criteria against which the NPS would compare any DMMP alternative that includes sediment disposal in the Seashore. Initially, data will be required to assess whether placement of dredged material within CALO meets one or more of the above criteria. If the initial investigation indicates that this alternative does meet one or more of the NPS criteria, then further research will be required to consider potential impacts to the natural and cultural resources in the park and provide information for NPS decision-making.

DMMP alternatives that include the disposal of non-beach-quality sediment near the park boundary may likewise result in impacts to park resources. Specifically, the NPS is concerned about the chemical and physical compatibility of such sediment with the existing sediment within the park. On the other hand, the NPS would be willing to consider the nearshore disposal of beach-quality sediment if it were designed to replenish the eroded ebb shoal and/or the deflated offshore profile. Therefore, the DMMP should include information about the source(s), the chemical and physical composition, and the quantity of any sediment proposed for disposal in the nearshore areas along Shackleford Banks, and the intended purpose and justification for placing it there.

Additionally, the DMMP should include information about the intended dimensions and location of the navigation channel through Beaufort Inlet and whether the maintenance of this channel would result in the dredging of areas within park boundaries. The DMMP should note that any such dredging would need to proceed in accordance with NPS mandates for the protection of park resources.

All DMMP alternatives should consider data including, but not limited to, historic and existing beach and nearshore morphology; historic and existing alongshore sediment transport rates and directions; characterization of the nearshore macroinvertebrate communities in the potential disposal areas; and characterization of potential dredge material to ensure that the sediments are free of contaminants and are compatible in grain-size, composition and color with existing beach and nearshore sediments. Establishment of pre-project conditions and post-project monitoring should be included in each alternative. Each alternative must be presented in sufficient detail in the DMMP and the associated compliance documentation to enable CALO to fully assess the beneficial and adverse impacts of that alternative on the park.

The objective that should be considered in all MCHP DMMP alternatives is the conservation of park resources and values unimpaired for the enjoyment of current and future generations.

I hope that this letter satisfactorily responds to your July 31, 2009 requests. If you have any questions, please do not hesitate to contact me at 252-728-2250 ext. 3014.

Sincerely,

Russel J Wilson

Russel J. Wilson,
Superintendent

KILPATRICK
STOCKTON LLP
Attorneys at Law

Suite 400 3737 Glenwood Avenue
Raleigh NC 27612
t 919 420 1700 f 919 420 1800
www.KilpatrickStockton.com

Steven J. Levitas
direct dial 919 420 1707
direct fax 919 510 6145
slevitas@kilpatrickstockton.com

October 1, 2009

Via First Class Mail and Electronic Mail

U.S. Army Corps of Engineers
Wilmington District
Attention: Stacy Samuelson
Post Office Box 1890
Wilmington, NC 28402-1890

Re: Comments Regarding the Interim Operations Plan and the Dredged Material Management Plan, Morehead City Harbor, North Carolina

Dear Mr. Samuelson:

I am writing on behalf of Carteret County, North Carolina to provide comments regarding the Interim Operations Plan (the "IOP") and the Dredged Material Management Plan ("DMMP") for the Morehead City Harbor Project ("MCHP"). We appreciate the Corps' willingness to allow Carteret County to participate on the Project Delivery Team and its openness during the development of the DMMP. Carteret County, however, has several concerns related to the development of the DMMP, which are summarized below.

1. The material disposed in the existing nearshore berm has exhibited little to no movement, and if the Corps intends to use this area after the IOP, a new consistency determination is required.

Initially, in approximately 1992, the Corps proposed to locate the nearshore disposal area along the -18-foot depth contour. The Corps' own analysis indicated that dredged material disposed in water depth of -25-feet or greater will not exhibit significant movement. Despite this conclusion, in approximately 1994, the Corps proposed that the nearshore berm be located west of Beaufort Inlet between the -25 and -30-foot contours. In fact, when disposing dredged material in the nearshore berm, the Corps has placed such material between approximately the -26 and -40-foot contours. The Corps has acknowledged, as reflected in the following excerpts from Corps documents, that this material has exhibited little to no movement.

- "[B]athymetric surveys suggest that aside from flattening slightly over the past several years, [the nearshore berm] remains generally stable, even though several severe weather events have impacted the area. Bruce Ebersole suggested that the maximum depth of active transport may be 20 feet MLW or less, so that the peaks of the mound are pushed over but the bulk of the mound remains essentially stable." Draft Corps Proposal and Scope of Work – Analysis of Material Movement Nearshore Placement Area, December 10, 2001.

- Dredged material placed in the nearshore berm has exhibited "very little movement." Final Section 111 Report, June 2001, p. 48.

- "The MHC ocean bar dredging job has material placement in the nearshore disposal area, which does not move toward the beach." Internal Corps Email dated October 18, 2005.

- "In fact, this area is the same area where we've been placing material in the nearshore for years that has not moved. (We even have a letter from several years ago from NC DCM asking us why our nearshore berm is not moving.)." Internal Corps Email dated February 24, 2006.

As previously stated, Carteret County does not object to the disposal of dredged material in the existing nearshore berm during implementation of the IOP provided it is limited to a *one-time event* and is superseded by a permanent DMMP that complies with the CZMA and other applicable requirements.

2. In developing the DMMP, the Corps should evaluate the existing and proposed nearshore disposal areas to determine the benefits, if any, of such disposal practices on the ebb tidal delta and adjacent beaches.

It is Carteret County's understanding that the Corps is evaluating a proposal to expand the existing nearshore disposal area off of Bogue Banks and to create a new nearshore disposal area off of Shackleford Banks. The Corps has shown the approximate location of these nearshore disposal areas, but has not defined the specific coordinates or water depths. Nonetheless, based on the approximate location of the proposed nearshore disposal areas, these areas appear be in water depths less than -25 feet MLW. Carteret County supports the Corps efforts to dispose of material in the nearshore disposal area in depths less than -25 feet MLW.

During the development of the DMMP, the Corps should evaluate the movement of dredged material in the existing nearshore disposal area and perform modeling and other tests to predict the potential for movement of dredged material in the expanded and new nearshore disposal areas. In response to concerns raised by the State of North Carolina and Carteret County, in late 2001, the Corps proposed evaluating the existing nearshore disposal area and a shallow water test disposal area. The proposed study included the following tasks:

- Evaluation of the nearshore placement area, inlet and shoreline;

- Wave climate and wave transformation;

- Circulation modeling;
- Sediment transport modeling;
- Field data monitoring;
- Shallow water test mound;
- Recommendations of future placement techniques and locations; and
- Communication of study results and recommendations.

Due to the high cost of the proposal and limited funds, the Corps did not pursue this study. The Corps should use its past experience as a guide in evaluating the existing nearshore disposal area and proposed expansion and creation of new disposal areas during development of the DMMP.

3. Disposal of dredged material in the nearshore berm should not take the place of disposal of beach-quality dredged material directly on the beach and in the proper location.

As the Corps has recognized, it is appropriate to dispose of beach-quality dredged material directly on the beach. *See* Corps, Environmental Assessment, Morehead City Harbor Section 933 Project, May 2003, p. E-3 ("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, to the maximum extent practicable. Placement of this sand on beaches merely represents return of material, which eroded from beaches, and is, therefore, replenishment with native material."). However, not only must such material be placed directly on the beaches, this material must also be placed in the proper location.

During the first year of the IOP, the Corps has proposed to place dredged material directly on the beach. The Corps, however, has proposed to place the vast majority of this material east of the nodal point, which will provide little or no benefit to beaches west of the nodal point. The Corps has recognized that as a result of the MCHP, "waves now have the potential to transport greater volumes of littoral sediment into Beaufort Inlet compared to the pre-project case" and "[e]ssentially all of the material placed on the Fort Macon shoreline in 1978 and 1994 appeared to be transported directly into Beaufort Inlet within a few years following disposal." Corps, Final Section 111 Report, pp. 29, 42-45. Further, one of the factors that the Corps uses to evaluate its dredged material management practices under the Federal Standard is "minimizing losses into the entrance channel." Internal Corps Email, Oct. 16, 2002. Thus, not only does placement of dredged material east of the nodal point provide little or no benefit to the beaches west of the nodal point, it is also inconsistent with the Corps' interpretation of its own regulations.

The Corps should evaluate a number of potential impacts that the MCHP may be causing west of the nodal point. As discussed above, the MCHP has increased the potential for sand to be transported back to Beaufort Inlet; therefore, there is likely less sand available for beaches west of the nodal point compared to pre-project conditions. Not only is there less sand available in the system, research indicates that the MCHP has the potential to increase wave energy and erosion rates during major storm events as far west as eight (8) miles west of Beaufort Inlet. Past wave transformation analyses conducted by the Corps have not focused on individual storm events. Model results from Olsen Associates, Inc. suggest several points alongshore in the vicinity of Pine Knoll Shores where small reversals and erosional hot-spots are indicated. During development of the DMMP, the Corps should evaluate whether the MCHP has the potential to impact erosion rates of areas west of the nodal point during major storm events.[1] Finally, the Corps has acknowledged that the nearshore off of Pine Knoll Shores is steeper than off of Atlantic Beach, which may result in shoreline impacts. Internal Corps Email, Oct. 16, 2002. ("A 50-ft berm would also provide minimal benefit for Pine Knoll Shores. Because the nearshore is so steep, the unit volume required for constructing a 50-ft berm is more than twice that required for a similar berm width for most of Atlantic Beach."); Internal Corps Document, Mike Wutkowski, Feb. 2002 ("There is an import[ant] issue here beyond [whether] or not the disposal berm is moving. (There has been no study on whether the berm has moved.) ERDC has pointed out that the effects of dredging may still be coming. The process is the ocean bar deflates, the offshore deepens and the shoreline adjusts to the deepening. The locals have asked bout this. . . . Headquarters said they are unconcerned about offshore effects. We should get this in writing and be sure they understand that it may indicate a shoreline impact.").

Carteret County has previously provided comments expressing its concerns that more dredged material should be placed west of the nodal point. Carteret County, however, does not object to the disposal of dredged material on the beach in its proposed location during implementation of the IOP provided it is limited to a *one-time event* and is superseded by a permanent DMMP that adequately evaluates the impacts of the MCHP west of the nodal point. Further, the Corps should use placement of sand directly on the beaches of Bogue Banks during the first year of the IOP as an opportunity to evaluate the movement of dredged material placed in this location. In addition to monitoring beach profiles before and after placement of the dredged material, the Corps should collect additional data on sediment movement by performing a tracer study.

4. The Corps should establish specific disposal controls, conditions and requirements for the potential disposal of non-beach quality dredged material in the ODMDS to avoid or minimize potential impacts to beach-quality dredged material previously disposed in the ODMDS.

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[1] When conducting wave transformation analyses, the model grid within the surf zone should be finer in the cross-shore direction to accurately predict where waves are breaking.

Carteret County addresses this issue in comments provided to the Corps regarding the draft Site Management and Monitoring Plan ("SMMP") in a letter dated September 29, 2009. A copy of this letter is attached.

Thank you again for the opportunity to provide these comments. Carteret County looks forward to working with the Corps to ensure that they are appropriately addressed in the DMMP.

With best wishes,

Sincerely yours,

KILPATRICK STOCKTON LLP

Attachment

Steven J. Levitas

cc: Greg "Rudi" Rudolph
William "Buck" Fugate
Justin McCorcle
Chris Frabotta
Coleman Long

REC'D 12/3/1\[1\]

United States Department of the Interior

NATIONAL PARK SERVICE
Southeast Regional Office
Atlanta Federal Center
1924 Building
100 Alabama St., SW.
Atlanta, Georgia 30303

IN REPLY REFER TO:
SER-PC

DEC 02 2010

W. Coleman Long
Chief, Planning and Environmental Branch
Department of the Army
Wilmington District, Corps of Engineers
69 Darlington Avenue
Wilmington, North Carolina 28403-1343

Dear Mr. Long:

The U.S. Army Corps of Engineers (USACE) has inquired whether the National Park Service (NPS) wishes the USACE to expand the scope of its Morehead City Harbor Project Dredged Material Management Plan (MCHP DMMP) to include an additional alternative that may benefit Cape Lookout National Seashore (Seashore). Specifically, the USACE has proposed an alternative that would allow the placement of dredged material at eroding areas of the Shackleford Banks section of the Seashore. The placement of dredged material would mitigate impacts of the MCHP on Shackleford Banks by filling in the steepened beach profiles in the central and western portion of this area. After a review of policy as it relates to Shackleford Banks, the NPS has determined that such an alternative, appropriately implemented, would be consistent with bureau policy and should be included in the DMMP and associated environmental impact statement (EIS).

The NPS is pleased that the USACE has recognized this opportunity to mitigate ongoing impacts associated with maintenance dredging of the MCHP. The management policies of the NPS provide that natural resources are to be managed to preserve fundamental physical and biological processes, as well as individual species, features, and plant and animal communities. Accordingly, NPS typically will not interfere in natural biological or physical processes to conduct active management. However, an exception to this policy is recognized when intervention is necessary to restore natural resource functioning that has been disrupted by past or ongoing human activities. This exception can even apply in those areas, such as Shackleford Banks, that are proposed for designation as wilderness.

Shackleford Banks has been managed to preserve its wilderness resources and values since January 14, 1986. On that date, NPS Director William Penn Mott, Jr., signed a wilderness recommendation proposing that Congress designate 2,990 acres of the island as wilderness. Because Shackleford Banks is proposed wilderness, active manipulation of the island's environment is not normally permitted. However, our management policies allow for intervention in wilderness areas to the extent necessary to correct past mistakes, the impacts of human use, and influences outside of wilderness boundaries.

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The NPS has special expertise with respect to the project's potential environmental impacts at the Seashore, and for this reason, we ask that NPS be named a federal cooperating agency on this project. As a cooperating agency, we can offer early review and comment on EIS draft sections in areas of NPS mandates, as well as help prepare those portions of the document, such as the Minimum Requirements Analysis for Wilderness (MRA), that lie particularly within our knowledge and expertise. The NPS manages wilderness in such a way as to maintain its natural, untrammeled and undeveloped qualities, while providing opportunities for solitude and a primitive and unconfined type of recreation. The MRA process is designed to identify those tools and measures that will accomplish the objectives of the project while minimizing impacts on wilderness resources and values.

In addition to taking the foregoing steps, the NPS proposes to assist the USACE in development of the EIS in the following manner:

- Assist in the development and/or review of any monitoring plans or adaptive management plans that might be required
- Provide comments on working drafts of the EIS documents
- Respond to other USACE requests for information
- Participate in public meetings, as appropriate

The NPS's cooperating agency status and level of involvement would not preclude our independent review and comment responsibilities under Section 102(2)(C) of the National Environmental Policy Act. Similarly, our being a cooperating agency would not imply that NPS would necessarily concur with all aspects of the USACE's EIS.

If the proposed alternative were to become the USACE's selected alternative, no actual deposition of sediment could take place at Shackleford Banks until NPS had signed a decision document authorizing such deposition. Assuming no material disagreements among our respective agencies with respect to environmental impacts, the NPS's standard practice would be to adopt relevant parts of the DMMP EIS to provide the necessary compliance for this decision document.

The proposed alternative represents a significant opportunity to address ongoing erosion issues at Shackleford Banks and protect vitally important natural and wilderness resources for future generations. We appreciate your coordination with us and look forward to working with the USACE on this important project.

The primary NPS contact for the overall EIS and NEPA-related issues will be Michael Rikard ((252) 728-2250 x3012). The NPS technical contact for dredging and beach placement related issues will be Jodi Eshleman ((215) 597-1782).

Sincerely,

For David Vela
Regional Director
Southeast Region

cc: Russell J. Wilson, Superintendent, Cape Lookout National Seashore

DEPARTMENT OF THE ARMY
WILMINGTON DISTRICT, CORPS OF ENGINEERS
69 DARLINGTON AVENUE
WILMINGTON, NORTH CAROLINA 28403-1343

REPLY TO
ATTENTION OF:

February 15, 2011

Environmental Resources Section

Mr. David Vela, Regional Director
National Park Service, Southeast Regional Office
Atlanta Federal Center, 1924 Building
100 Alabama St., SW.
Atlanta, Georgia 30303

Dear Mr. Vela:

In response to National Park Service (NPS) letter dated December 2, 2010, the U.S. Army Corps of Engineers, Wilmington District (USACE) formally names the National Park Service as a Federal cooperating agency on the Morehead City Harbor Dredged Material Management Plan and integrated Environmental Impact Statement (DMMP/EIS). The NPS has special expertise with respect to the project's potential environmental impacts at Shackleford Banks, which will be invaluable for our successful completion of the DMMP/EIS. We appreciate your willingness to serve as a cooperating agency in the preparation of this plan; this letter serves as an outline of each agency's responsibilities in the planning process.

The USACE proposes to undertake the following activities to maximize this interagency cooperation:

- Invite the NPS to all relevant coordination meetings;
- Consult with the NPS on any relevant technical studies that will be required for the DMMP/EIS;
- Organize joint field reviews with appropriate NPS staff;
- Provide NPS with pertinent project information, including study results and a detailed project schedule that will identify project milestones;
- Encourage NPS to use the above documents, or other documents which it chooses to provide, to express its views on subjects within its jurisdiction or expertise; and
- Include information in the project environmental documents that cooperating agencies will need to discharge their National Environmental Policy Act (NEPA) responsibilities and any other requirements regarding jurisdictional approvals, permits, licenses, and/or clearances.

As outlined in the letter of December 2, 2010, we understand that, as a cooperating agency, the NPS will provide early review and comment on EIS draft sections in areas of NPS mandates, and will help prepare those portions of the document, such as the Minimum Requirements Analysis for Wilderness (MRA), that lie particularly within the agency's knowledge and expertise. In addition, the NPS will assist the USACE in development of the DMMP/EIS in the following manner:

- Provide assistance and guidance in the development and/or review of any monitoring plans or adaptive management plans that might be required;
- Provide comments on working drafts of the DMMP/EIS documents within agreed-upon timeframes;
- Respond to other USACE requests for information in a timely manner; and
- Participate in public meetings, as appropriate.

It is understood that the NPS's cooperating agency status and level of involvement will not preclude its independent review and comment responsibilities under Section 102(2)(C) of the National Environmental Policy Act. Similarly, it is understood that being a cooperating agency does not imply that NPS will necessarily concur with all aspects of the Corps' DMMP/EIS. It is our goal, however, to seek concurrence between our agencies on all matters of importance to our respective agencies.

The NPS has the right to expect that the DMMP/EIS will enable it to discharge its jurisdictional responsibilities. If the proposed alternative for beach placement of material on Shackleford Banks was to become the Corps' selected alternative, no actual deposition of sediment would take place at Shackleford Banks until NPS signs a decision document authorizing such deposition. We expect that at the end of the National Environmental Policy Act (NEPA) process, the NPS will adopt relevant parts of the DMMP/EIS to provide the necessary compliance for this decision document. The Corps intends to utilize the DMMP/EIS, in its entirety, and the subsequent record of decision as our decision making documents.

We look forward to working with you on this important project. If you have any questions or would like to discuss in more detail the project or our agencies' respective roles and responsibilities during the preparation of the DMMP/EIS, please contact Ms. Jenny Owens, Environmental Resources Section, at 910-251-4757.

Sincerely,

Elden Gatwood

Elden Gatwood
Chief, Planning and Environmental Branch

APPENDIX E

EXPLANATION OF VERTICAL DATUM

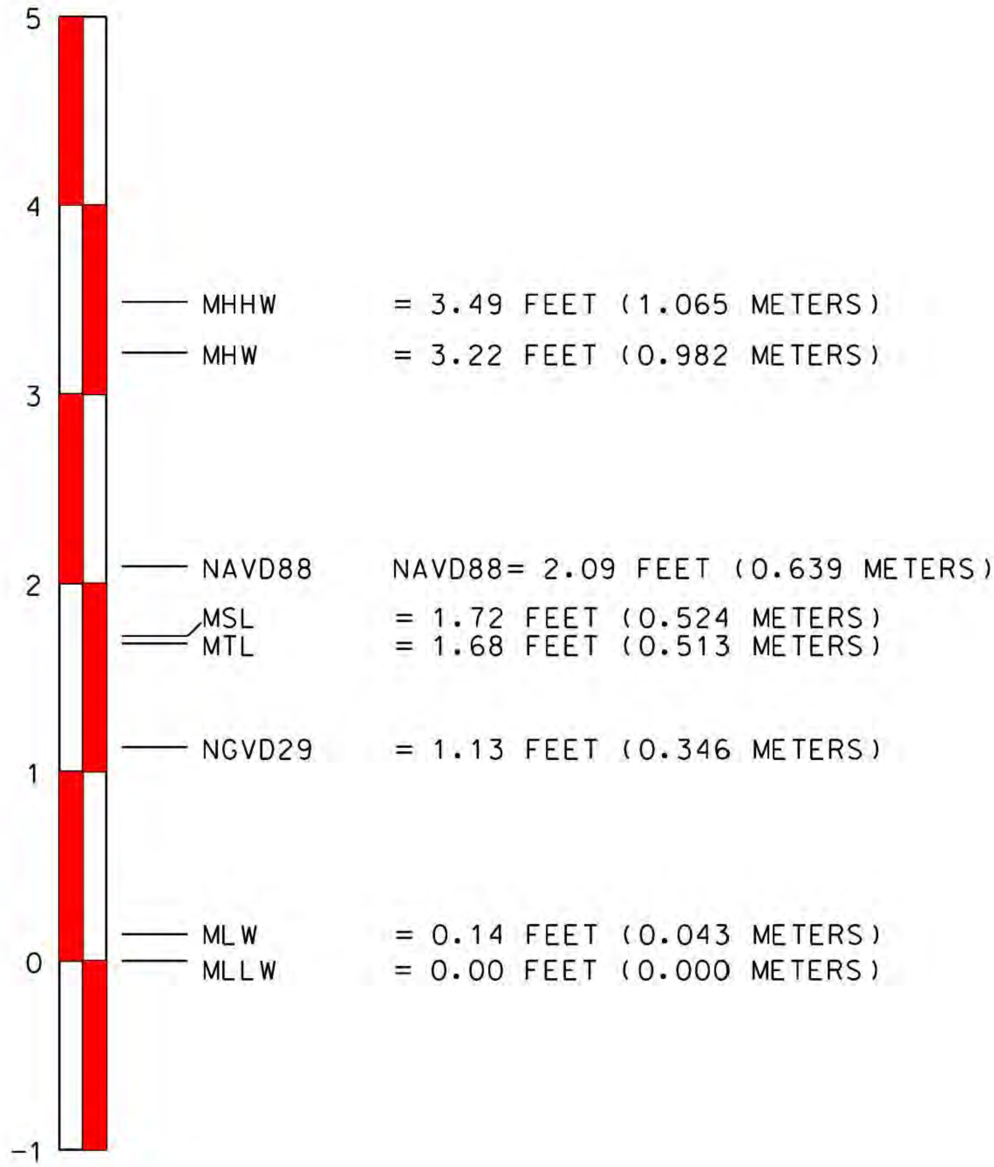
VERTICAL DATUM

A vertical datum is used for measuring the elevations of points on the earth's surface. Vertical data are either tidal, based on sea levels, gravimetric, based on a geoid, or geodetic, based on the same ellipsoid models of the earth used for computing horizontal datums.

In common usage, elevations are often cited in height above sea level; this is a widely used tidal datum. Because ocean tides cause water levels to change constantly, the sea level is generally taken to be some average of the tide heights. Mean lower low water — the average of the lowest points of a semi-diurnal tide reached on each day during a measuring period of several years — is the datum used for measuring water depths on some nautical charts, for example; this is called the chart datum. While the use of sea-level as a datum is useful for geologically *recent* topographic features, sea level has not stayed constant throughout geological time, so is less useful when measuring very long-term processes.

A geodetic vertical datum takes some specific zero point, and computes elevations based on the geodetic model being used, without further reference to sea levels. Usually, the starting reference point is a tide gauge, so at that point the geodetic and tidal datums might match, but due to sea level variations, the two scales may not match elsewhere. One example of a geoid datum is NAVD88, used in North America, which is referenced to a point in Quebec, Canada.

The graphic below shows the relationship between the various vertical datums for the Morehead City Harbor, NC tidal bench mark.



Elevation Information, Station ID #8656502, Morehead City Harbor, NC

APPENDIX F

MOREHEAD CITY HARBOR
MONITORING PLAN

MOREHEAD CITY HARBOR MONITORING PLAN

U.S. ARMY CORPS OF ENGINEERS
WILMINGTON DISTRICT

September 2013

MOREHEAD CITY HARBOR MONITORING PLAN

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Morehead City Harbor Monitoring Plan

Introduction: The Dredge Material Management Plan (DMMP) developed for the Morehead City Harbor and Navigation channel includes provisions for periodic placement of littoral material removed from Inner Harbor and the ocean entrance channel. Disposal of this material may occur in several locations including disposal on the beach along Bogue and Shackleford Banks, placement in the nearshore placement areas within the ebb tide delta, disposal in the Ocean Dredge Material Disposal Site (ODMDS), or Brandt Island. Disposal of material along Bogue Banks will occur within the region shown on Figure 1, approximately covering a 10 mile section of the eastern end of the island between stations 59 and 107. Specific disposal locations within this area shall be determined at the time of the dredging operation to minimize environmental impacts and maximize benefits while minimizing cost. The disposal location for Shackleford Banks is shown in Figure 2 to be between stations 229 and 424. Figure 3 displays the locations where placement within the nearshore environment will occur. These locations include the existing and new nearshore placement areas on the west (Bogue) side of the ebb tide delta and the new nearshore placement area on the east (Shackleford) side of the ebb tide delta. Also included in Figure 3 is the ODMDS location which is used for disposal of non beach quality material, as well as disposal of beach compatible dredged material where weather conditions are unfavorable for placement in the nearshore area.

The maintenance material disposal plan for the Morehead City Harbor and entrance channel was based on the present understanding of sediment transport/beach response patterns in the vicinity of Beaufort Inlet. Due to the highly variable nature of littoral processes and the uncertainty associated with the occurrence and impact of severe coastal storms; the response of the adjacent beaches, shoaling patterns in the entrance channel, and changes in the ebb tide delta (including the nearshore placement areas) will be observed through a routine monitoring program. The results of this monitoring program will be used to make necessary adjustments in the beach disposal location and volumetric distribution of the littoral material removed from the navigation channel and harbor. In addition, the data collected as part of the monitoring program will be used to feed numerical models. These models, when developed, will provide a more complete picture of the system processes. Also, they will enable evaluation of different "what if" scenarios to determine the effects of future actions within the system such as dredging or sand placement. The use of these modeling tools in combination with the results gathered from the monitoring plan would allow for the best management of the system.

With regard to the history of the shorelines along Bogue and Shackleford Banks, the behavior of these beaches has been documented by various engineering reports conducted by the Corps of Engineers, State of North Carolina, and private consultants. In addition, Carteret County has been monitoring the shoreline of Bogue Banks through repetitive beach profile surveys since 1999 and the shoreline of Shackleford Banks since 2005. The Corps of Engineers will use these existing shoreline data sets in combination with other historic survey data to compare the behavior of the shoreline following the implementation of the DMMP. Accordingly, the results of the comparison of the monitoring data with the data gathered prior to the DMMP implementation can be used to modify the sand distribution in future disposal operations.

Monitoring Program: The monitoring program will focus on the response of four main areas in the vicinity of the Morehead City navigation project. The first is the adjacent beach evolution and how these changes compare with the historic changes along the beaches adjacent to Beaufort Inlet. Second, the monitoring will cover the changes within the ebb tide delta and compare with previous inlet surveys to measure morphologic changes. Third, detailed monitoring of the nearshore placement area will be gathered to aid in determining the location of successive placements within the nearshore area. The fourth area of concentration will be an analysis of the ODMDS. The monitoring plan discussed here is funding dependent and is subject to changes on an annual basis.

A) Bogue Banks Monitoring Plan.

i. **Extent of Coverage.** The beach profile stations used will be the locations established by Carteret County as part of their local monitoring program. The profiles will begin at profile 53 just east of the Emerald Isle town limits and extend through profile 116 located at the far eastern end of the island. The profiles are spaced approximately 800 to 1000 feet apart and include approximately 63 stations covering nearly 53,000 feet of the island.

ii. **Profiles.** Surveys of the onshore portion of the beach profiles will occur two times a year for the first five years of the monitoring program and annually through the remaining 15 years of the DMMP. Surveys will cover the area from the landward limit of the profile line (generally the back toe of the dune) seaward to wading depth (-3 to -5 feet NAVD88). One survey will be conducted in the spring (May or June) and the other in the fall (November or December). Offshore profile surveys will be conducted at the same interval as the onshore profiles and should be scheduled to be gathered within 5 days of the corresponding onshore profiles. The offshore profile surveys will extend seaward variable distances to a depth of -40 feet NAVD88. Offshore profiles within the inlet

(Profiles 113 through 116) shall extend to the west prism line of the navigation channel.

iii. **Aerial Photographs.** Color rectified photography shall be collected on an annual basis near the time of the spring profile survey. Collection may be through satellite imagery or through dedicated flights of the island. The nominal scale of the photography will be 1 inch equals 200 feet.

B) Shackleford Banks Monitoring Plan.

i. **Extent of Coverage.** Beach profile stations for Shackleford Banks were established by the USACE in 1991 and these locations have been used by Carteret County in their monitoring program since 2005. These locations will be used for the collection of future monitoring surveys as part of the DMMP monitoring plan. The existing stations are variably spaced at between 1500 and 2500 feet. The coverage will include the entire island comprised of approximately 46,000 feet which is monitored over 24 profile lines.

iv. **Profiles.** Surveys of the onshore portion of the beach profiles will occur two times a year for the first five years of the monitoring program and annually through the remaining 15 years of the DMMP. Surveys will cover the area from the landward limit of the profile line (generally the back toe of the dune) seaward to wading depth (-3 to -5 feet NAVD88). One survey will be conducted in the spring (May or June) and the other in the fall (November or December). Offshore profile surveys will be conducted at the same interval as the onshore profiles and should be scheduled to be gathered within 5 days of the corresponding onshore profiles. The offshore profile surveys will extend seaward variable distances to a depth of -40 feet NAVD88.

v. **Aerial Photographs.** Color rectified photography shall be collected on an annual basis near the time of the spring profile survey. Collection may be through satellite imagery or through dedicated flights of the island. The nominal scale of the photography will be 1 inch equals 200 feet.

C) Nearshore and Ebb Tide Delta Monitoring Plan.

i. **Ebb Tide Delta.** Current surveys of the ebb tide delta indicate that the delta is deflating on both sides of the navigation channel. Monitoring future changes in the ebb tide delta will be accomplished by surveying the entire delta once every two years for the first two surveys with surveys gathered every third year thereafter through the life of the 20 year DMMP. Specifically surveys should be collected in fiscal year 2015, 2017, 2020, 2023, 2026, 2029, and 2032. The proposed aerial extent of the delta survey coverage is indicated on Figure 4, which includes the nearshore placement area, as well as a portion of the ODMDS. Surveys should provide 100% coverage of the proposed ETD monitoring area.

ii. **Nearshore Placement areas.** Figure 3 displays the nearshore placement areas that will be surveyed on a periodic basis to capture the evolution of the material within the cells. Surveys of the nearshore placement area and the surrounding monitoring area will be taken just prior to placing material within the placement area, as well as just after placement has occurred. At a minimum, a survey will be made annually corresponding to the time of the spring profile surveys on the adjacent beaches. Monitoring surveys of the area will be used to modify future placement designs and should provide 100% coverage of the nearshore placement areas.

iii. **Ocean Dredge Material Disposal Site.** Monitoring of the ODMDS will be accomplished through a combination of the ebb tide delta surveys and specific site surveys. Site specific surveys will be gathered through the Morehead City ODMDS Site Management and Monitoring Plan (SMMP) (USACE, 2009). Surveys obtained through the SMMP will be gathered just prior to disposal of material within the ODMDS as well as just after disposal is complete.

D) Wave and Current Measurements.

Directional Wave Measurements. In addition to the extensive surveying discussed above, a wave gauge is included as an integral part of the monitoring program. The initial location of the gauge will be just offshore of Atlantic Beach in approximately 20 feet of water. After 12 months of data collection at the initial deployment location, the gauge will be moved just offshore of Shackleford Banks at a depth of 20 feet to collect another 12 months of data. Exact location of the gauge will be determined when funding is available based on the existing inlet bathymetry at that time. The bottom-mounted gauge will consist of a combination of an Acoustic Doppler Current Profiler (ADCP) meter and pressure gauge. This combination is capable of producing measurements of wave height, period, direction, and currents over the water column. These measurements will in turn be used to compute potential sediment transport rates necessary for the proper disposal of maintenance material along the beaches.

E) **Data Collection and Monitoring Report.** Raw data collected as a result of the monitoring plan will be made available to any interested party as it becomes available. A report summarizing the monitoring activity will be prepared annually and will include an analysis of the observed changes and trends along the adjacent beaches and a comparison to expected or historical trends. The report will also include an assessment of the shoaling patterns in the entrance channel, changes in the ebb tide delta, and an analysis of the wave measurements. This report will also be provided to Carteret County, the Towns of Atlantic Beach, Pine Knoll Shores, Indian Beach and any other interested party. Each annual report will summarize the data collected during the year and will incorporate data contained in previous monitoring reports.

<u>Numerical Modeling:</u> In addition to the data collection and analysis of the monitoring plan, it is intended to develop a collection of numerical models to be used to simulate the coastal hydrodynamics and sedimentation within and around Beaufort Inlet. This work may be combined with the efforts of the Regional Sediment Management (RSM) program being implemented through the U.S. Army Corps of Engineers, Wilmington District. The RSM program is working toward development of a regional understanding of the sediment processes along the coast of North Carolina. By combining the results of the regional sediment budget developed under the RSM program with the project specific modeling of Beaufort Inlet, the management of the resources within and around Beaufort Inlet should be improved.

A) Regional Circulation Model. Regional water levels and currents during normal and storm conditions will be simulated using the Advanced Circulation model, ADCIRC, (Luettich, et al. 1991). ADCIRC is a hydrodynamic numerical model that simulates water surface elevations and currents from astronomic tidal forcing, wind and barometric pressure fields.

B) Coastal Modeling System. The Coastal Modeling System (CMS) (Buttolph et al. 2006) was developed by the Coastal Inlet Research Program (CIRP) at the U.S. Army Engineer Research and Development Center (ERDC) in Vicksburg, Mississippi. The purpose of the model development was to calculate navigation channel and morphologic change within an inlet complex and its connection to processes on adjacent beaches. The modeling system consists of three main components which operate through the Surface water Modeling System (SMS) interface.

1. **CMS- WAVE** is a steady-state, finite difference, spectral model that simulates depth and current-induced wave refraction and shoaling, depth and steepness-induced wave breaking, diffraction, and wave growth.
2. **CMS-FLOW** is a two-dimensional, finite difference numerical approximation of the depth-integrated continuity and momentum equations. The model will produce high resolution time and space varying water levels, velocity fields, sediment transport rates, and bathymetric changes.
3. **CMS-PTM** is the Particle Tracking Model (PTM) which is forced by a combination of the CMS-WAVE and CMS-Flow models. The PTM can be used to isolate and track specific sources of sediment, monitor sediment sources impacting inlets, predict potential turbidity impacts, and track and predict sediment fate.

Figure 1. Beach Disposal Locations Along Bogue Banks

Figure 2. Beach Disposal Location Along Shackleford Banks

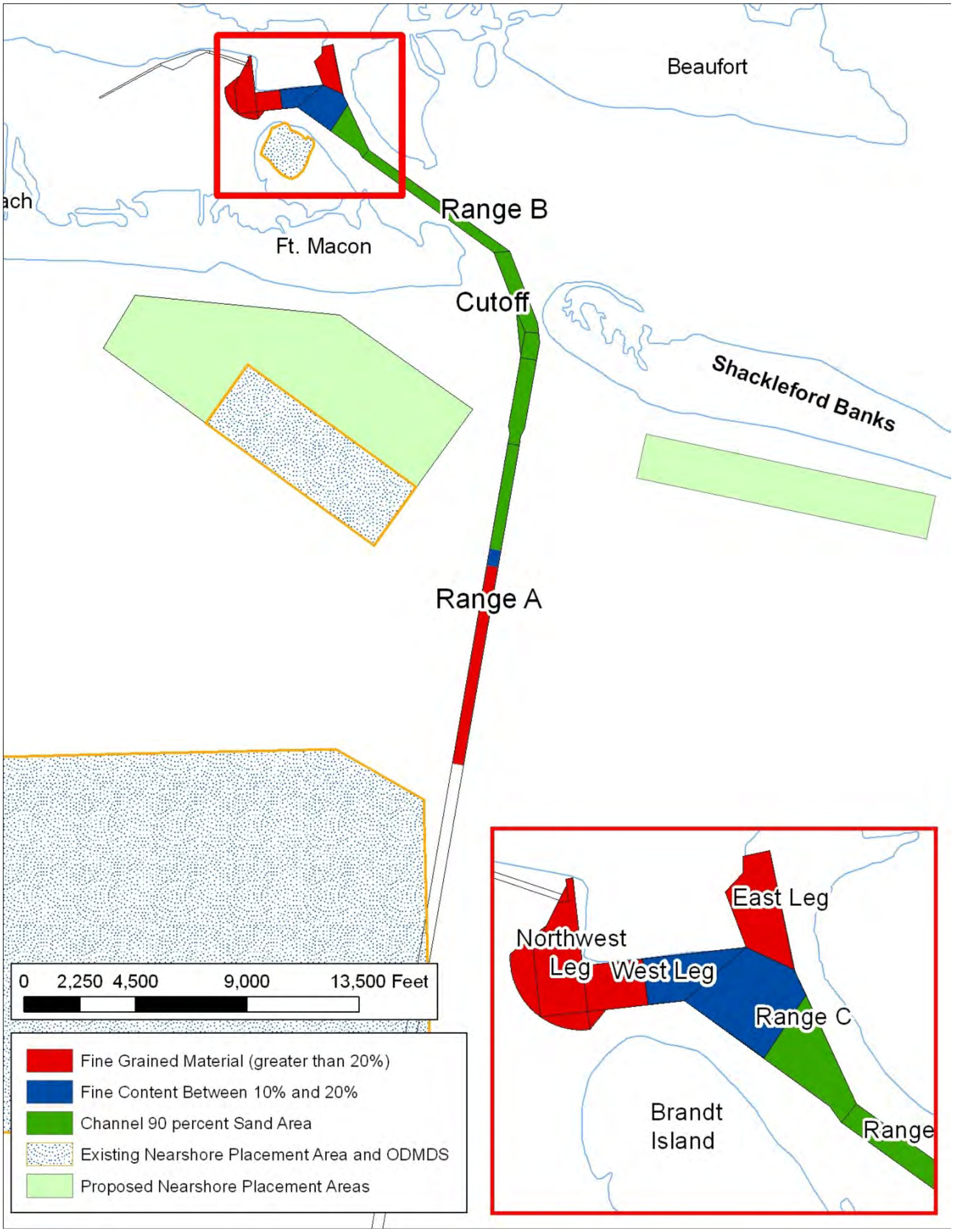

Figure 3. Nearshore Placement and ODMDS Disposal Locations

Figure 4. Ebb Tide Delta Survey Extent

Beaufort Inlet Grab Sample Locations

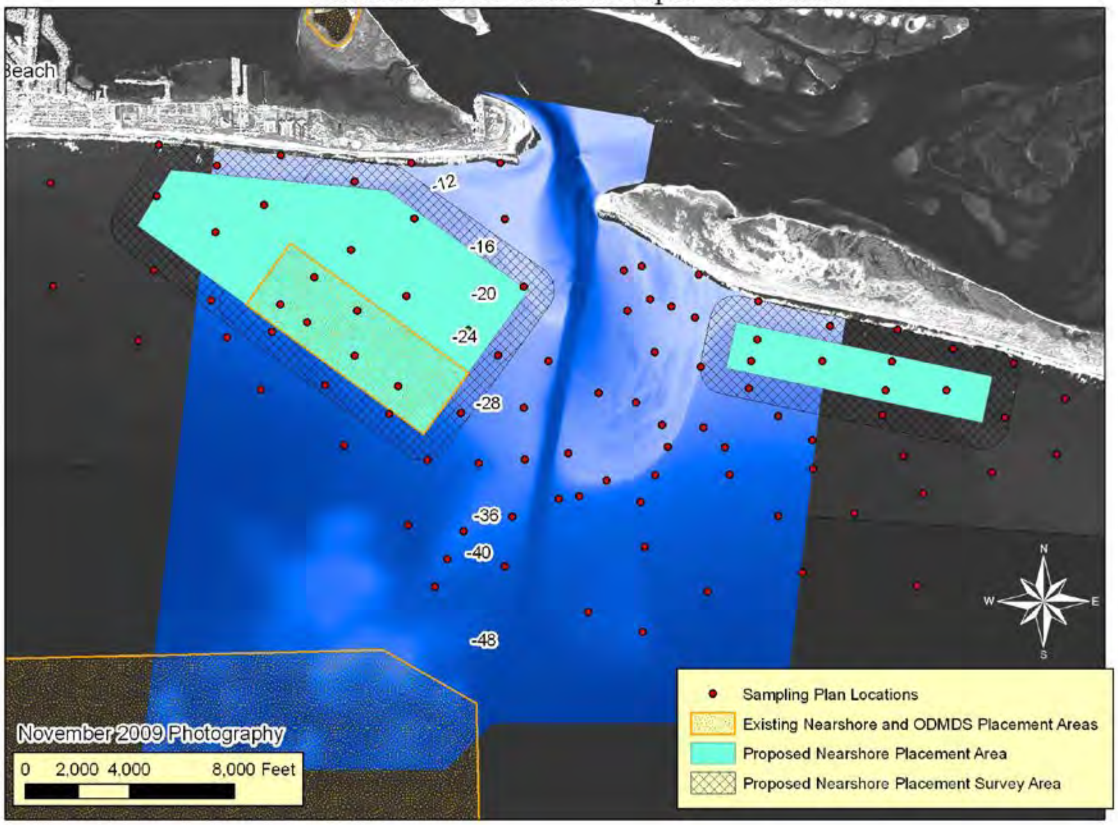

Figure 5. Beaufort Inlet Grab Sample Locations

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APPENDIX G

COST ESTIMATES
MOREHEAD CITY HARBOR DMMP

Appendix G: Cost Engineering

Morehead City Harbor DMMP
Morehead City
NORTH CAROLINA

1. The Cost Engineering Appendix project costs were prepared to identify the Current Working Estimate (CWE) for the least cost, environmentally acceptable alternative for disposal of maintenance dredged material from Morehead City Harbor for 20 years.

Costs for the alternative selected plan are shown in ATTACHMENT 1. The plan occurs over a 3-year period and then is repeated each 3 year period with possibly some minor variances depending on dredging quantities. Attachment 1 (sheet 1) (for years 2015-2028 Inner harbor disposal to Brandt Island) and Attachment 1 (sheet 2) (years 2029-2034 Inner Harbor disposal to ODMDS) shows unit price, quantity, mob/demob, contract durations, and total cost with a 20% contingency.

2. The TOTAL CURRENT WORKING ESTIMATE (CWE) for the 3 year cycle as shown in Attachment 1 (sheet 1) - $33,684,000 and Attachment 1 (sheet 2) - $35,354,000. These construction, monitoring, engineering and construction management costs have been established to be the Baseline CWE at January 2011 price levels.

The CWE's are shown in the MCACES (Microcomputer Aided Cost Engineering System) summary sheets – Attachment 2. MCACES is the format used to identify costs within Corps of Engineers report documents.

3. The Cost Estimates were prepared under guidance given in the Corps of Engineers Regulation ER 1110-2-1302, CIVIL WORKS COST ENGINEERING and Engineering Instructions, ETL 1110-2-573, CONSTRUCTION COST ESTIMATES.

4. Details of the viable DMMP alternatives considered are identified in Section 3 of the DMMP Main Report. Unit costs for a multitude of dredging alternatives for each reach of the Morehead City Harbor are shown in Attachment 3. The Harbor was divided into 5 reaches or sections from the Inner Harbor through the outer Ocean Bar. Disposal or placement locations for each reach and various methods

of dredging are also identified in Attachment 3. The reaches represent similar material characteristics within each reach.

The 5 separate reaches/sections were identified as follows:

1. Northwest Leg, West Leg(1) and East Leg – typically less than 80% sand
2. West Leg(2) and N. Range C – typically material between 80% and 90% sand
3. South Range C and N. Range B – material greater than 90% sand
4. South Range B, Cutoff channel thru N. Range A to Station 110+00 – material greater than 90% sand
5. South Range A Station 110+00 thru 125+00 – typically less than 80% sand

Attachment 3 shows viable dredging alternative methods and disposal or placement locations considered. Only unit prices are shown along with yearly contract quantities of material likely to be dredged. Unit prices are not shown for alternatives which were determined not to be a reasonable solution because of environmental restrictions, soil characteristics, equipment limitations, etc. Attachment 3 was used as a first step for identifying unit prices to be carried forward into Attachment 4 which includes MOB & DEMOB and average annual costs.

5. Unit prices and mobilization-demobilization costs were developed for all alternatives using CEDEP (Corps of Engineers Dredge Estimating Program) and review of historical methods and pricing where conditions were similar.

6. Dredging quantities were developed by Coastal Engineering Section and are annual contract quantities of material likely to be dredged. Year 2 and Year 3 are multiples of the annual quantities.

7. Attachment 4 combines unit prices, quantities, and mob/demob with dredging methods for each alternative evaluated. A contingency of 20% was included to represent unanticipated conditions or uncertainties at the time the estimate was developed.

8. Based on typical needs and past dredging patterns/methods, a description of the alternative SELECTED PLAN as shown in Attachment 1is as follows:

YEAR 1- Pipeline dredge material from Reach 4 (1,200,000 cy), to the beach on Bogue Banks and Shackleford Banks. Material dredged is from the reach S. Range B, Cutoff channel, and thru N. Range A (Station 110+00).

YEAR 2- Hopper dredge from Reach 3 (346,000 cy) and Reach 4 (650,000 cy) to Nearshore placement areas in the ebb tide delta region of Bogue and Shackleford Banks.

YEAR 3 – Pipeline dredge material from Reach 1 (362,000 cy) from Northwest Leg, East Leg, and West Leg(1) and pipeline dredge Reach 2 (152,000 cy) West Leg(2) and N. Range C into Brandt Island. (In years 2029-2034 dredging will be by Bucket and Barge to the ODMDS because Brandt Island will have reached capacity and cannot accept any more dredge material).

- In addition to pipeline dredge in YEAR 3, a Hopper will dredge material Reach 4 (810,000 cy) to the Nearshore placement areas in the ebb tide delta region of Bogue and Shackleford Banks. Reach 5 will also Hopper dredge material (344,000 CY) in S. Range A (from Station 110+00 to 125+00) to the ODMDS.

Most of the Mob & Demob costs represent combining MHC Harbor dredging activities with other contracts using similar equipment, except when material in Reach 4 is placed on the beaches at Bogue and Shackleford Banks.

Construction/dredging times are shown in months with each alternative shown in Attachment 1. All construction times can be completed within required environmental windows where applicable.

9. Other alternatives associated within the DMMP and dredging scenarios included evaluation of dike raises at Brandt Island, clean out of Brandt Island for additional capacity and potential construction of bird islands. These associated costs are shown in Attachment 5. These costs are not part of the selected plan for 15 years.

The preliminary evaluation of the latter years, 15 thru 20, indicates it would become more beneficial to dredge material in Reaches 1 and 2 and haul material to the ODMDS, rather than building dikes and continuing pipeline dredging material into Brandt Island. This comparable scenario will continue to be reviewed and updated throughout the DMMP project life.

Attachment 1 (sheet 1) - MOREHEAD CITY HARBOR DMMP - - PROPOSED PLAN - - RECURRING PLAN EVERY THREE (3) YEARS for **Years 2015-2028**

JANUARY 1, 2011 PRICE LEVEL

	Dredging Location	Dredging Method	Disposal or Placement Location	PIPE DISTANCE	MILES	YEAR 1 Unit price / QTY / Contract Time	YEAR 2 Unit price / QTY / Contract Time	YEAR 3 Unit price / QTY / Contract Time
IH-1	**Northwest & West Leg(1) and East Leg**	Small Pipeline dredge	Brandt Island	6,000 LF				**362,000 cy** 1.7 Mos Part 1 of 2 Reaches for Year 3 Contract **$4.35** Mob-As part of larger waterway contract Mob-Demob TOTAL = $1,574,700 + $200,000 =$1,774,700 **Pipeline Dredge** with 20% Contingency = **$2,129,640**
IH-12	**West Leg(2) & N.Range C**	Small Pipeline dredge	Brandt Island	6,000 LF				**152,000 cy** 0.7 Mos Part 2 of 2 Reaches for Year 3 Contract Mob-As part of larger waterway contract % Mob-Demob TOTAL **$4.30** = $653,600 + $200,000 =$853,600 **Pipeline Dredge** with 20% Contingency = **$1,024,320**
OH-5	**S.Range C & N.Range B**	Hopper Dredge	Nearshore East		6.7 MILES		**346,000 cy** 0.8 Mos **Hopper Dredge** Part 1 of 2 Reaches for Year 2 Contract % Mob-Demob TOTAL **$4.25** = $1,470,500 + $275,000 =$1,745,500 with 20% Contingency = **$2,094,600**	
OH-7a	**S.Range C & N.Range B**	Hopper Dredge	Nearshore West		6.7 MILES			
	Quantity to nearshore- split 78% and 22%		269,880 cy WEST	76,120 cy EAST				
OH-16 & OH-18a	**S.Range B, Cut-off, N.Range A to Sta 110**	Hopper	Nearshore West & East		5.2 MILES	**1,200,000 cy** 2.6 Mos	**650,000 cy** 1.4 Mos **Hopper Dredge** Part 2 of 2 Reaches for Year 2 Contract % Mob-Demob TOTAL **$4.10** = $2,665,000 + $275,000 =$2,940,000 with 20% Contingency = **$3,528,000**	**810,000 cy** 1.8 Mos **Hopper Dredge** Part 1 of 2 Reaches for same Hopper contract % Mob-Demob TOTAL **$4.10** = $3,321,000 + $275,000 =$3,596,000 with 20% Contingency = **$4,315,200**
	Quantity to nearshore- split 78% and 22%	**Yr. 2**	507,000 cy WEST	143,000 cy EAST				
		Yr. 3	631,800 cy WEST	178,200 cy EAST				
OH-19	**S.Range B, Cut-off, N.Range A to Sta 110**	Large Pipeline dredge	Bogue Banks	18,500 LF	Avg unit price	Mob-Demob TOTAL **$7.82** = $9,384,000 + $3,100,000 =$12,484,000 **Pipeline Dredge w/placement on the beaches**		
	Quantity to beaches -split 57% and 43%		684,000 cy Bogue	516,000 cy Shackleford				
OH-21	**S.Range B, Cut-off, N.Range A to Sta 110**	Large Pipeline dredge	Shackleford Banks	19,500 LF	**$7.85 /cy**	with 20% Contingency = **$14,980,800**		
	Additional	$500,000	Mob-Demob pipe & equipment (both beaches)			Added mob both beaches w/conting **$600,000**		
OEC-3	**S.Range A, Sta 110+00 to 125+00**	Hopper	ODMDS		5.0 MILES			**344,000 cy** 0.8 Mos **Hopper Dredge** Part 2 of 2 Reaches for same Hopper contract % Mob-Demob TOTAL **$3.50** = $1,204,000 + $275,000 =$1,479,000 with 20% Contingency = **$1,774,800**
		Total Quantities		**3,864,000 cy**		2.6 Mos YEAR 1 **1,200,000 cy**	2.2 Mos YEAR 2 **996,000 cy**	5.0 Mos YEAR 3 **1,668,000 cy**
		TOTAL Dredging all 3 years without contingency		**$25,372,800**		**TOTAL YEAR 1 with Contingency** **$15,580,800** Dredging Only	**TOTAL YEAR 2 with Contingency** **$5,622,600** Dredging Only	**TOTAL YEAR 3 with Contingency** **$9,243,960** Dredging Only
		TOTAL Dredging all 3 years with Contingency		**$30,447,360**				
	Monitoring w/contingency					**MONITORING w/conting** **$542,570**	**MONITORING w/conting** **$510,600**	**MONITORING w/conting** **$498,295**
	PED 3%					**PED w/conting** **$467,424**	**PED w/conting** **$168,678**	**PED w/conting** **$277,319**
	S&A # mos * $65,000					**S&A w/conting** **$205,196**	**S&A w/conting** **$172,640**	**S&A w/conting** **$393,708**
	TOTAL YEARLY					**TOTAL YEARLY w/20% contingency** **$16,795,990**	**TOTAL YEARLY w/20% contingency** **$6,474,518**	**TOTAL YEARLY w/20% contingency** **$10,413,282**
						WITHOUT CONTINGENCY **$13,996,658**	WITHOUT CONTINGENCY **$5,395,432**	WITHOUT CONTINGENCY **$8,677,735**

Attachment 1 (sheet 1 of 2) – Costs for Proposed Base Plan - Years 2015 through 2028

Attachment 1 (sheet 2) - MOREHEAD CITY HARBOR DMMP - - PROPOSED PLAN - - RECURRING PLAN EVERY THREE (3) YEARS for **Years 2029- 2034** JANUARY 1, 2011 PRICE LEVEL

Attachments 1a and 1b identify the proposed plan for each year of the 3-year maintenance cycle

	Dredging Location	Dredging Method	Disposal or Placement Location	PIPE DISTANCE	MILES	YEAR 1 Unit price / QTY / Contract Time	YEAR 2 Unit price / QTY / Contract Time	YEAR 3 Unit price / QTY / Contract Time
IH-2	Northwest & West Leg(1) and East Leg	Bucket & Barge	ODMDS		10.1 MILES			362,000 cy 1.3 Mos Part 1 of 2 Reaches for Year 3 Contract $7.07 Mob-As part of larger waterway contract Mob-Demob TOTAL = $2,559,340 + $185,000 =$2,744,340 Bucket & Barge with 20% Contingency = $3,293,208
IH-13	West Leg(2) & N.Range C	Bucket & Barge	ODMDS		9.6 MILES			152,000 cy 0.6 Mos Part 2 of 2 Reaches for Year 3 Contract Mob-As part of larger waterway contract % Mob-Demob TOTAL $7.15 = $1,086,800 + $185,000 =$1,271,800 Bucket & Barge with 20% Contingency = $1,526,160
OH-5	S.Range C & N.Range B	Hopper Dredge	Nearshore East		6.7 MILES		346,000 cy 0.8 Mos Hopper Dredge Part 1 of 2 Reaches for Year 2 Contract % Mob-Demob TOTAL $4.25 = $1,470,500 + $275,000 =$1,745,500 with 20% Contingency = $2,094,600	
OH-7a	S.Range C & N.Range B	Hopper Dredge	Nearshore West		6.7 MILES			
	Quantity to nearshore - split 78% and 22%		269,880 cy WEST	76,120 cy EAST				
OH-16 & OH-18a	S.Range B, Cut-off, N.Range A to Sta 110	Hopper	Nearshore West & East		5.2 MILES	1,200,000 cy 2.6 Mos	650,000 cy 1.4 Mos Hopper Dredge Part 2 of 2 Reaches for Year 2 Contract % Mob-Demob TOTAL $4.10 = $2,665,000 + $275,000 =$2,940,000 Hopper with 20% Contingency = $3,528,000	810,000 cy 1.8 Mos Hopper Dredge Part 1 of 2 Reaches for same Hopper contract % Mob-Demob TOTAL $4.10 = $3,321,000 + $275,000 =$3,596,000 Hopper with 20% Contingency = $4,315,200
	Quantity to nearshore -split 78% and 22% Yr. 2		507,000 cy WEST	143,000 cy EAST				
		Yr. 3	631,800 cy WEST	178,200 cy EAST				
OH-19	S.Range B, Cut-off, N.Range A to Sta 110	Large Pipeline dredge	Bogue Banks	18,500 LF	Avg unit price	Mob-Demob TOTAL $7.82 = $9,384,000 + $3,100,000 =$12,484,000 Pipeline placement on the beaches		
	Quantity to beaches - split 57% and 43%		684,000 cy Bogue	516,000 cy Shackleford				
OH-21	S.Range B, Cut-off, N.Range A to Sta 110	Large Pipeline dredge	Shackleford Banks	19,500 LF	$7.85 /cy	with 20% Contingency = $14,980,800		
	Additional	$500,000	Mob-Demob pipe & equipment (both beaches)			Added mob both beaches w/conting $600,000		
OEC-3	S.Range A, Sta 110+00 to 125+00	Hopper	ODMDS		5.0 MILES			344,000 cy 0.8 Mos Hopper Dredge Part 2 of 2 Reaches for same Hopper contract % Mob-Demob TOTAL $3.50 = $1,204,000 + $275,000 =$1,479,000 Hopper with 20% Contingency = $1,774,800

			YEAR 1		YEAR 2		YEAR 3	
			YEAR 1 (2.6 Mos)	1,200,000 cy	YEAR 2 (2.2 Mos)	996,000 cy	YEAR 3 (4.5 Mos)	1,668,000 cy
	TOTAL Quantities	3,864,000 cy						
	TOTAL Dredging all 3 years without contingency	$26,760,640	TOTAL YEAR 1 with Contingency	$15,580,800	TOTAL YEAR 2 with Contingency	$5,622,600	TOTAL YEAR 3 with Contingency	$10,909,368
	TOTAL Dredging all 3 years with contingency	$32,112,768	Dredging Only		Dredging Only		Dredging Only	
Monitoring w/contingency			MONITORING w/conting	$542,570	MONITORING w/conting	$510,600	MONITORING w/conting	$498,295
PED 3%			PED w/conting	$467,424	PED w/conting	$168,678	PED w/conting	$327,281
S&A # mos * $65,000			S&A w/conting	$205,196	S&A w/conting	$172,640	S&A w/conting	$348,516
TOTAL YEARLY			TOTAL YEARLY w/20% contingency	$16,795,990	TOTAL YEARLY w/20% contingency	$6,474,518	TOTAL YEARLY w/20% contingency	$12,083,460
			WITHOUT CONTINGENCY	$13,996,658	WITHOUT CONTINGENCY	$5,395,432	WITHOUT CONTINGENCY	$10,069,550

Attachment 1 (sheet 2 of 2) – Costs for Proposed Base Plan - Years 2029 through 2034

Attachment 2 – MCACES (7 pages)

MHC DMMP MAY 1 2012 (2015-2028)
MOREHEAD CITY DMMP - CURRENT WORKING ESTIMATE (CWE) YEARS 2015 to 2028

Estimated by	CESAW-TS-EE
Designed by	USACE - WILMINGTON DISTRICT
Prepared by	John Caldwell
Preparation Date	4/30/2012
Effective Date of Pricing	1/1/2011
Estimated Construction Time	150 Days

Description	Page

Date	Author	Note
	CESAW-TS-EE	See COST NARRATIVE as part of this APPENDIX
10/29/2010	CESAW-TS-EE	This detail estimate is for the MHC DMMP

Description	Quantity	UOM	ContractCost	Contingency	ProjectCost
Project Cost Summary Report			28,106,379	5,577,411	33,683,789
12 MHC DMMP - YEAR 1 --	1	LS	13,996,658	2,799,332	16,795,990
12_02 --Pipeline to Bogue and Shackleford Banks	1	LS	12,984,000	2,596,800	15,580,800
30 --MONITORING	1	LS	452,141	90,428	542,569
30 --PLANNING, ENGINEERING & DESIGN	1	LS	389,520	77,904	467,424
31 --S&A-CONST MGT	1	LS	170,997	34,199	205,196
12 MHC DMMP - YEAR 2 --	1	LS	5,413,932	1,060,586	6,474,518
12_02 --Hopper Dredge to Nearshore	1	LS	4,685,500	937,100	5,622,600
31 --MONITORING	1	LS	444,000	66,600	510,600
30 --PLANNING, ENGINEERING & DESIGN	1	LS	140,565	28,113	168,678
31 --S&A-CONST MGT	1	LS	143,867	28,773	172,640
12 MHC DMMP - YEAR 3 --	1	LS	8,695,789	1,717,493	10,413,282
12_02 --Pipeline to Brandt Island	1	LS	2,628,300	525,660	3,153,960
12_03 --Hopper Dredge to Nearshore & ODMDS	1	LS	5,075,000	1,015,000	6,090,000
30 --MONITORING	1	LS	433,300	64,995	498,295
30 --PLANNING, ENGINEERING & DESIGN	1	LS	231,099	46,220	277,319
31 --S&A-CONST MGT	1	LS	328,090	65,618	393,708

Currency in US dollars

Description	Quantity	UOM	ContractCost	Contingency	ProjectCost
Contract Cost Summary Report			28,106,379	5,577,411	33,683,789
12 MHC DMMP - YEAR 1 --	1	LS	13,996,658	2,799,332	16,795,990
12_02 --Pipeline to Bogue and Shackleford Banks	1	LS	12,984,000	2,596,800	15,580,800
---1 PIPELINE - Mob, Demob & Preparatory Work	1	LS	3,600,000	720,000	4,320,000
			7.82		9.38
---2 Dredge South Rg B; Cutoff; and North Rg A to Station 110+00	1,200,000	CY	9,384,000	1,876,800	11,260,800
30 --MONITORING	1	LS	452,141	90,428	542,569
30_23 --MONITORING	1	LS	452,141	90,428	542,569
30 --PLANNING, ENGINEERING & DESIGN	1	LS	389,520	77,904	467,424
30_23 --Plans, Engineering and Design	1	LS	389,520	77,904	467,424
31 --S&A-CONST MGT	1	LS	170,997	34,199	205,196
31_12 --Construction Mgt	1	LS	170,997	34,199	205,196
12 MHC DMMP - YEAR 2 --	1	LS	5,413,932	1,060,586	6,474,518
12_02 --Hopper Dredge to Nearshore	1	LS	4,685,500	937,100	5,622,600
--1 Mob, Demob & Preparatory Work	1	LS	550,000	110,000	660,000
			4.25		5.10
--2 Dredge South Range "C" & N. Range "B" to Nearshore	346,000	CY	1,470,500	294,100	1,764,600
			4.10		4.92
--3 Dredge South Range "B", CUTOFF, & N. Range "A" TO STA. 110+00 to Nearshore	650,000	CY	2,665,000	533,000	3,198,000
31 --MONITORING	1	LS	444,000	66,600	510,600
30_23 --MONITORING	1	LS	444,000	66,600	510,600
30 --PLANNING, ENGINEERING & DESIGN	1	LS	140,565	28,113	168,678
30_23 --Plans, Engineering and Design	1	LS	140,565	28,113	168,678
31 --S&A-CONST MGT	1	LS	143,867	28,773	172,640
31_12 --Construction Contracts	1	LS	143,867	28,773	172,640
12 MHC DMMP - YEAR 3 --	1	LS	8,695,789	1,717,493	10,413,282
12_02 --Pipeline to Brandt Island	1	LS	2,628,300	525,660	3,153,960
---1 PIPELINE - Mob, Demob & Preparatory Work	1	LS	400,000	80,000	480,000

Currency in US dollars

Description	Quantity	UOM	ContractCost	Contingency	ProjectCost
---2 Dredge Northwest; &WEST LEG (1) & East Leg to Brandt Island	362,000	CY	*4.35* 1,574,700	314,940	*5.22* 1,889,640
---3 Dredge WEST LEG (2) and N. Range "C" to Brandt Island	152,000	CY	*4.30* 653,600	130,720	*5.16* 784,320
12_03 --Hopper Dredge to Nearshore & ODMDS	1	LS	5,075,000	1,015,000	6,090,000
---1 HOPPER - Mob, Demob & Preparatory Work	1	LS	550,000	110,000	660,000
---2 Dredge South Range "B",- CUTOFF, & -N. Range "A" TO STA. 110+00 to NEARSHORE	810,000	CY	*4.10* 3,321,000	664,200	*4.92* 3,985,200
---2 Dredge South Range "A" - - Sta 110+00 to 125+00 to ODMDS	344,000	CY	*3.50* 1,204,000	240,800	*4.20* 1,444,800
30 --MONITORING	1	LS	433,300	64,995	498,295
30_23 --MONITORING	1	LS	433,300	64,995	498,295
30 --PLANNING, ENGINEERING & DESIGN	1	LS	231,099	46,220	277,319
30_23 --Plans, Engineering and Design	1	LS	231,099	46,220	277,319
31 --S&A-CONST MGT	1	LS	328,090	65,618	393,708
31_12 --Construction Mgt	1	LS	328,090	65,618	393,708

Currency in US dollars

Attachment 3 (sheet 1 of 2) - Morehead City Harbor DMMP - Cost Estimates (Short Version)

Dredging methods & disposal locations considered for each reach of the project. Only unit prices are shown along with yearly anticipated shoaling rates for years 1, 2, and 3.
Unit Prices are **not** shown for measures determined not to be reasonable options because of environmental restrictions due to soil characteristics, equipment limitations, etc.
This sheet was used to identify costs to carry forward into the more detailed analysis in Attachment 4, which includes Mob and Demob.
Bold lettering identifies the selected measures after analysis of all measures. Background colors represent various types of dredges.

Item ID #	Effective Pricing Level is January 2011 ------------------------------ Morehead City Harbor DMMP Reaches	Dredging Method	Disposal or Placement Location	Pipeline Distance (Linear Feet)	1-way travel Distance	1-YR QTY		2-YR QTY		3-YR QTY
						120,750 cy		**241,500 cy**		**362,250 cy**
IH-1	IH (NW-W(1)-EAST)	18-inch Pipeline	Brandt Island	6,000 LF		$4.96		$4.47		**$4.34**
IH-2	IH (NW-W(1)-EAST)	Mechanical w/ Scow	ODMDS		10.1 miles	$7.13		$7.09		$7.07
						50,750 cy		**101,500 cy**		**152,250 cy**
IH-12	IH (W2-N.Range C)	18-inch Pipeline	Brandt Island	6,000 LF		$6.08		$4.64		**$4.30**
IH-13	IH (W2-N.Range C)	Mechanical w/ Scow	ODMDS		9.6 miles	$7.79		$7.29		$7.15
IH-14	IH (W2-N.Range C)	Hopper	ODMDS		9.6 miles	$7.61		$7.28		$7.24
IH-15	IH (W2-N.Range C)	Mechanical w/ Scow	Nearshore West-shallow		7.5 miles	$8.29		$7.49		$7.41
IH-15a	IH (W2-N.Range C)	Mechanical w/ Scow	Nearshore West- expanded		8.0 miles	$7.67		$7.39		$7.06
IH-15b	IH (W2-N.Range C)	Mechanical w/ Scow	Nearshore West- existing		7.0 miles	$7.62		$7.31		$7.01
IH-16	IH (W2-N.Range C)	Hopper	Nearshore West -shallow		7.5 miles	$8.69		$8.47		$8.39
IH-16a	IH (W2-N.Range C)	Hopper	Nearshore West -expanded		8.0 miles	$7.61		$7.50		$7.32
IH-16b	IH (W2-N.Range C)	Hopper	Nearshore West -existing		7.0 miles	$7.18		$6.96		$6.74
IH-17	IH (W2-N.Range C)	Mechanical w/ Scow	Nearshore East- shallow		7.5 miles	$8.29		$7.49		$7.41
IH-17a	IH (W2-N.Range C)	Mechanical w/ Scow	Nearshore East		7.0 miles	$7.62		$7.31		$7.01
IH-18	IH (W2-N.Range C)	Hopper	Nearshore East - shallow		7.5 miles	$8.69		$8.47		$8.39
IH-18a	IH (W2-N.Range C)	Hopper	Nearshore East		7.0 miles	$7.18		$6.96		$6.74
						115,450 cy		**230,900 cy**		**346,350 cy**
OH-1	OH (S.Range C-N.Range B)	18-inch Pipeline	Brandt Island	6,000 LF			NOT VIABLE- Material is greater than 90 % SAND			
OH-2	OH (S.Range C-N.Range B)	Mechanical w/ Scow	ODMDS		9.4 miles	$7.62		$7.27		$7.10
OH-3	OH (S.Range C-N.Range B)	Hopper	ODMDS		9.4 miles	$4.87		$4.54		$4.44
OH-4	OH (S.Range C-N.Range B)	Mechanical w/ Scow	Nearshore West-Existing		6.7 miles	$7.28		$7.15		$6.96
OH-4a	OH (S.Range C-N.Range B)	Mechanical w/ Scow	Nearshore West-expanded		7.7 miles	$7.54		$7.33		$7.01
OH-4b	OH (S.Range C-N.Range B)	Mechanical w/ Scow	Nearshore West-shallow		7.2 miles	$8.28		$7.49		$7.34
OH-5	OH (S.Range C-N.Range B)	Hopper	Nearshore West-existing		6.7 miles	$4.67		$4.35		**$4.23**
OH-5a	OH (S.Range C-N.Range B)	Hopper	Nearshore West-expanded		7.7 miles	$5.08		$4.55		$4.52
OH-5b	OH (S.Range C-N.Range B)	Hopper	Nearshore West-shallow		7.2 miles	$5.91		$5.28		$5.14
OH-6	OH (S.Range C-N.Range B)	Mechanical w/ Scow	Nearshore East-shallow		7.2 miles	$8.28		$7.49		$7.34
OH-6a	OH (S.Range C-N.Range B)	Mechanical w/ Scow	Nearshore East		6.7 miles	$7.28		$7.15		$6.96
OH-7	OH (S.Range C-N.Range B)	Hopper	Nearshore East-shallow		7.2 miles	$5.91		$5.28		$5.14
OH-7a	OH (S.Range C-N.Range B)	Hopper	Nearshore East		6.7 miles	$4.67		$4.35		**$4.23**
OH-8	OH (S.Range C-N.Range B)	18-inch Pipeline	Fort Macon & Atlantic Beach	17,800 LF	3.4 miles	$10.39		$8.20		$8.20
OH-9	OH (S.Range C-N.Range B)	30-inch Pipeline	Fort Macon & Atlantic Beach	17,800 LF	3.4 miles	$8.85	$8.00 AVG	$7.14		$6.50
OH-9a	OH (S.Range C-N.Range B)	30-inch Pipeline	Nearshore - West	27,500 LF	5.2 miles	$10.81		$9.17		$8.80
OH-10	OH (S.Range C-N.Range B)	18-inch Pipeline	Shackleford Banks Beach	21,000 LF	4.0 miles	$12.28		$9.79		$9.30
OH-11	OH (S.Range C-N.Range B)	30-inch Pipeline	Shackleford Banks Beach	21,000 LF	4.0 miles	$9.70	$8.80 AVG	$7.89		$7.05
OH-11a	OH (S.Range C-N.Range B)	30-inch Pipeline	Nearshore - East	27,500 LF	5.2 miles	$10.81		$9.17		$8.80
OH-11b	OH (S.Range C-N.Range B)	18-inch Pipeline	Nearshore - East/West	27,500 LF	5.2 miles	$11.94		$11.34		$11.14
						886,050 cy		**1,772,100 cy**		**2,658,150 cy**
OH-12	OH (S.Range B, Cut-off, N.Range A; thru 110)	18-inch Pipeline	Brandt Island	13,000 LF			NOT VIABLE- Material is greater than 90 % SAND			
OH-13	OH (S.Range B, Cut-off, N.Range A; thru 110)	Mechanical w/ Scow	ODMDS		7.7 miles	$7.56		$7.13		$6.94
OH-14	OH (S.Range B, Cut-off, N.Range A; thru 110)	Hopper	ODMDS		7.7 miles	$4.24		$4.02		$3.98
OH-15	OH (S.Range B, Cut-off, N.Range A; thru 110)	Mechanical w/ Scow	Nearshore West-Existing		5.2 miles	$7.24		$7.01		$6.91
OH-15a	OH (S.Range B, Cut-off, N.Range A; thru 110)	Mechanical w/ Scow	Nearshore West-expanded		6.1 miles	$7.47		$7.13		$6.95
OH-15b	OH (S.Range B, Cut-off, N.Range A; thru 110)	Mechanical w/ Scow	Nearshore West-shallow		5.7 miles	$8.20		$7.45		$7.18
OH-16	OH (S.Range B, Cut-off, N.Range A; thru 110)	Hopper	Nearshore West-existing		5.2 miles	**$4.06**		$3.86		$3.80
OH-16a	OH (S.Range B, Cut-off, N.Range A; thru 110)	Hopper	Nearshore West-expanded		6.1 miles	$4.34		$4.10		$4.05
OH-16b	OH (S.Range B, Cut-off, N.Range A; thru 110)	Hopper	Nearshore West-shallow		5.7 miles	$4.87		$4.61		$4.54
OH-17	OH (S.Range B, Cut-off, N.Range A; thru 110)	Mechanical w/ Scow	Nearshore East-shallow		5.7 miles	$8.20		$7.45		$7.18
OH-17a	OH (S.Range B, Cut-off, N.Range A; thru 110)	Mechanical w/ Scow	Nearshore East		5.2 miles	$7.24		$7.01		$6.91
OH-18	OH (S.Range B, Cut-off, N.Range A; thru 110)	Hopper	Nearshore East-shallow		5.7 miles	$4.87		$4.61		$4.54
OH-18a	OH (S.Range B, Cut-off, N.Range A; thru 110)	Hopper	Nearshore East		5.2 miles	**$4.06**		$3.86		$3.80
OH-19	OH (S.Range B, Cut-off, N.Range A; thru 110)	30-inch Pipeline	Fort Macon & Atlantic Beach	18,500 LF	3.5 miles	$8.73	**$7.82 AVG**	$6.90	$6.90 AVG	$6.89
OH-19a	OH (S.Range B, Cut-off, N.Range A; thru 110)	30-inch Pipeline	Nearshore - West	24,000 LF	4.5 miles	$9.61	$8.75 AVG	$7.89	$7.72 AVG	$7.54
OH-20	OH (S.Range B, Cut-off, N.Range A; thru 110)	Hopper Pumpout to Beach	Fort Macon & Atlantic Beach		6.5 miles	$10.16		$10.00		$10.00
OH-21	OH (S.Range B, Cut-off, N.Range A; thru 110)	30-inch Pipeline	Shackleford Banks Beach	19,500 LF	3.7 miles	$8.73	**$7.82 AVG**	$6.90	$6.90 AVG	$6.89
OH-21a	OH (S.Range B, Cut-off, N.Range A; thru 110)	30-inch Pipeline	Nearshore - East	24,000 LF	4.5 miles	$9.61	$8.75 AVG	$7.89	$7.72 AVG	$7.54
OH-22	OH (S.Range B, Cut-off, N.Range A; thru 110)	Hopper Pumpout to Beach	Shackleford Banks Beach		6.5 miles	$10.16		$10.00		$10.00
						114,500 cy		**229,000 cy**		**343,500 cy**
OEC-1	OEC (S.Range A; 110 to deep)	18-inch Pipeline	Brandt Island				NOT VIABLE - inefficient equipment operation			
OEC-2	OEC (S.Range A; 110 to deep)	Mechanical w/ Scow	ODMDS		5.0 miles	$7.41		$7.02		$6.36
OEC-3	OEC (S.Range A; 110 to deep)	Hopper	ODMDS		5.0 miles	$3.61		$3.50		**$3.50**

Attachment 3 (sheet 1 of 2) – Morehead City Harbor DMMP Cost Estimates (Short Version)

Attachment 3 (sheet 2 of 2) - Morehead City Harbor DMMP - Cost Estimates (Full Version)

Dredging methods & disposal locations considered for each reach of the project. Only unit prices are shown along with yearly anticipated shoaling rates for years 1, 2, and 3.
Unit Prices are **not** shown for measures determined not to be reasonable options because of environmental restrictions due to soil characteristics, equipment limitations, etc.
This sheet was used to identify costs to carry forward into the more detailed analysis in Attachment 4, which includes Mob and Demob.
Bold lettering identifies the selected measures after analysis of all measures. Background colors represent various types of dredges.

Item ID #	Effective Pricing Level is January 2011 ---------- Morehead City Harbor DMMP Reaches	Dredging Method	Disposal or Placement Location	Pipeline Distance (Linear Feet)	1- Way travel Distance	QTY		QTY		QTY
						120,750 cy		**241,500 cy**		**362,250 cy**
IH-1	IH (NW-W(1)-East)	18-inch Pipeline	Brandt Island	6,000 LF		$4.96		$4.47		**$4.34**
IH-2	IH (NW-W(1)-East)	Mechanical w/ Scow	ODMDS		10.1 miles	$7.13		$7.09		$7.07
IH-3	IH (NW-W(1)-East)	Hopper	ODMDS		10.1 miles	Not a viable alternative equipment efficiency operation				
IH-4	IH (NW-W(1)-East)	Mechanical w/ Scow	Nearshore West		7.5 miles	Not a viable alternative too much fine material				
IH-5	IH (NW-W(1)-East)	Hopper	Nearshore West		7.5 miles	Not a viable alternative too much fine material				
IH-6	IH (NW-W(1)-East)	Mechanical w/ Scow	Nearshore East		7.5 miles	Not a viable alternative too much fine material				
IH-7	IH (NW-W(1)-East)	Hopper	Nearshore East		7.5 miles	Not a viable alternative too much fine material				
IH-8	IH (NW-W(1)-East)	18-inch Pipeline	Fort Macon & Atlantic Beach	23,232 LF	4.4 miles	Not a viable alternative too much fine material				
IH-9	IH (NW-W(1)-East)	30-inch Pipeline	Fort Macon & Atlantic Beach	23,232 LF	4.4 miles	Not a viable alternative too much fine material				
IH-10	IH (NW-W(1)-East)	18-inch Pipeline	Shackleford Banks Beach	25,080 LF	4.8 miles	Not a viable alternative too much fine material				
IH-11	IH (NW-W(1)-East)	30-inch Pipeline	Shackleford Banks Beach	25,080 LF	4.8 miles	Not a viable alternative too much fine material				
						50,750 cy		**101,500 cy**		**152,250 cy**
IH-12	IH (W2-N.Range C)	18-inch Pipeline	Brandt Island	6,000 LF		$6.08		$4.64		**$4.30**
IH-13	IH (W2-N.Range C)	Mechanical w/ Scow	ODMDS		9.6 miles	$7.79		$7.29		$7.15
IH-14	IH (W2-N.Range C)	Hopper	ODMDS		9.6 miles	$7.61		$7.28		$7.24
IH-15	IH (W2-N.Range C)	Mechanical w/ Scow	Nearshore West-shallow		7.5 miles	$8.29		$7.49		$7.41
IH-15a	IH (W2-N.Range C)	Mechanical w/ Scow	Nearshore West- expanded		8.0 miles	$7.67		$7.39		$7.06
IH-15b	IH (W2-N.Range C)	Mechanical w/ Scow	Nearshore West- existing		7.0 miles	$7.62		$7.31		$7.01
IH-16	IH (W2-N.Range C)	Hopper	Nearshore West -shallow		7.5 miles	$8.69		$8.47		$8.39
IH-16a	IH (W2-N.Range C)	Hopper	Nearshore West -expanded		8.0 miles	$7.61		$7.50		$7.32
IH-16b	IH (W2-N.Range C)	Hopper	Nearshore West -existing		7.0 miles	$7.18		$6.96		**$6.74**
IH-17	IH (W2-N.Range C)	Mechanical w/ Scow	Nearshore East- shallow		7.5 miles	$8.29		$7.49		$7.41
IH-17a	IH (W2-N.Range C)	Mechanical w/ Scow	Nearshore East		7.0 miles	$7.62		$7.31		$7.01
IH-18	IH (W2-N.Range C)	Hopper	Nearshore East - shallow		7.5 miles	$8.69		$8.47		$8.39
IH-18a	IH (W2-N.Range C)	Hopper	Nearshore East		7.0 miles	$7.18		$6.96		**$6.74**
IH-19	IH (W2-N.Range C)	18-inch Pipeline	Fort Macon & Atlantic Beach	19,008 LF	3.6 miles	Not a viable alternative - too much fine material				
IH-20	IH (W2-N.Range C)	30-inch Pipeline	Fort Macon & Atlantic Beach	19,008 LF	3.6 miles	Not a viable alternative - too much fine material				
IH-21	IH (W2-N.Range C)	18-inch Pipeline	Shackleford Banks Beach	22,704 LF	4.3 miles	Not a viable alternative - too much fine material				
IH-22	IH (W2-N.Range C)	30-inch Pipeline	Shackleford Banks Beach	22,704 LF	4.3 miles	Not a viable alternative - too much fine material				
IH-23	IH (W2-N.Range C)	30-inch Pipeline	Nearshore West	30,000 LF	5.7 miles	$10.93		$9.78		$9.40
IH-24	IH (W2-N.Range C)	30-inch Pipeline	Nearshore East	30,000 LF	5.7 miles	$10.93		$9.78		$9.40
IH-25	IH (W2-N.Range C)	18-inch Pipeline	Nearshore West/East	30,000 LF	5.7 miles	$12.84		$12.31		$11.45
						115,450 cy		**230,900 cy**		**346,350 cy**
OH-1	OH (S.Range C-N.Range B)	18-inch Pipeline	Brandt Island	6,000 LF			NOT VIABLE- Material is greater than 90 % SAND			
OH-2	OH (S.Range C-N.Range B)	Mechanical w/ Scow	ODMDS		9.4 miles	$7.62		$7.27		$7.10
OH-3	OH (S.Range C-N.Range B)	Hopper	ODMDS		9.4 miles	$4.87		$4.54		$4.44
OH-4	OH (S.Range C-N.Range B)	Mechanical w/ Scow	Nearshore West-Existing		6.7 miles	$7.28		$7.15		**$6.96**
OH-4a	OH (S.Range C-N.Range B)	Mechanical w/ Scow	Nearshore West-expanded		7.7 miles	$7.54		$7.33		$7.01
OH-4b	OH (S.Range C-N.Range B)	Mechanical w/ Scow	Nearshore West-shallow		7.2 miles	$8.28		$7.49		$7.34
OH-5	OH (S.Range C-N.Range B)	Hopper	Nearshore West-existing		6.7 miles	$4.67		$4.35		**$4.23**
OH-5a	OH (S.Range C-N.Range B)	Hopper	Nearshore West-expanded		7.7 miles	$5.08		$4.55		$4.52
OH-5b	OH (S.Range C-N.Range B)	Hopper	Nearshore West-shallow		7.2 miles	$5.91		$5.28		$5.14
OH-6	OH (S.Range C-N.Range B)	Mechanical w/ Scow	Nearshore East-shallow		7.2 miles	$8.28		$7.49		$7.34
OH-6a	OH (S.Range C-N.Range B)	Mechanical w/ Scow	Nearshore East		6.7 miles	$7.28		$7.15		**$6.96**
OH-7	OH (S.Range C-N.Range B)	Hopper	Nearshore East-shallow		7.2 miles	$5.91		$5.28		$5.14
OH-7a	OH (S.Range C-N.Range B)	Hopper	Nearshore East		6.7 miles	$4.67		$4.35		**$4.23**
OH-8	OH (S.Range C-N.Range B)	18-inch Pipeline	Fort Macon & Atlantic Beach	17,800 LF	3.4 miles	$10.39		$8.20		$8.20
OH-9	OH (S.Range C-N.Range B)	30-inch Pipeline	Fort Macon & Atlantic Beach	17,800 LF	3.4 miles	$8.85	$8.00 AVG	$7.14		$6.50
OH-9a	OH (S.Range C-N.Range B)	30-inch Pipeline	Nearshore West	27,500 LF	5.2 miles	$10.81		$9.17		$8.80
OH-10	OH (S.Range C-N.Range B)	18-inch Pipeline	Shackleford Banks Beach	21,000 LF	4.0 miles	$12.28		$9.79		$9.30
OH-11	OH (S.Range C-N.Range B)	30-inch Pipeline	Shackleford Banks Beach	21,000 LF	4.0 miles	$9.70	$8.80 AVG	$7.89		$7.05
OH-11a	OH (S.Range C-N.Range B)	30-inch Pipeline	Nearshore East	27,500 LF	5.2 miles	$10.81		$9.17		$8.80
OH-11b	OH (S.Range C-N.Range B)	18-inch Pipeline	Nearshore West/East	27,500 LF	5.2 miles	$11.94		$11.34		$11.14
						886,050 cy		**1,772,100 cy**		**2,658,150 cy**
OH-12	OH (S.Range B, Cut-off, N.Range A; thru 110)	18-inch Pipeline	Brandt Island	13,000 LF			NOT VIABLE- Material is greater than 90 % SAND			
OH-13	OH (S.Range B, Cut-off, N.Range A; thru 110)	Mechanical w/ Scow	ODMDS		7.7 miles	$7.56		$7.13		$6.94
OH-14	OH (S.Range B, Cut-off, N.Range A; thru 110)	Hopper	ODMDS		7.7 miles	$4.24		$4.02		$3.98
OH-15	OH (S.Range B, Cut-off, N.Range A; thru 110)	Mechanical w/ Scow	Nearshore West-Existing		5.2 miles	$7.24		$7.01		$6.91
OH-15a	OH (S.Range B, Cut-off, N.Range A; thru 110)	Mechanical w/ Scow	Nearshore West-expanded		6.1 miles	$7.47		$7.13		$6.95
OH-15b	OH (S.Range B, Cut-off, N.Range A; thru 110)	Mechanical w/ Scow	Nearshore West-shallow		5.7 miles	$8.20		$7.45		$7.18
OH-16	OH (S.Range B, Cut-off, N.Range A; thru 110)	Hopper	Nearshore West-existing		5.2 miles	**$4.06**		$3.86		$3.80
OH-16a	OH (S.Range B, Cut-off, N.Range A; thru 110)	Hopper	Nearshore West-expanded		6.1 miles	$4.34		$4.10		$4.05
OH-16b	OH (S.Range B, Cut-off, N.Range A; thru 110)	Hopper	Nearshore West-shallow		5.7 miles	$4.87		$4.61		$4.54
OH-17	OH (S.Range B, Cut-off, N.Range A; thru 110)	Mechanical w/ Scow	Nearshore East-shallow		5.7 miles	$8.20		$7.45		$7.18
OH-17a	OH (S.Range B, Cut-off, N.Range A; thru 110)	Mechanical w/ Scow	Nearshore East		5.2 miles	$7.24		$7.01		$6.91
OH-18	OH (S.Range B, Cut-off, N.Range A; thru 110)	Hopper	Nearshore East-shallow		5.7 miles	$4.87		$4.61		$4.54
OH-18a	OH (S.Range B, Cut-off, N.Range A; thru 110)	Hopper	Nearshore East		5.2 miles	**$4.06**		$3.86		$3.80
OH-19	OH (S.Range B, Cut-off, N.Range A; thru 110)	30-inch Pipeline	Fort Macon & Atlantic Beach	18,500 LF	3.5 miles	$8.73	**$7.82 AVG**	$6.90	$6.90 AVG	$6.89
OH-19a	OH (S.Range B, Cut-off, N.Range A; thru 110)	30-inch Pipeline	Nearshore West	24,000 LF	4.5 miles	$9.61	$8.75 AVG	$7.89	$7.72 AVG	$7.54
OH-20	OH (S.Range B, Cut-off, N.Range A; thru 110)	Hopper pumpout to Beach	Fort Macon & Atlantic Beach		6.5 miles	$10.16		$10.00		$10.00
OH-21	OH (S.Range B, Cut-off, N.Range A; thru 110)	30-inch Pipeline	Shackleford Banks Beach	19,500 LF	3.7 miles	$8.73	**$7.82 AVG**	$6.90	$6.90 AVG	$6.89
OH-21a	OH (S.Range B, Cut-off, N.Range A; thru 110)	30-inch Pipeline	Nearshore East	24,000 LF	4.5 miles	$9.61	$8.75 AVG	$7.89	$7.72 AVG	$7.54
OH-22	OH (S.Range B, Cut-off, N.Range A; thru 110)	Hopper Pumpout to Beach	Shackleford Banks Beach		6.5 miles	$10.16		$10.00		$10.00
						114,500 cy		**229,000 cy**		**343,500 cy**
OEC-1	OEC (S.Range A; 110 to deep)	18-inch Pipeline	Brandt Island			Not a viable alternative equipment efficiency operation				
OEC-2	OEC (S.Range A; 110 to deep)	Mechanical w/ Scow	ODMDS		5.0 miles	7.41		7.02		6 LF
OEC-3	OEC (S.Range A; 110 to deep)	Hopper	ODMDS		5.0 miles	$3.61		$3.50		**$3.50**
OEC-4	OEC (S.Range A; 110 to deep)	Mechanical w/ Scow	Nearshore West		2.5 miles	Not a viable alternative - too much fine material				
OEC-5	OEC (S.Range A; 110 to deep)	Hopper	Nearshore West		2.5 miles	Not a viable alternative - too much fine material				
OEC-6	OEC (S.Range A; 110 to deep)	Mechanical w/ Scow	Nearshore East		2.9 miles	Not a viable alternative - too much fine material				
OEC-7	OEC (S.Range A; 110 to deep)	Hopper	Nearshore East		2.9 miles	Not a viable alternative - too much fine material				
OEC-8	OEC (S.Range A; 110 to deep)	18-inch Pipeline	Fort Macon & Atlantic Beach	19,958 LF	3.8 miles	Not a viable alternative - too much fine material				
OEC-9	OEC (S.Range A; 110 to deep)	30-inch Pipeline	Fort Macon & Atlantic Beach	19,958 LF	3.8 miles	Not a viable alternative - too much fine material				
OEC-10	OEC (S.Range A; 110 to deep)	18-inch Pipeline	Shackleford Banks Beach			Not a viable alternative - too much fine material				
OEC-11	OEC (S.Range A; 110 to deep)	30-inch Pipeline	Shackleford Banks Beach			Not a viable alternative - too much fine material				

Attachment 3 (sheet 2 of 2) – Morehead City Harbor DMMP Cost Estimates (Full Version)

Attachment 4 - Morehead City Harbor DMMP Detailed Costs for Viable Measures

Costs shown include quantities, unit prices, mob/demob, contingency, and average cost per dredging cycle for all measures shown in Attachment 3

Fuel Price = $3.00/Gallon

New ID	Range/Dredging Frequency/Disposal Location	Dredging Method		Dredging Quantity CY	Mob & Demob	Unit Price	Dredging Event Cost	with Contingency 26%	Effective Cost/cy	Average Cost Per Cycle
	NORTHWEST LEG, WEST LEG #1, AND EAST LEG									
IH_1	Brandt Island -No Overflow	18" Pipeline	16/18 Inch Pipeline							
	Annual			**120,750 cys**	$200,000	$4.96	$598,920	$1,006,639	$8.34	$1,006,639
	2-year Frequency			**241,500 cys**	$200,000	$4.47	$1,079,505	$1,612,176	$6.68	$806,088
	3-year Frequency			**362,250 cys**	$200,000	**$4.34**	$1,572,165	$2,232,928	$6.16	$744,309
	Mob/Demob considered shared with another contract where 18inch required i.e. within Morehead Harbor, AIWW, etc									
IH_2	ODMDS - No Overflow	Bucket & Barge	X 2,750 cy/load							
	Annual			**120,750 cys**	$185,000	$7.13	$860,948	$1,317,894	$10.91	$1,317,894
	2-year Frequency			**241,500 cys**	$185,000	$7.09	$1,712,235	$2,390,516	$9.90	$1,195,258
	3-year Frequency			**362,250 cys**	$185,000	$7.07	$2,561,108	$3,460,095	**$9.55**	$1,153,365
	Mob/Demob shared with East Leg and North Range C or other Morehead bucket barge range									
	WEST LEG # 2 AND NORTH RANGE C									
IH_{12}	Brandt Island	**18" Pipeline**	16/18 Inch Pipeline							
	Annual			**50,750 cys**	$200,000	$6.08	$308,560	$640,786	$12.63	$640,786
	2-year Frequency			**101,500 cys**	$200,000	$4.64	$470,960	$845,410	$8.33	$422,705
	3-year Frequency			**152,250 cys**	$200,000	**$4.30**	$654,675	$1,076,891	$7.07	$358,964
	Mob/Demob shared with another contract where 18inch required i.e. within Morehead Harbor, AIWW, etc									
IH_{13}	ODMDS	Bucket & Barge	X 3,750 cy/load							
	Annual			**50,750 cys**	$185,000	$7.79	$395,343	$731,232	$14.41	$731,232
	2-year Frequency			**101,500 cys**	$185,000	$7.29	$739,935	$1,165,418	$11.48	$582,709
	3-year Frequency			**152,250 cys**	$185,000	$7.15	$1,088,588	$1,604,720	$10.54	$534,907
	Mob/Demob considered shared with NW-West dredging or S.Range C or within Morehead Harbor									
IH_{14}	ODMDS	**Hopper**	X 2,800 cy/load							
	Annual			**50,750 cys**	$185,000	$7.61	$386,208	$719,721	$14.18	$719,721
		NOT VIABLE - EQUIPMENT								
	2-year Frequency			**101,500 cys**	$185,000	$7.28	$738,920	$1,164,139	$11.47	$582,070
	3-year Frequency			**152,250 cys**	$185,000	$7.24	$1,102,290	$1,621,985	$10.65	$540,662
	Mob/Demob considered shared with within Morehead Harbor (S.Range C and N. Range B) or Wilmington Harbor Contract									
IH_{15}	Nearshore - WEST/EAST shallow	Bucket & Barge	X 2,250 cy/load							
IH_{17}	Annual			**50,750 cys**	$185,000	$8.29	$420,718	$763,204	$15.04	$763,204
	2-year Frequency			**101,500 cys**	$185,000	$7.49	$760,235	$1,190,996	$11.73	$595,498
	3-year Frequency			**152,250 cys**	$185,000	$7.41	$1,128,173	$1,654,597	$10.87	$551,532
	Mob/Demob considered shared with NW-West dredging or S.Range C or within Morehead Harbor									
IH_{15a}	Nearshore - WEST expanded	Bucket & Barge	X 3,750 cy/load							
	Annual			**50,750 cys**	$185,000	$7.67	$389,253	$723,558	$14.26	$723,558
	2-year Frequency			**101,500 cys**	$185,000	$7.39	$750,085	$1,178,207	$11.61	$589,104
	3-year Frequency			**152,250 cys**	$185,000	$7.06	$1,074,885	$1,587,455	$10.43	$529,152
	Mob/Demob considered shared with NW-West dredging or S.Range C or within Morehead Harbor									
IH_{15b}	Nearshore - WEST existing- new EAST	Bucket & Barge	X 3,750 cy/load							
IH_{17a}	Annual			**50,750 cys**	$185,000	$7.62	$386,715	$720,361	$14.19	$720,361
	2-year Frequency			**101,500 cys**	$185,000	$7.31	$741,965	$1,167,976	$11.51	$583,988
	3-year Frequency			**152,250 cys**	$185,000	$7.01	$1,067,273	$1,577,863	$10.36	$525,954
	Mob/Demob considered shared with NW-West dredging or S.Range C or within Morehead Harbor									
IH_{16}	Nearshore - WEST/EAST shallow	**Hopper**	X 2,000 cy/load							
IH_{18}	Annual			**50,750 cys**	$185,000	$8.69	$441,018	$788,782	$15.54	$788,782
		NOT VIABLE - EQUIPMENT								
	2-year Frequency			**101,500 cys**	$185,000	$8.47	$859,705	$1,316,328	$12.97	$658,164
	3-year Frequency			**152,250 cys**	$185,000	$8.39	$1,277,378	$1,842,596	$12.10	$614,199
	Mob/Demob considered shared with within Morehead Harbor (S.Range C and N. Range B) or Wilmington Harbor Contract									
IH_{16a}	Nearshore - WEST expanded	**Hopper**	X 2,550 cy/load							
	Annual			**50,750 cys**	$185,000	$7.61	$386,208	$719,721	$14.18	$719,721
		NOT VIABLE - EQUIPMENT								
	2-year Frequency			**101,500 cys**	$185,000	$7.50	$761,250	$1,192,275	$11.75	$596,138
	3-year Frequency			**152,250 cys**	$185,000	$7.32	$1,114,470	$1,637,332	$10.75	$545,777
	Mob/Demob considered shared with within Morehead Harbor (S.Range C and N. Range B) or Wilmington Harbor Contract									
IH_{16b}	Nearshore - WEST existing- new EAST	**Hopper**	X 2,550 cy/load							
IH_{18a}	Annual			**50,750 cys**	$185,000	$7.18	$364,385	$692,225	$13.64	$692,225
		NOT VIABLE - EQUIPMENT								
	2-year Frequency			**101,500 cys**	$185,000	$6.96	$706,440	$1,123,214	$11.07	$561,607
	3-year Frequency			**152,250 cys**	$185,000	$6.74	$1,026,165	$1,526,068	**$10.02**	$508,689
	Mob/Demob considered shared with within Morehead Harbor (S.Range C and N. Range B) or Wilmington Harbor Contract									
	SOUTH RANGE C -AND- NORTH RANGE B (25% of Range B Shoal Quantity)									
OH_1	BRANDT ISLAND	**18" Pipeline**								
	Annual			**115,450 cys**						
							Not a viable alternative-therefore not priced			
	2-year Frequency			**230,900 cys**						
	3-year Frequency			**346,350 cys**						
OH_2	ODMDS	Bucket & Barge	X 3,750 cy/load							
	Annual			**115,450 cys**	$185,000	$7.62	$879,729	$1,341,559	$11.62	$1,341,559
	2-year Frequency			**230,900 cys**	$185,000	$7.27	$1,678,643	$2,348,190	$10.17	$1,174,095
	3-year Frequency			**346,350 cys**	$185,000	$7.10	$2,459,085	$3,331,547	$9.62	$1,110,516
	Mob/Demob considered shared with other parts of Morehead City Harbor Dredging									
OH_3	ODMDS	**Hopper**	X 2,800 cy/load							
	Annual hopper window 120 days			**115,450 cys**	$275,000	$4.87	$562,242	$1,054,924	$9.14	$1,054,924
	2-year Frequency			**230,900 cys**	$275,000	$4.54	$1,048,286	$1,667,340	$7.22	$833,670
	3-year Frequency			**346,350 cys**	$275,000	$4.44	$1,537,794	$2,284,120	$6.59	$761,373
	Mob/Demob considered shared with Contract for Wilmington Ocean Bar Contract OR other parts of Morehead City									
OH_4	Nearshore - WEST existing- new EAST	Bucket & Barge	X 3,750 cy/load							
OH6a	Annual			**115,450 cys**	$185,000	$7.28	$840,476	$1,292,100	$11.19	$1,292,100
	2-year Frequency			**230,900 cys**	$185,000	$7.15	$1,650,935	$2,313,278	$10.02	$1,156,639
	3-year Frequency			**346,350 cys**	$185,000	$6.96	$2,410,596	$3,270,451	$9.44	$1,090,150
	Mob/Demob considered shared with other parts of Morehead City Harbor Dredging									

Attachment 4 (sheet 1 of 3) – Morehead City Harbor Detailed Costs for Viable Measures

Attachment 4 - Morehead City Harbor DMMP Detailed Costs for Viable Measures
Costs shown include quantities, unit prices, mob/demob, contingency, and average cost per dredging cycle for all measures shown in Attachment 3
Fuel Price = $3.00/Gallon

New ID	Range/Dredging Frequency/Disposal Location	Dredging Method			Dredging Quantity CY	Mob & Demob	Unit Price	Dredging Event Cost	with Contingency 26%	Effective Cost/cy	Average Cost Per Cycle
OH_{4a}	Nearshore - WEST expanded	Bucket & Barge	X	3,750 cy/load							
	Annual				**115,450 cys**	$185,000	$7.54	$870,493	$1,329,921	$11.52	$1,329,921
	2-year Frequency				**230,900 cys**	$185,000	$7.33	$1,692,497	$2,365,646	$10.25	$1,182,823
	3-year Frequency				**346,350 cys**	$185,000	$7.01	$2,427,914	$3,292,271	$9.51	$1,097,424
OH_{4b}	Nearshore - WEST/EAST shallow	Bucket & Barge	X	2,250 cy/load							
OH_6	Annual				**115,450 cys**	$185,000	$8.28	$955,926	$1,437,567	$12.45	$1,437,567
	2-year Frequency				**230,900 cys**	$185,000	$7.49	$1,729,441	$2,412,196	$10.45	$1,206,098
	3-year Frequency				**346,350 cys**	$185,000	$7.34	$2,542,209	$3,436,283	$9.92	$1,145,428
OH_5	Nearshore - WEST existing- new EAST	**Hopper**	X	2,550 cy/load							
OH7a	Annual hopper window 120 days				**115,450 cys**	$275,000	$4.67	$539,152	$1,025,831	$8.89	$1,025,831
	2-year Frequency				**230,900 cys**	$275,000	$4.35	$1,004,415	$1,612,063	$6.98	$806,031
	3-year Frequency possibly 2 hoppers required				**346,350 cys**	$275,000	**$4.23**	$1,465,061	$2,192,476	$6.33	$730,825
	Mob/Demob considered shared with Contract for Wilmington Ocean Bar Contract OR other parts of Morehead City										
OH_{5a}	Nearshore - WEST expanded	**Hopper**	X	2,550 cy/load							
	Annual hopper window 120 days				**115,450 cys**	$275,000	$5.08	$586,486	$1,085,472	$9.40	$1,085,472
	2-year Frequency				**230,900 cys**	$275,000	$4.55	$1,050,595	$1,670,250	$7.23	$835,125
	3-year Frequency possibly 2 hoppers required				**346,350 cys**	$275,000	$4.52	$1,565,502	$2,319,033	$6.70	$773,011
	Mob/Demob considered shared with Contract for Wilmington Ocean Bar Contract OR other parts of Morehead City										
OH_{5b}	Nearshore - WEST/EAST shallow	**Hopper**	X	2,000 cy/load							
OH_7	Annual hopper window 120 days				**115,450 cys**	$275,000	$5.91	$682,310	$1,206,210	$10.45	$1,206,210
	2-year Frequency				**230,900 cys**	$275,000	$5.28	$1,219,152	$1,882,632	$8.15	$941,316
	3-year Frequency possibly 2 hoppers required				**346,350 cys**	$275,000	$5.14	$1,780,239	$2,589,601	$7.48	$863,200
	Mob/Demob considered shared with Contract for Wilmington Ocean Bar Contract OR other parts of Morehead City										
OH_8	Beach Disposal (Bogue Banks)	**18" Pipeline**	X	16/18-INCH Pipeline S. RANGE C & RANGE B							
	Annual pipeline window 165 days				**115,450 cys**	$1,500,000	$10.39	$1,199,526	$3,401,402	$29.46	$3,401,402
	2-year Frequency				**230,900 cys**	$1,500,000	$8.20	$1,893,380	$4,275,659	$18.52	$2,137,829
	3-year Frequency				**346,350 cys**	$1,500,000	$8.20	$2,840,070	$5,468,488	$15.79	$1,822,829
	Mob/Demob Price NOT SHARED since considered beach pipeline and Pipeline for E.Leg reduced to combine with this area										
OH_9	Beach Disposal (Bogue Banks)	30" Pipeline	X								
	Annual pipeline window 165 days				**115,450 cys**	$148,000	$8.85	$1,021,733	$1,473,863	$12.77	$1,473,863
	2-year Frequency				**230,900 cys**	$407,000	$7.14	$1,648,626	$2,590,089	$11.22	$1,295,044
	3-year Frequency				**346,350 cys**	$407,000	$6.50	$2,251,275	$3,349,427	$9.67	$1,116,476
	Mob/Demob shared for smaller quantities assumed to be with S. Range B, Cut off & N. Range A										
OH_{9a}	NEARSHORE BY PIPELINE WEST-EAST	30" Pipeline	X								
OH_{11a}	Annual pipeline window 165 days				**115,450 cys**	$160,000	$10.81	$1,248,015	$1,774,098	$15.37	$1,774,098
	2-year Frequency				**230,900 cys**	$440,000	$9.17	$2,117,353	$3,222,265	$13.96	$1,611,132
	3-year Frequency				**346,350 cys**	$440,000	$8.80	$3,047,880	$4,394,729	$12.69	$1,464,910
	Mob/Demob shared for smaller quantities assumed to be with S. Range B, Cut off & N. Range A										
OH_{10}	Beach Disposal (SHACKLEFORD Banks)	**18" Pipeline**									
	Annual				**115,450 cys**	$1,500,000	$12.28	$1,417,726	$3,676,335	$31.84	$3,676,335
	2-year Frequency				**230,900 cys**	$1,500,000	$9.79	$2,260,511	$4,738,244	$20.52	$2,369,122
	3-year Frequency				**346,350 cys**	$1,500,000	$9.71	$3,363,059	$6,127,454	$17.69	$2,042,485
	Mob/Demob Price NOT SHARED since considered beach pipeline and Pipeline for E.Leg reduced to combine with this area										
OH_{11}	Beach Disposal (SHACKLEFORD Banks)	30" Pipeline									
	Annual				**115,450 cys**	$148,000	$9.70	$1,119,865	$1,597,510	$13.84	$1,597,510
	2-year Frequency				**230,900 cys**	$407,000	$7.89	$1,821,801	$2,808,289	$12.16	$1,404,145
	3-year Frequency				**346,350 cys**	$407,000	$7.05	$2,441,768	$3,589,447	$10.36	$1,196,482
	Mob/Demob shared for smaller quantities assumed to be with S. Range B, Cut off & N. Range A										
OH_{11b}	NEARSHORE BY PIPELINE WEST-EAST	18" Pipeline									
	Annual				**115,450 cys**	$1,500,000	$11.94	$1,378,473	$3,626,876	$31.42	$3,626,876
	2-year Frequency				**230,900 cys**	$1,500,000	$11.34	$2,618,406	$5,189,192	$22.47	$2,594,596
	3-year Frequency				**346,350 cys**	$1,500,000	$11.14	$3,858,339	$6,751,507	$19.49	$2,250,502
	Mob/Demob shared for smaller quantities assumed to be with S. Range B, Cut off & N. Range A										
	SOUTH RANGE B (75% of Range B Quantity), CUT-OFF, NORTH RANGE A - - TO STA 110+00										
OH_{12}	BRANDT ISLAND	**18" Pipeline**									
	Annual				**886,050 cys**			Not a viable alternative-therefore not priced			
	2-year Frequency				**1,772,100 cys**						
	3-year Frequency				**2,658,150 cys**						
OH_{13}	ODMDS	Bucket & Barge	X	3,750 cy/load							
	Annual				**886,050 cys**	$550,000	$7.56	$6,698,538	$9,133,158	$10.31	$9,133,158
	2-year Frequency				**1,772,100 cys**	$1,100,000	$7.13	$12,635,073	$17,306,192	$9.77	$8,653,096
	3-year Frequency				**2,658,150 cys**	$1,650,000	$6.94	$18,447,561	$25,322,927	$9.53	$8,440,976
	Mob/Demob --NOT--shared for large quantities (MAY BE SHARED if QUANTITIES SMALLER)										
OH_{14}	ODMDS	**Hopper**		2,800 cy/load							
	Annual				**886,050 cys**	$275,000	$4.24	$3,756,852	$5,080,134	$5.73	$5,080,134
	2-year Frequency			2 MOBS	**1,772,100 cys**	$1,100,000	$4.02	$7,123,842	$10,362,041	$5.85	$5,181,020
	3-year Frequency			3 MOBS	**2,658,150 cys**	$1,650,000	$3.98	$10,579,437	$15,409,091	$5.80	$5,136,364
	Mob/Demob --NOT--shared for large quantities (MAY BE SHARED if QUANTITIES SMALLER)										

Attachment 4 (sheet 2 of 3) – Morehead City Harbor Detailed Costs for Viable Measures

Attachment 4 - Morehead City Harbor DMMP Detailed Costs for Viable Measures
Costs shown include quantities, unit prices, mob/demob, contingency, and average cost per dredging cycle for all measures shown in Attachment 3
Fuel Price = $3.00/Gallon

New ID	Range/Dredging Frequency/Disposal Location	Dredging Method			Dredging Quantity CY	Mob & Demob	Unit Price	Dredging Event Cost	with Contingency 26%	Effective Cost/cy	Average Cost Per Cycle
OH$_{15}$	Nearshore - WEST existing- new EAST	Bucket & Barge	X	3,750 cy/load							
OH$_{17a}$	Annual				**886,050 cys**	$550,000	$7.24	$6,415,002	$8,775,903	$9.90	$8,775,903
	2-year Frequency			2 MOBS	**1,772,100 cys**	$1,100,000	$7.01	$12,422,421	$17,038,250	$9.61	$8,519,125
	3-year Frequency			3 MOBS	**2,658,150 cys**	$1,650,000	$6.91	$18,367,817	$25,222,449	$9.49	$8,407,483
	Mob/Demob --NOT--shared for large quantities (MAY BE SHARED if QUANTITIES SMALLER)										
OH$_{15a}$	Nearshore - WEST expanded	Bucket & Barge	X	3,750 cy/load							
	Annual				**886,050 cys**	$550,000	$7.47	$6,618,794	$9,032,680	$10.19	$9,032,680
	2-year Frequency			2 MOBS	**1,772,100 cys**	$1,100,000	$7.13	$12,635,073	$17,306,192	$9.77	$8,653,096
	3-year Frequency			3 MOBS	**2,658,150 cys**	$1,650,000	$6.95	$18,474,143	$25,356,420	$9.54	$8,452,140
OH$_{15b}$	Nearshore - WEST/EAST shallow	Bucket & Barge	X	2,250 cy/load							
OH$_{17}$	Annual				**886,050 cys**	$550,000	$8.20	$7,265,610	$9,847,669	$11.11	$9,847,669
	2-year Frequency			2 MOBS	**1,772,100 cys**	$1,100,000	$7.45	$13,202,145	$18,020,703	$10.17	$9,010,351
	3-year Frequency			3 MOBS	**2,658,150 cys**	$1,650,000	$7.18	$19,085,517	$26,126,751	$9.83	$8,708,917
OH$_{16}$	Nearshore - WEST existing- new EAST	**Hopper**		2,550 cy/load							
OH$_{18a}$	Annual				**886,050 cys**	**$275,000**	**$4.06**	$3,597,363	$4,879,177	$5.51	$4,879,177
	2-year Frequency			2 MOBS	**1,772,100 cys**	$1,100,000	$3.86	$6,840,306	$10,004,786	$5.65	$5,002,393
	3-year Frequency			3 MOBS	**2,658,150 cys**	$1,650,000	$3.80	$10,100,970	$14,806,222	$5.57	$4,935,407
	Mob/Demob --NOT--shared for large quantities (MAY BE SHARED if QUANTITIES SMALLER)										
OH$_{16a}$	Nearshore - WEST expanded	**Hopper**		2,550 cy/load							
	Annual				**886,050 cys**	$275,000	$4.34	$3,845,457	$5,191,776	$5.86	$5,191,776
	2-year Frequency			2 MOBS	**1,772,100 cys**	$1,100,000	$4.10	$7,265,610	$10,540,669	$5.95	$5,270,334
	3-year Frequency			3 MOBS	**2,658,150 cys**	$1,650,000	$4.05	$10,765,508	$15,643,539	$5.89	$5,214,513
	Mob/Demob --NOT--shared for large quantities (MAY BE SHARED if QUANTITIES SMALLER)										
OH$_{16b}$	Nearshore - WEST/EAST shallow	**Hopper**		2,000 cy/load							
OH$_{18}$	Annual				**886,050 cys**	$275,000	$4.87	$4,315,064	$5,783,480	$6.53	$5,783,480
	2-year Frequency			2 MOBS	**1,772,100 cys**	$1,100,000	$4.61	$8,169,381	$11,679,420	$6.59	$5,839,710
	3-year Frequency			3 MOBS	**2,658,150 cys**	$1,650,000	$4.54	$12,068,001	$17,284,681	$6.50	$5,761,560
	Mob/Demob --NOT--shared for large quantities (MAY BE SHARED if QUANTITIES SMALLER)										
OH$_{19}$	Beach Disposal(Shackleford and Bogue Banks)	**30" Pipeline**									
OH$_{21}$	Annual pipeline window 165 days				**886,050 cys**	$3,700,000	$8.73	$7,735,217	$14,408,373	$16.26	$14,408,373
		AVERAGE FOR THIS ALTERNATIVE				**$3,700,000**	**$7.82**	$10,386,721	$17,749,269	$13.35	$11,832,846
	2-year Frequency				**1,772,100 cys**	$3,700,000	$6.90	$12,227,490	$20,068,637	$11.32	$10,034,319
	3-year Frequency				**2,658,150 cys**	$3,700,000	$6.89	$18,314,654	$27,738,463	$10.44	$9,246,154
	Mob/Demob --NOT--shared for large quantities										
OH$_{19a}$	NEARSHORE BY PIPELINE WEST-EAST	**30" Pipeline**									
OH$_{21a}$	Annual pipeline window 165 days				**886,050 cys**	$4,000,000	$9.61	$8,514,941	$15,768,825	$17.80	$15,768,825
		AVERAGE FOR THIS ALTERNATIVE				$4,000,000	$8.75	$11,629,406	$19,693,052	$14.82	$13,128,701
	2-year Frequency				**1,772,100 cys**	$4,000,000	$7.89	$13,981,869	$22,657,155	$12.79	$11,328,577
	3-year Frequency				**2,658,150 cys**	$4,000,000	$7.54	$20,042,451	$30,293,488	$11.40	$10,097,829
	Mob/Demob --NOT--shared for large quantities										
OH$_{20}$	Beach Disposal (Bogue Banks)	**Hopper Pumpout**	X								
OH$_{22}$	Annual hopper window	USING 10,000 CY/DAY = 304,100CY/MO			**886,050 cys**	$945,000	$10.16	$9,002,268	$12,533,558	$14.15	$12,533,558
		1,216,400 CY PER HOPPER PER SEASON									
	2-year Frequency 2-hoppers required			2 MOBS	**1,772,100 cys**	$1,495,000	$10.00	$17,721,000	$24,212,160	$13.66	$12,106,080
	3-year Frequency			3 MOBS	**2,658,150 cys**	$2,045,000	$10.00	$26,581,500	$36,069,390	$13.57	$12,023,130
	Hopper with PUMPOUT TO BEACH Mob/Demob --NOT--shared for large quantities (MAY BE SHARED if QUANTITIES SMALLER)										
	SOUTH RANGE A - AND 110+00 OUT BOUND										
OEC$_2$	ODMDS from 110+00 outward	Bucket & Barge	X	3,750 cy/load							
	Annual				**114,500 cys**	$275,000	$7.41	$848,445	$1,415,541	$12.36	$1,415,541
	2-year Frequency				**229,000 cys**	$275,000	$7.02	$1,607,580	$2,372,051	$10.36	$1,186,025
	3-year Frequency				**343,500 cys**	$275,000	$6.36	$2,184,660	$3,099,172	$9.02	$1,033,057
	Mob/Demob considered shared with other parts of Morehead City Harbor Dredging										
OEC$_3$	ODMDS from 110+00 outward	**Hopper**	X	2,800 cy/load							
	Annual hopper window 90 days				**114,500 cys**	$275,000	$3.61	$413,345	$867,315	$7.57	$867,315
	2-year Frequency				**229,000 cys**	$275,000	$3.50	$801,500	$1,356,390	$5.92	$678,195
	3-year Frequency				**343,500 cys**	**$275,000**	**$3.50**	$1,202,250	$1,861,335	$5.42	$620,445
	Mob/Demob considered shared with Contract for Wilmington Ocean Bar Contract OR other parts of Morehead City Harbor										
	All other OEC-Outer Entrance Channel alternatives not considered vialble alternatives.										

Attachment 4 (sheet 3 of 3) – Morehead City Harbor Detailed Costs for Viable Measures

PRICE LEVEL FOR THESE ESTIMATES = JANUARY 2011

------ 1. Brandt Island - EXPAND Footprint of Existing Dike and Raise to 42, 43, 47, 52 & 55 ft
------ 2. Raise existing dike footprint to elevation from approximate elevation 39.5 ft to 45 ft
------ 3. Remove Material Inside Brandt Island (clean out) to ODMDS
------ 4. Create Bird Islands behind Shackleford Banks

RAISE DIKE WITH EXPANDED FOOTPRINT TO ELEVATIONS 42, 43, 47, 52, & 55 FT

1. FULL RAISE OF EXPANDED DIKES from existing - raise from existing elevation 2012 up to elevation shown
RAISE DIKE WITH EXPANDED FOOTPRINT TO ELEVATIONS 42, 47, ETC.

ELEVATION	QTY cy's	UNIT PRICE - Embankment	TOTAL	mob/demob	Mitigation Coastal Little Bluestem	clear/grub acres	clear and grub	NEW SPILLWAYS	seed/mulch	TOTAL Construction	WITH 25% Contingency	PED&S/A	DIKE Capacity (cy)	Capacity for dredge material - cy's	Cost/cy for Dredge capacity with contingency	AVG Pipelline to Brandt with MOB/DEMOB & contingency	**TOTAL EFF COST/CY to Brandt Island**	**AVG OF B+B TO ODMDS & NEARSHORE**
42 FT	442,157	$5.25	$2,321,324	$489,496	$75,000	84	$252,000	$630,000	$294,000	$4,061,820	$5,077,275	$718,023	1,690,723	1,445,000	$4.01	$6.13	**$10.14**	**$9.23**
43	485,112	$5.25	$2,546,837	$507,905	$75,000	84	$252,000	$630,000	$294,000	$4,305,742	$5,382,178	$737,842	1,853,878	1,527,000	$4.01	$6.13	**$10.14**	**$9.23**
47	656,931	$5.25	$3,448,888	$581,542	$75,000	84	$252,000	$630,000	$294,000	$5,281,430	$6,601,787	$817,116	2,506,497	2,153,000	$3.45	$6.13	**$9.58**	**$9.23**
52	917,100	$5.25	$4,814,775	$693,043	$75,000	84	$252,000	$630,000	$294,000	$6,758,818	$8,448,522	$937,154	3,300,624	2,850,000	$3.29	$6.13	**$9.42**	**$9.23**
55	1,088,300	$5.25	$5,713,575	$766,414	$75,000	84	$252,000	$630,000	$294,000	$7,730,989	$9,663,737	$1,016,143	3,771,856	3,386,000	$3.15	$6.13	**$9.28**	**$9.23**

2. RAISE EXISTING DIKE FOOTPRINT (FROM APPROXIMATELY 39,5 FT TO ELEVATION 45 FT) Capacity of existing dike without raise to 45 FT = 2,977,434 CY

ELEVATION	QTY cy's	UNIT PRICE - Embankment	TOTAL	mob/demob	Mitigation	clear/grub acres	total clear and grub	NEW SPILLWAY	costs for seed/mulch	TOTAL ALL COSTS	WITH 25% CONTINGEN CY	PED&S/A	DIKE Capacity (cy)	Capacity for dredge material - cy's	Cost/cy for Dredge capacity with contingency	AVG Pipelline to Brandt with MOB/DEMOB & contingency	TOTAL EFF COST/CY to Brandt Island	**AVG OF B+B TO ODMDS & NEARSHORE**
45	135,000	$5.50	$742,500	$372,000	$0	10	$30,000	$315,000	$66,500	$1,526,000	$1,907,500	$286,125	622,566	311,283	$7.05	$6.13	**$13.18**	**$9.23**

3. CLEAN OUT BRANDT ISLAND - ONCE IT BECOMES FULL OF DREDGED MATERIAL

	QTY	UNIT PRICE				PED & S/A	Total with 20% contingency	Cost/cy of capacity
MOB AND DEMOB - dredge & land equipment	1 LS	$1,000,000	$1,000,000					
Dredge ENTRANCE TO CUT INTO DIKE	100,000 cy	$7.00	$700,000					
Dredge Interior and place into ODMDS	3,812,000 cy	$7.00	$26,684,000					
REPLACE-REINSTALL DIKE	100,000 cy	$7.00	$700,000					
NEW SPILLWAYS, BONDS ETC	$872,520		$875,000					
TOTAL			$29,959,000			$898,770	$37,029,324	$9.71 /CY

4. MOREHEAD CITY HARBOR CREATION OF BIRD ISLANDS FROM DREDGED MATERIAL

15 ACRE SITE(S) BEHIND SHACKLEFORD BANKS		
Enclosure will be by geotube filled sandbags Based on pi Rsq = area		
radius = 457 ft		
circumference = 2,865 LF of geotube		
Average water depth to fill 15 acre site = 5 ft x 653,400 sf =	121,000	cy
Material dredged from channel to fill inside geotubes of 121,000 cy		$2,904,000
Assume----------- 242,000 cy to result in 121,000 cy inside at $12/cy		
Cost of geotubes filled with nearby sand for height of 5 feet approximately		
		$1,148,000
Misc Mob-Demob for equipment costs on Island, Geotube mob/demob		$500,000
COST FOR 1-BIRD ISLAND	TOTAL	**$4,552,000**
	WITH 25% conting	**$5,690,000**
		PER ISLAND

AVERAGE Pipeline unit price To Brandt Island	
Pipeline costs Inner Harbor (with MOB/DEMOB and 20% contingency	
$2,126,598	IH-1 pipeline to Brandt- $5.87/cy * 362,250 cy
$1,025,610	IH-12 pipeline to Brandt- $6.74/cy * 152,250 cy
$3,152,208	Total Pipeline cost with mob/demob & contingency
514,500 cy	
$6.13 /cy	Average pipeline cost to Brandt Island
AVERAGE B+B unit price To ODMDS & Nearshore	
FOR 3 YEAR CYCLE	
$3,295,329	IH-2 Bucket/Barge to ODMDS- $9.10/cy * 362,250 cy
$1,453,398	IH-16b Bucket/Barge to Nearshore- $9.55/cy * 152,250cy
$4,748,727	Total B+B cost with mob/demob and contingency
514,500 cy	
$9.23 /cy	Avg cost for Bucket/Barge to ODMDS & NEARSHORE

Attachment 5 - Morehead City Harbor DMMP cost considerations for alternative comparisons

Attachment 6 – Total Project Cost (TPC) (4 pages)

Total Project Cost (TPCS) BASICS:
A completed TPCS will show the overall project cost by feature account of a project and an estimate of the total cost to complete the project(fully funded estimate). It is essentially a summary of a program's cost by summing each construction contract by WBS feature and its estimated lands damages and associated administrative costs. These costs are escalated to the midpoint of construction and summed to give a fully funded cost.
Things you need to complete a TPCS:
Projected budget year planned to obtain funding to support the project development and construction.
Effective price level date of estimate.
Estimate of construction costs for the appropriate work breakdown structure.
Estimates for other accounts (lands, damages, real estate, relocations, etc)
Midpoint of construction schedule.
Midpoint of design schedule.
Midpoint of Lands and Damages, Relocations...
30/31 accounts estimates or they may be calculated based on rule of thumb percentages (default on the spreadsheet).
Risk Based contingencies.
Current CWCCIS table (updated 2x per year, Mar and Sep) Downloadable from NWW's web site.
Other data that may be nice to know: (you will need this for the 902 limit)
Authorization legislation and date.
Baseline estimate (estimate presented to Congress for authorization) Most likely in a report by the Chief of Engineers. You need this for the Work Breakdown Structure (WBS) to track changes in the project.
Amount actually authorized by Congress.
Contracts awarded, contracts ongoing and the respective WBS code and amount (contingencies on completed work and ongoing construction are less than future construction work)
Total of expenditures by WBS feature and year.
Total project cost spreadsheet sums the account costs for a project/program based on the estimate data entered and will calculate the 30/31 accounts based on the percentages input into the data sheet.(For the 30/31 accounts the spreadsheet default is to use the rule of thumb percentages from the data sheet. These may be changed accordingly either thru changing the percentages in the data sheet or may be adjusted for each item individually. (The Excel goal seeking function may be useful))
Things to remember:
- Estimates should be less than two years old (ER 1110-2-1302).
- Make sure you are using the latest CWCCIS table/numbers for your TPCS!
- Check that the costs are reasonable for where you are at in the stage of the project! I.e.- If you have already completed the bid package for a contract and have it on the shelf you most likely have expended most of the design cost. Therefore the rule of thumb 30/31 account percentages and amounts may be too high.
How it works:
Each estimate for the project/program is entered on a separate page of the TPCS The estimate value (from MCACES)is entered in the left column of the page. Contingency is entered and the sum of the estimate and the total is calculated. Based on the date of the price level of the estimate, inflation is applied to bring the cost to the desired program year (middle column). From here the construction estimate is inflated to the midpoint of construction.
All of the estimates sum up to the top sheet (summary-it's the one with the signature blocks on it). It is important to remember to check that the sheets sum correctly by WBS structure. Don't mix accounts!

Fully Funded Contracts that have had funds obligated but not expended usually are entered at fully funded award price with 10% contingency. In general they are assumed to be at program year price level.
For a non fully funded contract that have been awarded escalation to the midpoint may be required. For this situation, make sure that you have an accurate total of estimated costs.
TPCS Sheet. Generally Obligations should be entered as an estimate and expenditures should be totaled and put in the spent thru column on the summary page. The key is to exclude contingency and escalation on spent funds.
GENERAL INSTRUCTIONS:
This worksheet is setup to include a summary sheet and four (4) separate contracts with one Construction WBS code. If more "Contract" sheets are added, or you need to have multiple Construction WBS codes then:
1- Fill out project data- this will populate the signatory blocks, program year, preparation date, etc.
2 - Change the "Sum" in reference column 3 to sum correctly to the sheets below,
3- Copy the revised formulas in column 3 to columns 4, 9 & 10, 15 & 16
4 - Use row "X" to check the summation of the spreadsheet.
5 - Select the appropriate Quarter for each item. Indexes & Time Period dates will come automatically. Check Time Periods.
6 Select Feature WBS. Feature description will come in automatically.
7- Enter the amounts spent thru the past Fiscal year in the appropriate cells in reference column 13 on the summary page

PROJECT LOCATION	Morehead City, North Carolina
PROGRAM YEAR	2015
ESTIMATE PREPARED DATE	2/9/2012
EST EFF. PRICE LEVEL DATE	1/1/2011
DATE TPCS PREPARED	10/14/2012
ENGINEERING REPORT AS BASIS	DMMP

			Districts Vary			
ENGINEERING & DESIGN PHASE -> 30 ACCOUNT						
PROJECT MANAGER,	Program Management:	2.5%	0.5%	30.0	6.8%	Sum per % of 30 Account
CHIEF, DPM,				30.0		
CHIEF, PLANNING,	Planning & Environmental Compliance:	1.0%	0.5%	30.0		
CHIEF, ENGINEERING,	Engineering & Design:	15.0%	3.3%	30.0		
CHIEF, COST ENGINEERING,						
CHIEF, ENGINEERING,	Engineering Tech Review & VE:	1.0%	0.5%	30.0		
CHIEF, CONTRACTING,	Contracting & Reprographics:	1.0%	0.5%	30.0		
CHIEF, ENGINEERING,	Engineering During Construction:	3.0%	0.5%	30.0		Escalate to Mid Point Construction
CHIEF, PLANNING,	Planning During Construction	2.0%	0.5%	30.0		
CHIEF, OPERATIONS,	Project Operation:	1.0%	0.5%	30.0		
CONSTRUCTION PHASE -> 31 ACCOUNT						
CHIEF, CONSTRUCTION,	Supervision & Assurance:	10.0%	4.0%	31.0	8.0%	Sum per % of 31 Account
CHIEF, OPERATIONS,	Project Operation:	2.0%	2.0%	30.0		
CHIEF, DPM,	Program Management:	2.5%	2.0%	31.0		
					14.8%	Sum per % of 30 & 31 Accounts
REAL ESTATE -> 01 ACCOUNT						
CHIEF, REAL ESTATE,						
CULTURAL RESOURCES -> 18 ACCOUNT						
CHIEF, PLANNING,						
SPENT THRU FYXX COSTS						
CHIEF, DPM,						

%'s are based on construction dollars amounts.
Accept default distribution of 30 and 31 accounts
or
Enter your preferred percentages
or
Use Goal Seek on each individual line within the TPCS spreadsheet to make the estimate match a 564

Estimate Prepared:	9-Feb-12					Program Year (Budget EC):		2015					
Effective Price Level:	1-Jan-11					Effective Price Level Date:		1 OCT 14	FULLY FUNDED PROJECT ESTIMATE				
			RISK BASED										
Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	TOTAL ($K)	Mid-Point Date	ESC (%)	COST ($K)	CNTG ($K)	FULL ($K)
B	***C***	***D***	***E***	***F***	***G***	***H***	***I***	***J***	***P***	***L***	***M***	***N***	***O***
FY2015													
CONTRACT COST TOTALS:	$13,997	$3,639	26.0%	**$17,636**		$14,655	$3,810	$18,465	2012Q4	0.4%	$14,719	$3,827	**$18,546**
FY2016													
CONTRACT COST TOTALS:	$5,396	$1,403	26.0%	**$6,799**		$5,653	$1,470	$7,123	2013Q3	2.3%	$5,786	$1,504	**$7,290**
FY2017													
CONTRACT COST TOTALS:	$8,678	$2,256	26.0%	**$10,934**		$9,096	$2,365	$11,461	2014Q3	4.4%	$9,494	$2,468	**$11,962**
FY2018													
CONTRACT COST TOTALS:	$13,997	$3,639	26.0%	**$17,636**		$14,655	$3,810	$18,465	2015Q3	6.2%	$15,567	$4,047	**$19,614**
FY2019													
CONTRACT COST TOTALS:	$5,396	$1,403	26.0%	**$6,799**		$5,653	$1,470	$7,123	2016Q3	8.3%	$6,122	$1,592	**$7,714**
FY2020													
CONTRACT COST TOTALS:	$8,678	$2,256	26.0%	**$10,934**		$9,096	$2,365	$11,461	2017Q3	10.5%	$10,052	$2,614	**$12,666**
FY2021													
CONTRACT COST TOTALS:	$13,997	$3,639	26.0%	**$17,636**		$14,655	$3,810	$18,465	2018Q3	12.3%	$16,458	$4,279	**$20,737**
FY2022													
CONTRACT COST TOTALS:	$5,396	$1,403	26.0%	**6,799**		$5,653	$1,470	$7,123	2019Q3	14.6%	$6,477	$1,684	**$8,161**
FY2023													
CONTRACT COST TOTALS:	$8,678	$2,256	26.0%	**$10,934**		$9,096	$2,365	$11,461	2020Q3	17.0%	$10,639	$2,766	**$13,405**
FY2024													
CONTRACT COST TOTALS:	$13,997	$3,639	26.0%	**$17,636**		$14,655	$3,810	$18,465	2021Q3	18.7%	$17,397	$4,523	**$21,920**
FY2025													
CONTRACT COST TOTALS:	$5,396	$1,403	26.0%	**$6,799**		$5,653	$1,470	$7,123	2022Q3	21.2%	$6,850	$1,781	**$8,631**
FY2026													
CONTRACT COST TOTALS:	$8,678	$2,256	26.0%	**$10,934**		$9,096	$2,365	$11,461	2023Q3	23.8%	$11,257	$2,927	**$14,184**
FY2027													
CONTRACT COST TOTALS:	$13,997	$3,639	26.0%	**$17,636**		$14,655	$3,810	$18,465	2024Q3	25.5%	$18,386	$4,780	**$23,166**
FY2028													
CONTRACT COST TOTALS:	$5,396	$1,403	26.0%	**$6,799**		$5,653	$1,470	$7,123	2025Q3	28.1%	$7,243	$1,883	**$9,126**
FY2029 INNER TO ODMDS													
CONTRACT COST TOTALS:	$10,069	$2,618	26.0%	**$12,687**		$10,550	$2,743	$13,293	2026Q3	30.7%	$13,784	$3,584	**$17,368**
FY2030													
CONTRACT COST TOTALS:	$13,997	$3,639	26.0%	**$17,636**		$14,655	$3,810	$18,465	2027Q3	32.6%	$19,430	$5,052	**$24,482**
FY2031													
CONTRACT COST TOTALS:	$5,396	$1,403	26.0%	**$6,799**		$5,653	$1,470	$7,123	2028Q3	35.5%	$7,658	$1,991	**$9,649**
FY2032 INNER TO ODMDS													
CONTRACT COST TOTALS:	$10,069	$2,618	26.0%	**$12,687**		$10,550	$2,743	$13,293	2029Q3	38.2%	$14,576	$3,790	**$18,366**
FY2033													
CONTRACT COST TOTALS:	$13,997	$3,639	26.0%	**$17,636**		$14,655	$3,810	$18,465	2030Q3	40.1%	$20,533	$5,338	**$25,871**
FY2034													
CONTRACT COST TOTALS:	$5,396	$1,403	26.0%	**$6,799**		$5,653	$1,470	$7,123	2031Q3	43.2%	$8,096	$2,105	**$10,201**

Attachment 7 – Abbreviated Cost Risk Analysis (10 pages)

Abbreviated Risk Analysis

Project (less than $40M): **Morehead City Harbor - DMMP - Morehead City, NC**
Project Development Stage: **Feasibility (Recommended Plan)**
Risk Category: **Low: Simple-No Life Safety**

Dredge Material Management Plan (DMMP) 2015 thru 2034

Total Construction Contract Cost = **$ 26,665,688** Represents 3-YEARS of Dredging

	WBS	Potential Risk Areas	No PED or S&A Contract Cost		% Contingency	$ Contingency	Total
1	12 02 HARBORS	Pipeline Dredge INNER to Brandt Island -- MCACES Year 3 and then ODMDS years 2029 & 2032	$ 2,628,300		21.47%	$ 564,204	$ 3,192,504.16
2	12 02 HARBORS	Hopper Dredge ENTRANCE to Nearshore - MCACES Years 2 and 3	$ 8,281,500		21.47%	$ 1,777,749	$ 10,059,248.64
3	12 02 HARBORS	Pipeline Dredge ENTRANCE to Beaches -- MCACES Year 1	$ 12,984,000		32.73%	$ 4,250,305	$ 17,234,304.53
4	12 02 HARBORS	Hopper Dredge Outer Entrance to ODMDS -- MCACES Year 3	$ 1,479,000		21.47%	$ 317,490	$ 1,796,489.61
5	12 02 HARBORS	Physical Monitoring and Surveys (3-years)	$ 1,292,888		7.21%	$ 93,250	$ 1,386,137.73
12		**Remaining Construction Items**	$ -	*0.0%*			
13	30 PLANNING, ENGINEERING, AND DESIGN	**Planning, Engineering, & Design**	$ 761,185		9.22%	$ 70,167	$ 831,351.86
14	31 CONSTRUCTION MANAGEMENT	**Construction Management**	$ 642,957		9.22%	$ 59,268	$ 702,225.47

Totals				
Total Construction Estimate	$ 26,665,688	26.26%	$ 7,002,997	$ 33,668,685
Total Planning, Engineering & Design	$ 761,185	9.22%	$ 70,167	$ 831,352
Total Construction Management	$ 642,957	9.22%	$ 59,268	$ 702,225
Total	$ 28,069,830	25.41%	$ 7,132,432	$ 35,202,262

Overall USE 26%

Abbreviated Risk Analysis

Morehead City Harbor - DMMP - Morehead City, NC
Feasibility (Recommended Plan)

Meeting Date: 30-Oct-12

PDT Members

Note: PDT involvement is commensurate with project size and involvement.

Project Management:	Bob Keistler
Planner:	
Study Manager:	Jenny Owens
Contracting:	
Real Estate:	
Relocations:	
Economics:	Chris Graham
Engineering & Design:	Lee Danley
Technical Lead:	
Geotech:	Ben Lackey
Hydrology:	Kevin Conner
Civil:	Jimmy Hargrove
Environmental:	Hugh Heine
Cultural Resources:	John Mayer
Electrical:	
Cost Engineering:	John Caldwell
Construction:	
Operations:	

Morehead City Harbor - DMMP - Morehead City, NC
Feasibility (Recommended Plan)
Abbreviated Risk Analysis

Meeting Date: 30 Oct 2012

Risk Level

	Negligible	Marginal	Significant	Critical	Crisis
Very Likely	2	3	4	5	5
Likely	1	2	3	4	5
Possible	0	1	2	3	4
Unlikely	0	0	1	2	3

Risk Element	Potential Risk Areas	Concerns Pull Down Tab (ENABLE MACROS THRU TRUST CENTER) (Choose ALL that apply)	Concerns	PDT Discussions & Conclusions (Include logic & justification for choice of Likelihood & Impact)	Likelihood	Impact	Risk Level
Project Scope Growth							
						Max Potential Cost Growth	40%
PS-1	Pipeline Dredge INNER to Brandt Island --- MCACES Year 3 and then ODMDS years 2029 & 2032	• Potential for scope growth, added features and quantities?	INNER HARBOR • Potential for scope growth, added features and quantities? FULL FUNDING may not be provided ANNUALLY for dredging all quantities needed to be removed.	If funding is not sufficient and quantities have to be reduced, then smaller quantities may cause increase in unit pricing if bank heights are not optimal.	Likely	Negligible	1
PS-2	Hopper Dredge ENTRANCE to Nearshore - MCACES Years 2 and 3	• Project accomplish intent?	ENTRANCE CHANNEL SAME AS PS-1	Smaller quantities may cause increase in unit pricing if bank heights are not optimal. NEW NEARSHORE disposal areas give some flexibility options - HOWEVER, this could also leave more material in channel that PIPELINE TO BEACHES would have to dredge during PS-3.	Likely	Negligible	1
PS-3	Pipeline Dredge ENTRANCE to Beaches -- MCACES Year 1	• Project accomplish intent?	ENTRANCE CHANNEL SAME AS PS-1	Pipeline contract quantities TO THE BEACH may need to be larger than normal 3 year cycle rotation because material was not removed in other years (PS-2).	Likely	Significant	3
PS-4	Hopper Dredge Outer Entrance to ODMDS -- MCACES Year 3	• Project accomplish intent?	OUTER ENTRANCE SAME AS PS-1	OUTER BAR is not impacted as much as significant a change in scope and could be done with other HOPPER contracts. But still anticipate unit price increase.	Likely	Negligible	1
PS-5	Physical Monitoring and Surveys (3-years)	• Project accomplish intent?	NO CONCERNS - Scope and costs are well defined.		Possible	Negligible	0
PS-6	Planning, Engineering, & Design	• Potential for scope growth, added features and quantities?	NO CONCERNS - Requirments for PED for O&M dredging are based on historical data and well defined costs.		Unlikely	Negligible	0
PS-7	Construction Management	• Potential for scope growth, added features and quantities?	NO CONCERNS - Requirments for S&A for O&M dredging are based on historical data and well defined costs.		Unlikely	Negligible	0

Acquisition Strategy

						Max Potential Cost Growth	30%
Risk Element	Potential Risk Areas	Concerns Pull Down Tab (ENABLE MACROS THRU TRUST CENTER) (Choose ALL that apply)	Concerns	PDT Discussions & Conclusions (Include logic & justification for choice of Likelihood & Impact)	Likelihood	Impact	Risk Level
AS-1	Pipeline Dredge INNER to Brandt Island --- MCACES Year 3 and then ODMDS years 2029 & 2032	• Limited bid competition anticipated?	• Limited BID COMPETITIONS anticipated? The sooner the bid opening acquisition the more competition there will be for dredging.	For best competition and timing of bids to be out early in the dredge year (beginning NOVEMBER 15). BID OPENING should not be later than OCTOBER 15 If not early, bids could possibly be significantly higher.	Possible	Significant	2
AS-2	Hopper Dredge ENTRANCE to Nearshore - MCACES Years 2 and 3	• Limited bid competition anticipated?	SAME CONCERNS AS RISK ELEMENT AS-1	SAME CONCLUSIONS RISK ELEMENT AS-1	Possible	Significant	2
AS-3	Pipeline Dredge ENTRANCE to Beaches -- MCACES Year 1	• Limited bid competition anticipated?	SAME CONCERNS AS RISK ELEMENT AS-1 • Limited bid competition anticipated?	SAME CONCLUSIONS RISK ELEMENT AS-1	Possible	Significant	2
AS-4	Hopper Dredge Outer Entrance to ODMDS -- MCACES Year 3	• Limited bid competition anticipated?	SAME CONCERNS AS RISK ELEMENT AS-1 • Limited bid competition anticipated?	SAME CONCLUSIONS RISK ELEMENT AS-1	Possible	Significant	2
AS-5	Physical Monitoring and Surveys (3-years)	• Limited bid competition anticipated?	Additional -Cultural resource investigations may be necessary for PIPELINE DISCHARGE directly into nearshore disposal areas. • Limited bid competition anticipated?	Contract acquisition for surveys may require additional investigations for cultural resources in nearshore disposal areas.	Possible	Significant	2
AS-6	Planning, Engineering, & Design	• Limited bid competition anticipated?	NO CONCERNS - Requirments for PED for O&M dredging are based on historical data and well defined costs. • Limited bid competition anticipated?		Unlikely	Negligible	0
AS-7	Construction Management	• Limited bid competition anticipated?	NO CONCERNS - Requirments for S&A for O&M dredging are based on historical data and well defined costs. • Limited bid competition anticipated?		Unlikely	Negligible	0

Construction Elements							
						Max Potential Cost Growth	15%
Risk Element	Potential Risk Areas	Concerns Pull Down Tab (ENABLE MACROS THRU TRUST CENTER) (Choose ALL that apply)	Concerns	PDT Discussions & Conclusions (Include logic & justification for choice of Likelihood & Impact)	Likelihood	Impact	Risk Level
CE-1	Pipeline Dredge INNER to Brandt Island --- MCACES Year 3 and then ODMDS years 2029 & 2032	• Accelerated schedule or harsh weather schedule?	• Accelerated schedule or harsh weather schedule? • Unique construction methods?	EFFECTIVE WORK TIME % used in CEDEP. Safe harbor is not considered as significant costs since this work is for INNER HARBOR but in years when bucket and barge 2029 & 2032 there may be some additional costs for occasionally not being able to transport offshore due to weather. - - - - Only unique construction methods may be string bean shoals or areas where dredge is more inefficient than historical average.	Likely	Negligible	1
CE-2	Hopper Dredge ENTRANCE to Nearshore - MCACES Years 2 and 3	• Accelerated schedule or harsh weather schedule?	• Accelerated schedule or harsh weather schedule? • Unique construction methods?	Historical weather was considered in the EFFECTIVE WORK TIME % USED IN CEDEP. Safe harbor is not considered as significant since BY HOPPER isn't hard to move in & out of safe HARBOR. - - Only unique construction methods may be string bean shoals or areas where dredge is more inefficient than historical average.	Likely	Negligible	1
CE-3	Pipeline Dredge ENTRANCE to Beaches -- MCACES Year 1	• Accelerated schedule or harsh weather schedule?	• Accelerated schedule or harsh weather schedule? • Unique construction methods?	Historical weather was considered in the EFFECTIVE WORK TIME % USED IN CEDEP. Safe harbor is not considered as significant since HARBOR is so close by but it may be likely. Only unique construction methods may be string bean shoals or areas where dredge is more inefficient than historical average.	Likely	Negligible	1
CE-4	Hopper Dredge Outer Entrance to ODMDS -- MCACES Year 3	• Accelerated schedule or harsh weather schedule?	• Accelerated schedule or harsh weather schedule? • Unique construction methods?	Historical weather was considered in the EFFECTIVE WORK TIME % USED IN CEDEP. Safe harbor is not considered as significant since BY HOPPER isn't hard to move in & out of safe HARBOR. - - Only unique construction methods may be string bean shoals or areas where dredge is more inefficient than historical average.	Likely	Negligible	1
CE-5	Physical Monitoring and Surveys (3-years)	• Accelerated schedule or harsh weather schedule?	NO CONCERNS - Requirments for monitoring and surveys for O&M dredging are based on historical data and well defined costs.		Unlikely	Negligible	0
CE-6	Planning, Engineering, & Design	• Accelerated schedule or harsh weather schedule?	NO CONCERNS - Requirments for PED for O&M dredging are based on historical data and well defined costs.		Unlikely	Negligible	0
CE-7	Construction Management	• Accelerated schedule or harsh weather schedule?	NO CONCERNS - Requirments for S&A for O&M dredging are based on historical data and well defined costs.		Unlikely	Negligible	0

Quantities for Current Scope							
						Max Potential Cost Growth	20%
Risk Element	Potential Risk Areas	Concerns Pull Down Tab (ENABLE MACROS THRU TRUST CENTER) (Choose ALL that apply)	Concerns	PDT Discussions & Conclusions (Include logic & justification for choice of Likelihood & Impact)	Likelihood	Impact	Risk Level
Q-1	Pipeline Dredge INNER to Brandt Island --- MCACES Year 3 and then ODMDS years 2029 & 2032	• Appropriate methods applied to calculate quantities?	• Sufficient investigations to develop quantities? Historical shoaling and quantities were evaluated for quantity expectations. • Appropriate methods applied to calculate quantities? Many alternatives considered in quantity development.	Quantities have been monitored for many years and was consistent including smaller storm patterns that may cause some changes in quantities. Major named storms or Hurricanes are historically addressed under separate funding and should not be considered for this risk analysis.	Likely	Negligible	1
Q-2	Hopper Dredge ENTRANCE to Nearshore - MCACES Years 2 and 3	• Appropriate methods applied to calculate quantities?	SAME AS Q-1 • Appropriate methods applied to calculate quantities?	SAME CONCLUSIONS AS Q-1	Likely	Negligible	1
Q-3	Pipeline Dredge ENTRANCE to Beaches -- MCACES Year 1	• Appropriate methods applied to calculate quantities?	SAME AS Q-1 • Appropriate methods applied to calculate quantities?	Quantity changes for pipeline dredging may be more significant in cost increase than quantities in years for nearshore - above Q-2.	Likely	Significant	3
Q-4	Hopper Dredge Outer Entrance to ODMDS -- MCACES Year 3	• Appropriate methods applied to calculate quantities?	SAME AS Q-1 • Appropriate methods applied to calculate quantities?	SAME CONCLUSIONS AS Q-1	Likely	Negligible	1
Q-5	Physical Monitoring and Surveys (3-years)	• Appropriate methods applied to calculate quantities?	Scope and costs may some repetitive evaluations to finalize quantity shoaling because of storms and DMMP dredge performance. • Appropriate methods applied to calculate quantities?	It is possible that additional monitoring and surveys could be significant increase because of storm events AND require more surveys to evaluate sholaing.	Possible	Significant	2
Q-6	Planning, Engineering, & Design	• Level of confidence based on design and assumptions?	NO CONCERNS - Requirments for PED for O&M dredging are based on historical data and well defined costs.		Unlikely	Negligible	0
Q-7	Construction Management	• Level of confidence based on design and assumptions?	NO CONCERNS - Requirments for S&A for O&M dredging are based on historical data and well defined costs.		Unlikely	Negligible	0

Specialty Fabrication or Equipment							
					Max Potential Cost Growth		50%
Risk Element	Potential Risk Areas	Concerns Pull Down Tab (ENABLE MACROS THRU TRUST CENTER) (Choose ALL that apply)	Concerns	PDT Discussions & Conclusions (Include logic & justification for choice of Likelihood & Impact)	Likelihood	Impact	Risk Level
FE-1	Pipeline Dredge INNER to Brandt Island --- MCACES Year 3 and then ODMDS years 2029 & 2032	• Risk of specialty equipment functioning first time? Test?	NO CONCERNS FOR FABRICATION OR EQUIPMENT		Unlikely	Negligible	0
FE-2	Hopper Dredge ENTRANCE to Nearshore - MCACES Years 2 and 3	• Unusual parts, material or equipment manufactured or installed?	NO CONCERNS FOR FABRICATION OR EQUIPMENT		Unlikely	Negligible	0
FE-3	Pipeline Dredge ENTRANCE to Beaches -- MCACES Year 1	• Unusual parts, material or equipment manufactured or installed?	NO CONCERNS FOR FABRICATION OR EQUIPMENT		Unlikely	Negligible	0
FE-4	Hopper Dredge Outer Entrance to ODMDS -- MCACES Year 3	• Unusual parts, material or equipment manufactured or installed?	NO CONCERNS FOR FABRICATION OR EQUIPMENT		Unlikely	Negligible	0
FE-5	Physical Monitoring and Surveys (3-years)	• Unusual parts, material or equipment manufactured or installed?	NO CONCERNS FOR FABRICATION OR EQUIPMENT		Unlikely	Negligible	0
FE-6	Planning, Engineering, & Design	• Unusual parts, material or equipment manufactured or installed?	NO CONCERNS FOR FABRICATION OR EQUIPMENT		Unlikely	Negligible	0
FE-7	Construction Management	• Unusual parts, material or equipment manufactured or installed?	NO CONCERNS FOR FABRICATION OR EQUIPMENT		Unlikely	Negligible	0

Cost Estimate Assumptions

						Max Potential Cost Growth	25%
Risk Element	Potential Risk Areas	Concerns Pull Down Tab (ENABLE MACROS THRU TRUST CENTER) (Choose ALL that apply)	Concerns	PDT Discussions & Conclusions (Include logic & justification for choice of Likelihood & Impact)	Likelihood	Impact	Risk Level
CT-1	Pipeline Dredge INNER to Brandt Island --- MCACES Year 3 and then ODMDS years 2029 & 2032	• Assumptions regarding crew, productivity, overtime?	• Assumptions regarding crew, productivity, overtime?	Estimate development and assumptions are consistent with historical O&M dredging methods, factors, and bids. PDT doesn't expect any major differences in the future. Cost methods similar to historic still could be neglible cost growth.	Likely	Negligible	1
CT-2	Hopper Dredge ENTRANCE to Nearshore - MCACES Years 2 and 3	• Assumptions regarding crew, productivity, overtime?	SAME AS CT-1 CONCERNS	SAME AS CT-1	Likely	Negligible	1
CT-3	Pipeline Dredge ENTRANCE to Beaches -- MCACES Year 1	• Assumptions regarding crew, productivity, overtime?	SAME AS CT-1 CONCERNS	SAME AS CT-1	Likely	Negligible	1
							FALSE
							FALSE
CT-6	Planning, Engineering, & Design	• Reliability and number of key quotes?	Requirments for PED for O&M dredging are based on historical data and well defined costs.	Although costs well defined, it is possible for marginal increases.	Possible	Marginal	1
CT-7	Construction Management	• Reliability and number of key quotes?	Requirments for S&A for O&M dredging are based on historical data and well defined costs.	Although costs well defined, it is possible for marginal increases.	Possible	Marginal	1

External Project Risks							
						Max Potential Cost Growth	20%
Risk Element	Potential Risk Areas	Concerns Pull Down Tab (ENABLE MACROS THRU TRUST CENTER) (Choose ALL that apply)	Concerns	PDT Discussions & Conclusions (Include logic & justification for choice of Likelihood & Impact)	Likelihood	Impact	Risk Level
EX-1	Pipeline Dredge INNER to Brandt Island --- MCACES Year 3 and then ODMDS years 2029 & 2032	• Unanticipated inflations in fuel, key materials?	• Potential for severe adverse weather? Covered by emergency funding. • Political influences, lack of support, obstacles? Funding under SCOPE OF WORK elements of RISK. • Unanticipated inflations in fuel, key materials? FUEL is the biggest item for fluctuation as high as $4.00/gallon historically. • Potential for market volatility impacting competition, pricing? Competition addressed in ACQUISITION STRATEGY which carries a greater weight overall.	Fuel fluctuations will always be concern and could effect range of pricing. CEDEP estimates could vary from current estimate of $3.00/gallon used to $4.00/gallon which is considered significant.	Likely	Significant	3
EX-2	Hopper Dredge ENTRANCE to Nearshore - MCACES Years 2 and 3	• Unanticipated inflations in fuel, key materials?	SAME CONCERNS AS EX-1 • Unanticipated inflations in fuel, key materials?	SAME CONCLUSIONS AS EX-1	Likely	Significant	3
EX-3	Pipeline Dredge ENTRANCE to Beaches -- MCACES Year 1	• Unanticipated inflations in fuel, key materials?	SAME CONCERNS AS EX-1 • Unanticipated inflations in fuel, key materials?	SAME CONCLUSIONS AS EX-1	Likely	Significant	3
							FALSE
							FALSE
EX-6	Planning, Engineering, &	• Political influences, lack of support, obstacles?	Requirments for PED for O&M dredging are based on historical data and well defined costs; however,	Engineering and Design Requirements for Environmental compliance could possibly change	Possible	Significant	2
EX-7	Construction Management	• Political influences, lack of support, obstacles?	based on historical data and well defined costs; however, future requirements for environmental	environmental compliance could possibly change and increase costs during construction.	Possible	Significant	2

Morehead City Harbor - DMMP - Morehead City, NC
Feasibility (Recommended Plan)
Abbreviated Risk Analysis

Typical Risk Elements	Pipeline Dredge INNER to Brandt Island ...	Hopper Dredge ENTRANCE to Nearsho...	Pipeline Dredge ENTRANCE to Beaches ...	Hopper Dredge Outer Entrance to ODMDS MCACES...	Physical Monitoring and Surveys (3...	Planning, Engineering, & Design	Construction Management
	Potential Risk Areas						
Project Scope Growth	1	1	3	1	-	-	-
Acquisition Strategy	2	2	2	2	2	-	-
Construction Elements	1	1	1	1	-	-	-
Quantities for Current Scope	1	1	3	1	2	-	-
Specialty Fabrication or Equipment	-	-	-	-	-	-	-
Cost Estimate Assumptions	1	1	1	1	-	1	1
External Project Risks	3	3	3	3	-	2	2

APPENDIX H

EVALUATION OF SECTION 404(b)(1)
(PUBLIC LAW 95-217) GUIDELINES 40 CFR 230

An evaluation of the placement of dredge and/or fill material into waters of the United States includes the standard form.

MOREHEAD CITY HARBOR DMMP
CARTERET COUNTY, NORTH CAROLINA

Preliminary Evaluation of Section 404 (b) (1) Guidelines 40 CFR 230

This evaluation covers the placement of all fill material into waters and wetlands of the United States required for the maintenance of the Morehead City Harbor, Carteret County, North Carolina. The proposed DMMP plans to place harbor maintenance sediment in the upland diked facility on Brandt Island (includes a return of effluent pipeline to the inner harbor), the ocean beaches and nearshore areas off Bogue and Shackleford Banks, and the US EPA approved ODMDS. Please note, prior to any construction the required Section 401 Water Quality Certificates from the NC Division of Water Quality will be obtained for the Morehead City Harbor DMMP and all conditions/restrictions will be complied with.

Section 404 Public Notice No. CESAW-TS-PE-

		Preliminary 1/	Final 2/
1.	Review of Compliance (230.10(a)-(d)) A review of the NEPA Document indicates that:		
a.	The discharge represents the least environmentally damaging practicable alternative and if in a special aquatic site, the activity associated with the discharge must have direct access or proximity to, or be located in the aquatic ecosystem to fulfill its basic purpose (if no, see section 2 and NEPA document);	YES ☒ NO☐	YES ☐ NO☐
b.	The activity does not: 1) violate applicable State water quality standards or effluent standards prohibited under Section 307 of the CWA; 2) jeopardize the existence of federally listed endangered or threatened species or their habitat; and 3) violate requirements of any federally designated marine sanctuary (if no, see section 2b and check responses from resource and water quality certifying agencies);	YES☒ NO☐*	YES☐ NO☐
c.	The activity will not cause or contribute to significant degradation of waters of the U.S. including adverse effects on human health, life stages of organisms dependent on the aquatic ecosystem, ecosystem diversity, productivity and stability, and recreational, aesthetic, and economic values (if no, see section 2);	YES☒ NO☐	YES☐ NO☐
d	Appropriate and practicable steps have been taken to minimize potential adverse		

impacts of the discharge on the aquatic
ecosystem (if no, see section 5). YES☒ NO☐* YES☐ NO☐

Proceed to Section 2

*, 1, 2/ See page 6.

2. Technical Evaluation Factors (Subparts C-F) **N/A** **Not Significant** **Significant**

a. Physical and Chemical Characteristics of the Aquatic Ecosystem (Subpart C)

	N/A	Not Significant	Significant
(1) Substrate impacts.		X	
(2) Suspended particulates/turbidity impacts		X	
(3) Water column impacts.		X	
(4) Alteration of current patterns			
and water circulation.		X	
(5) Alteration of normal water			
fluctuations/hydroperiod.		X	
(6) Alteration of salinity gradients.	NA	X	

b. Biological Characteristics of the Aquatic Ecosystem (Subpart D)

	N/A	Not Significant	Significant
(1) Effect on threatened/endangered		X	
species and their habitat.		X	
(2) Effect on the aquatic food web.		X	
(3) Effect on other wildlife (mammals			
birds, reptiles, and amphibians).		X	

c Special Aquatic Sites (Subpart E)

	N/A	Not Significant	Significant
(1) Sanctuaries and refuges.	NA		
(2) Wetlands.	NA		
(3) Mud flats.	NA		
(4) Vegetated shallows.	NA		
(5) Coral reefs.	NA		
(6) Riffle and pool complexes.	NA		

d. Human Use Characteristics (Subpart F)

	N/A	Not Significant	Significant
(1) Effects on municipal and private water supplies.	NA		
(2) Recreational and commercial fisheries impacts		X	
(3) Effects on water-related recreation.		X	
(4) Aesthetic impacts.		X	
(5) Effects on parks, national and historical monuments, national seashores, wilderness areas,		X	
research sites, and similar preserves.		X	

Remarks: Where a check is placed under the significant category, preparer add explanation below.

Proceed to Section 3

*See page 6.

3. Evaluation of Dredged or Fill Material (Subpart G) 3/

a. The following information has been considered in evaluating the biological availability of possible contaminants in dredged or fill material. (Check only those appropriate.)

(1) Physical characteristics	☒
(2) Hydrography in relation to known or anticipated sources of contaminants	☒
(3) Results from previous testing of the material or similar material in the vicinity of the project	☒
(4) Known, significant sources of persistent pesticides from land runoff or percolation	☐
(5) Spill records for petroleum products or designated (Section 311 of CWA) hazardous substances	☐
(6) Other public records of significant introduction of contaminants from industries, municipalities, or other sources	☒
(7) Known existence of substantial material deposits of substances which could be released in harmful quantities to the aquatic environment by man-induced discharge activities	☐
(8) Other sources (specify).	☐

List appropriate references.

Reference: Draft Environmental Impact Statement, Morehead City Harbor DMMP, Carteret County, North Carolina, dated .

b. An evaluation of the appropriate information in 3a above indicates that there is reason to believe the proposed dredge or fill material is not a carrier of contaminants, or that levels of contaminants are substantively similar at extraction and disposal sites and not likely to result in degradation of the disposal site.** YES ☒ NO☐*

Proceed to Section 4

*, 3/, see page 6.

4. Disposal Site Determinations (230.11(f)).

a. The following factors as appropriate, have been considered in evaluating the disposal site.

(1) Depth of water at disposal site. ☒

(2) Current velocity, direction, and variability at disposal site ☒

(3) Degree of turbulence. ☒

(4) Water column stratification ☒

(5) Discharge vessel speed and direction ☒

(6) Rate of discharge ☒

(7) Dredged material characteristics (constituents, amount and type of material, settling velocities). ☒

(8) Number of discharges per unit of time. ☒

(9) Other factors affecting rates and patterns of mixing (specify)

List appropriate references.

Reference: .. Draft Environmental Impact Statement, Morehead City Harbor DMMP, Carteret County, North Carolina

b. An evaluation of the appropriate factors in 4a above indicates that the disposal site and/or size of mixing zone are acceptable. YES ☒ NO ☐*

5. Actions to Minimize Adverse Effects (Subpart H).

All appropriate and practicable steps have been taken, through application of recommendations of 230.70-230.77, to ensure minimal adverse effects of the proposed discharge. List actions taken. YES ☒ NO ☐*

See DEIS.

Return to section 1 for final stage of compliance review. See also note 3/, page 3.
*See page 6.

6. Factual Determinations (230.11).

A review of appropriate information as identified in items 2-5 above indicates that there is minimal potential for short- or long-term environmental effects of the proposed discharge as related to:

a. Physical substrate at the disposal site (review sections 2a, 3, 4, and 5). YES ☒ NO ☐*

b. Water circulation, fluctuation, and salinity (review sections 2a, 3, 4, and 5). YES ☒ NO ☐*

c. Suspended particulates/turbidity (review sections 2a, 3, 4, and 5). YES ☒ NO ☐*

d Contaminant availability (review sections 2a, 3, and 4). YES ☒ NO ☐*

e. Aquatic ecosystem structure and function (review sections 2b and c, 3, and 5). YES ☒ NO ☐*

f. Disposal site (review sections 2, 4, and 5). YES ☒ NO ☐*

g. Cumulative impact on the aquatic ecosystem. YES ☒ NO ☐*

h. Secondary impacts on the aquatic ecosystem. YES ☒ NO ☐*

7. Findings.

a.The proposed disposal site for discharge of dredged or fill material complies with the Section 404(b)(1) guidelines. . . . .☒

b.The proposed disposal site for discharge of dredged or fill material complies with the Section 404(b)(1) guidelines with the inclusion of the following conditions:. . . . .☐

c.The proposed disposal site for discharge of dredged or fill material does not comply with the Section 404(b)(1) guidelines for the following reasons(s):

(1)There is a less damaging practicable alternative . . . . ☐

(2)The proposed discharge will result in significant degradation of the aquatic ecosystem . . . .☐

*See page 6.

(3) The proposed discharge does not include all practicable and appropriate measures to minimize potential harm to the aquatic ecosystem. ☐

8.

____

Steven A. Baker
Colonel, U.S. Army
District Engineer

Date: ____________________

*A negative, significant, or unknown response indicates that the permit application may not be in compliance with the Section 404(b)(1) Guidelines.

1/ Negative responses to three or more of the compliance criteria at this stage indicate that the proposed projects may not be evaluated using this "short form procedure." Care should be used in assessing pertinent portions of the technical information of items 2 a-d, before completing the final review of compliance.

2/ Negative response to one of the compliance criteria at this stage indicates that the proposed project does not comply with the guidelines. If the economics of navigation and anchorage of Section 404(b)(2) are to be evaluated in the decision-making process, the "short form evaluation process is inappropriate."

3/ If the dredged or fill material cannot be excluded from individual testing, the "short-form" evaluation process is inappropriate.

APPENDIX I

ASSESSMENT OF POTENTIAL LARVAL ENTRAINMENT MORTALITY DUE TO HYDRAULIC DREDGING OF BEAUFORT INLET

Assessment of potential larval entrainment mortality due to hydraulic dredging of Beaufort Inlet

Lawrence R. Settle
NOAA/NOS
National Centers for Coastal Ocean Science
Center for Coastal Fisheries and Habitat Research
101 Pivers Island Road
Beaufort, NC 28516

The larval fish distribution, abundance, seasonality, transport and ingress at Beaufort Inlet has been extensively studied, particularly during the fall-winter period coinciding with the permitted dredging window (see references below). The concentration of fish larvae (all species combined) typically ranges from 0.5 to 5 larvae m^{-3}. The concentration (i.e. abundance) of larvae varies both spatially and temporally over a range of scales. It is therefore important to recognize that not all larvae in the inlet would be vulnerable to entrainment. Larvae are not equally distributed in the inlet as the flow has considerable asymmetry. During flood the bulk of the transport is on the eastern side of the inlet and most larvae enter on that side. Ebb flows containing larvae that were not retained in the estuary are strongest on the west side of the inlet. In addition, many larvae exhibit a vertical migration strategy that facilitates tidal stream transport. That is, larvae are up in the water column during flood and descend to near the bottom during ebb. Such behavior helps to prevent larvae from being flushed back out the inlet.

One can estimate the potential larval entrainment mortality due to hydraulic dredging of Beaufort Inlet using a simple mathematical model that incorporates the following:

C = concentration of larvae
= 0.5 to 5.0 larvae m^{-3}

M = proportion of larvae dying by natural causes every six hours
= 0.0125 (i.e. 5 % d^{-1}) to 0.025 (i.e. 10 % d^{-1})

V = volume of water entrained by dredge (24 h operation)
= 173,299 $m^3\ d^{-1}$ (USACE)

$\mathbf{P_s}$ = spring tidal prism
= 1.42 E8 m^3 (Jarrett, 1976)

$\mathbf{P_n}$ = neap tidal prism
= 1.32 E8 m^3 (Logan, 1995)

$\mathbf{P_b}$ = proportion of larvae in the bottom of the water column
= 0.1 to 1.0
$\mathbf{P_c}$ = proportion of larvae in the navigation channel
= 0.1 to 1.0

$\mathbf{P_r}$ = proportion of larvae retained inside to estuary during ebb phase
= 0.1 to 1.0

$\mathbf{E_s}$ = proportion of daily spring tidal volume entrained by dredge
= $V / 2\ P_s\ d^{-1}$
= 0.0006

E_n = proportion of daily neap tidal volume entrained by dredge
= $V / 2 P_n d^{-1}$
= 0.0007

L_s = initial number of larvae within a spring tidal prism
= $C * P_s$

L_n = initial number of larvae within a neap tidal prism
= $C * P_n$

K_{sf} = number of larvae entrained during a single spring tide flood phase
= $(L_s - (L_s * M * 2)) * P_b * P_c * E_s$

K_{se} = number of larvae entrained during a single spring tide ebb phase
= $(L_s - (L_s * M * 2) - K_{sf}) * P_b * P_c * P_r * E_s$

K_{nf} = number of larvae entrained during neap tide flood phase
=$(L_n - (L_n * M * 2)) * P_b * P_c * E_n$
K_{ne} = number of larvae entrained during neap tide ebb phase
= $(L_n - (L_n * M * 2)- K_{nf}) * P_b * P_c * P_r * E_n$

K_s = absolute larval entrainment mortality d^{-1} during spring tide
= $(K_{sf} + K_{se}) * 2$

Z_s = percent larval entrainment mortality d^{-1} during spring tide
= $(K_s/L_s*2)*100$

K_n = absolute larval entrainment mortality d^{-1} during neap tide
= $(K_{nf} + K_{ne}) * 2$
Z_n = percent larval entrainment mortality d^{-1} during neap tide
= $(K_n/L_n*2)*100$

Mortality due to entrainment was simulated 10,100 times for each level of natural mortality (i.e. 5% d^{-1} and 10% d^{-1}) during both spring and neap tidal conditions by systematically varying **C**, $\mathbf{P_b}$, $\mathbf{P_c}$, and $\mathbf{P_c}$ over the ranges outlined above using SAS Version 8.2 (SAS Institute Inc., Cary, NC). The results depicting the distribution of outcomes are shown below and include the minimum, maximum and mean impact levels as well as the 10%, 25%, 50% (median), 75% and 90% quantiles.

Natural mortality 10 % d^{-1} Natural mortality 5 % d^{-1}

	$\mathbf{K_s}$ No.	$\mathbf{Z_s}$ %	$\mathbf{K_n}$ No.	$\mathbf{Z_n}$ %	$\mathbf{K_s}$ No.	$\mathbf{Z_s}$ %	$\mathbf{K_n}$ No.	$\mathbf{Z_n}$ %
min	914	0.0006	991	0.0008	925	0.0007	1004	0.0008
max	1660902	0.1170	1801169	0.1365	1682195	0.1185	1824261	0.1382
mean	246426	0.0316	267246	0.0316	249585	0.0320	270672	0.0373
10 %	16282	0.0036	17658	0.0042	16490	0.0037	17884	0.0043
25 %	48845	0.0070	52973	0.0082	49471	0.0071	53651	0.0083
50 %	132906	0.0239	144136	0.0278	134610	0.0242	145984	0.0282
75 %	376763	0.0579	408595	0.0676	381594	0.0587	413833	0.0684
90 %	657882	0.0632	713472	0.0737	666316	0.0640	722619	0.0746

What is quite apparent is that both $\mathbf{Z_s}$ and $\mathbf{Z_n}$ (i.e. the percentage of the daily flux of larvae entrained) are very low regardless of larval concentration and the distribution of larvae within the channel. Under the worst-case scenario where the dredge operates 24 h d^{-1}, all larvae are in the navigation channel, on the bottom, and with poor retention in the estuary following flood stage, the maximum percentage entrained barely exceeds 0.1 % d^{-1}. Most of the simulated scenarios (see the 90 % quantiles) indicate the percent entrainment mortality to be less than 0.06 to 0.07 % d^{-1} with over half falling below 0.03 % d^{-1} (see 50 % quantile). The actual number of larvae entrained however, can range from as few as 914 up to over 1.8 million depending on the initial concentration of larvae within the tidal prism.
This simple analysis of the potential entrainment impacts to larvae could be further refined by stochastically varying the spatial and temporal concentration of larvae and their positions within the water column, but, based on the results presented here, such effort is not required to

achieve a useful first approximation of the level of impact to the resource. Because the estimated entrainment mortality, even under the worst-case scenario, is minimal (0.1 % d^{-1}), it seems reasonable to conclude that while any larvae that are entrained will certainly be killed, it is likely that the impact at the population-level would be insignificant.

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APPENDIX J

NMFS and USFWS
BIOLOGICAL ASSESSMENT (BA)
FOR
THREATENED AND ENDANGERED SPECIES

Morehead City Harbor
Draft Integrated DMMP and EIS,
Carteret County, North Carolina

BIOLOGICAL ASSESSMENT (BA)
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1.00 PROPOSED PROJECT

The proposed project is implementation of the proposed Dredged Material Management Plan for the Morehead City Harbor Federal Navigation Project. The proposed project is described in detail in the Morehead City Harbor Draft Integrated Dredged Material Management Plan (DMMP) and Environmental Impact Statement. Section 3.4.2 of the Draft Integrated DMMP and EIS fully describes the Proposed Action.

The U. S. Army Corps of Engineers (USACE), Wilmington District is responsible for the operation and maintenance of the federally-authorized Morehead City Harbor federal navigation channel. Engineering Regulation (ER) 1105-2-100 provides that a Dredged Material Management Plan (DMMP) be developed for federal navigation projects if a preliminary assessment does not indicate sufficient capacity to accommodate maintenance dredging for at least the next twenty years. The DMMP is a planning document that ensures that sufficient confined disposal facilities are available for at least the next 20 years and that maintenance dredging activities are performed in an environmentally acceptable manner, use sound engineering techniques, and are economically justified. The final product of this report will be an integrated DMMP and Environmental Impact Statement pursuant to the National Environmental Policy Act (NEPA). The DMMP addresses dredging needs, disposal capabilities, capacities of disposal areas, environmental compliance requirements, and potential for beneficial use of dredged material and indicators of continued economic justification. This DMMP will ensure sufficient disposal capacity for the 20-year period beginning in 2015 and extending through 2034. The EIS addresses the environmental impacts of implementing the DMMP.

The study area for the Morehead City Harbor DMMP includes the Morehead City Harbor navigation channels, the adjacent mainland area, the beaches of Bogue Banks and Shackleford Banks, the nearshore Atlantic Ocean off of Bogue Banks and Shackleford Banks, the Environmental Protection Agency (EPA) designated Morehead City Ocean Dredged Material Disposal Site (ODMDS), and the existing disposal sites of Brandt Island, Marsh Island and Radio Island.

The current Federal authorization for the Morehead City Harbor project consists of both deep draft and shallow draft channels. The deep draft portion of the project provides navigation channels from the deep water of the Atlantic Ocean to the North Carolina State Ports Authority (NCSPA) facilities. The shallow draft portion of the project provides for navigation channels from the waterfront docks at downtown Morehead City to the deep draft portion of the project. Dredging methods and disposal/placement options depend on the channel location and the *in situ* material characteristics. Based on these sediment characteristics and potential disposal locations, the deep draft channels or ranges are grouped into three sections; the Inner Harbor, the Outer Harbor, the Outer Entrance Channel.

The DMMP for the Morehead City Harbor project was developed using a consistent and logical procedure by which dredged material management measures have been identified, evaluated, screened, and recommended so that dredged material placement operations are conducted in a timely, environmentally sensitive, and cost-effective manner. Table J-1 summarizes the proposed DMMP.

DMMP Cycle	Harbor Section	Navigation Range Dredged	Dredge Plant	Proposed Disposal or Placement Location	Quantity Likely to be Dredged (cy)
Years 1, 4, 7, 10…	Outer	S. Range B, Cutoff, N. Range A to Sta. 110+00	30-inch pipeline	Fort Macon State Park/Atlantic Beach & Shackleford Banks	1,200,000
Years 2, 5,8,11…	Outer	S. Range C-N. Range B	hopper	Nearshore West & East	346,000
	Outer	S. Range B, Cutoff, N. Range A to Sta. 117+00	hopper	Nearshore West & East	650,000
Years 3,6,9,12…	Inner	Northwest Leg, West Leg 1 & East Leg	18-inch pipeline	Brandt Island or ODMDS (Bucket & Barge)	362,000
	Inner	West Leg 2 & N. Range C	18-inch pipeline	Brandt Island or ODMDS (Bucket & Barge)	152,000
	Outer	S. Range B, Cutoff, N. Range A to Sta. 117+00	hopper	Nearshore West & East	810,000
	Outer Entrance Channel	S. Range A, Sta. 117+00 out	hopper	ODMDS	344,000

Table J-1. Summary of the proposed Morehead City Harbor DMMP

Approximately 1 million cubic yards of dredged material are removed from the Morehead City Harbor annually. Current maintenance disposal practices, without modification, result in the need for “new” or expanded disposal sites or modified disposal options, including beneficial uses, by 2028. The proposed DMMP provides virtually unlimited disposal capacity for the Morehead City Harbor navigation project by recommending the following: continued use of Brandt

Island without expansion, disposal of coarse-grained material on the beaches of Fort Macon State Park, Atlantic Beach, and Shackleford Banks, expansion of the Nearshore West placement area, a new Nearshore East placement area and continued use of the EPA designated ODMDS. The proposed DMMP will provide more than adequate disposal capacity to maintain the Morehead City Harbor navigation project to the fully authorized dimensions for at least the next 20 years.

Beach disposal Alternatives on Bogue Banks and Shackleford Banks. Recommendations for future beach disposal operations along Bogue Banks are based on the volumetric losses within the area of Atlantic Beach and Fort Macon. It is recommended that future beach disposal operations place material primarily between Fort Macon and the town limits of Atlantic Beach as the base location. The quantity and location of future placements should be sufficient to ameliorate losses that have occurred between beach disposal operations and would be based on changes observed through the monitoring program. Figure J-1 displays the potential area designated for disposal of beach quality sand on Shackleford Banks.

The DMMP includes disposal of place suitable dredged sediment on approximately 3.65 miles of beach on Shackleford Banks (see Figure J-1). The area of possible impact on the Shackleford beach is from about the toe of the existing dune to the -24 foot depth of closure. The existing frontal dune on Shackleford Banks will not be impacted. The sediment placed below or waterward of the base of the existing frontal dune may range in height from about 6 feet NAVD and up to approximately 150 foot wide within the Shackleford Banks disposal area. Figure 4-2 in the DMMP/EIS shows the typical beach cross section of the proposed sediment berm in relationship to the existing frontal dune on Shackleford Banks.

For each dredge disposal occurrence (on average once every three years) on Shackleford Beach, only about a third to a half of the 3.65 mile disposal area on Shackelford Banks would be impacted with disposal of harbor sediment. After each beach disposal event (once every three years), the next occurrence would be located in another portion of the disposal area. The USACE, in coordination with the NPS would alternate disposal areas within the 3.65 mile long beach disposal area on Shackleford Banks so as not to impact the same disposal area time after time.

In several areas along the ocean beach strand from the spit to the start of the beach disposal location, there is no “dry” beach and the ocean waters come up to the base of the existing frontal dune during high tide. This means that in several areas, the mean high water (MHW) contour comes up to the base of the existing dune. The dredge contractor will not be allowed to impact the existing frontal dune along the ocean strand from the spit to the disposal area on Shackleford Banks. All beach equipment (dozers, pipeline sections, etc.) will be walked during low tide along the beach strand to the disposal site. This also means that no dredge pipeline from the dredge to the disposal area will be aligned along the ocean beach strand from the spit to the disposal area on Shackleford Banks. The end of the dredge pipeline will be submerged offshore from the dredge working in the harbor channels to the disposal site on Shackleford Banks. Once the end of the dredge pipeline emerges onshore within the sediment berm disposal site, the contractor will set up the dump shack, fencing, light stands and stockpile additional shore pipe within the constructed upland berm area (waterward of the existing frontal dune). Again the existing frontal dune will not be adversely impacted by the contractor's equipment on Shackleford Banks.

The NPS has the option to decline disposal of sand on Shackleford Banks during the life of the DMMP. Prior to any disposal activities on Shackleford Banks, a "Special Use Permit (SUP)" will be obtained from the NPS. The SUP will be obtained prior to start of construction and will contain conditions and restrictions that the contractor must meet. Before the contractor mobilizes their equipment to Shackleford Banks, the USACE, its contractor and the NPS will also meet to discuss all issues and decide on a work plan to ensure that there are no adverse impacts to Shackleford Banks.

Figure J-1. Proposed Shackleford Banks Beach disposal Area

2.00 PRIOR COORDINATION

Potential impacts on listed species have also been addressed previously for the project area. In May 2003, the USACE prepared a BA for the Morehead City Harbor Section 933 which authorized the disposal of maintenance dredged material from the existing Federal navigation channels onto the beaches of Bogue Banks from Fort Macon State Park to Indian Beach/Salter Path. The USFWS provided the USACE with a Biological Opinion (BO) dated July 22, 2003, which authorized the Section 933 project contingent on the USACE's compliance with all reasonable and prudent measures and the terms and conditions of the BO. NMFS indicated that additional consultation would not be required if the Section 933 project complied with the terms and conditions of the NMFS Regional Biological Opinion of September 27, 1997.

On 18 September 2008, the USACE provided NMFS with a revised Draft South Atlantic Regional Biological Assessment (SARBA). The USACE' SARBA would authorize the following activities: "*Dredging activities in the coastal waters, navigation channels (including designated Ocean Dredged Material Disposal Sites (ODMDS)), and sand mining areas in the South Atlantic Ocean from North Carolina/Virginia Border through and including Key West, Florida and the Islands of Puerto Rico and the U.S. Virgin Islands (USVI)*". Once NMFS provides the USACE with their Biological Opinion, any new conditions or restrictions would supersede the NMFS Biological Opinion dated September 25, 1997. Hopper dredging within the Morehead City Harbor would comply with any new conditions and/or restrictions found within the new NMFS BO.

The Finding of No Significant Impact (FONSI) for the Morehead City Interim Operations Plan (IOP) was approved on June 2009 (USACE 2009). The analysis of project impacts for the IOP resulted in a determination of "may affect, but not likely to adversely affect" threatened or endangered species as a result of implementation of the proposed project components. By letter dated April 13, 2009, the USFWS concurred with this determination, provided that reasonable and prudent measures and the terms and conditions of the July 22, 2003 Biological Opinion are met. By implementation of the Regional Biological Opinion of September 27, 1997 terms and conditions, for project implementation, by letter dated May 8, 2009 the NOAA, National Marine Fisheries Service found that additional consultation would not be required.

Dredging and disposal methods associated with the proposed action are similar to current maintenance dredging methods described in these previously coordinated documents.

3.0 SPECIES CONSIDERED UNDER THIS ASSESSMENT

Updated lists of threatened and endangered (T&E) species for the project area were obtained from NMFS (Southeast Regional Office, St. Petersburg, FL) and the

USFWS (Field Office, Raleigh, NC). These were combined to develop the following composite list in Table J-2, which includes T&E species that could be present in the area based upon their geographic range. However, the actual occurrence of a species in the area would depend upon the availability of suitable habitat, the season of the year relative to a species' temperature tolerance and migratory habits, and other factors.

Table J-2. Threatened and Endangered Species Potentially Present in Carteret County, NC

Species Common Names	Scientific Name	Federal Status
Vertebrates		
American alligator	*Alligator mississippiensis*	T(S/A)
Eastern cougar	*Felis concolor couguar*	Endangered*****
North Atlantic Right whale	*Eubaleana glacialis*	Endangered
Blue Whale	*Balaenoptera musculus*	Endangered
Sei whale	*Balaenoptera borealis*	Endangered
Sperm whale	*Physeter macrocephalus*	Endangered
Finback whale	*Balaenoptera physalus*	Endangered
Humpback whale	*Megaptera novaeangliae*	Endangered
Green sea turtle	*Chelonia mydas*	Threatened[1]
Hawksbill turtle	*Eretmochelys imbricata*	Endangered
Kemp's ridley sea turtle	*Lepidochelys kempii*	Endangered
Leatherback sea turtle	*Dermochelys coriacea*	Endangered
Loggerhead sea turtle	*Caretta caretta*	Threatened
West Indian Manatee	*Trichechus manatus*	Endangered
Piping Plover	*Charadrius melodus*	Threatened
Red-cockaded woodpecker	*Picoides borealis*	Endangered
Roseate tern	*Sterna dougallii*	Endangered
Red Knot	*Calidris canutus rufa*	Proposed Threatened
Smalltooth sawfish	Pristis pectinata	Endangered
Shortnose sturgeon	*Acipenser brevirostrum*	Endangered
Atlantic Sturgeon	*Acipenser oxyrhynchus oxyrhynchus*	Endangered
Invertebrates		
a skipper (butterfly)	*Atrytonopsis sp1*	FSC
Vascular Plants		
Rough-leaved loosestrife	*Lysimachia asperulaefolia*	Endangered
Seabeach amaranth	*Amaranthus pumilus*	Threatened

[1]Green turtles are listed as threatened, except for breeding populations in Florida and on the Pacific Coast of Mexico, which are listed as endangered.

Table J-2 KEY:

T(S/A) - Threatened due to similarity of appearance (e.g., American alligator)--a species that is threatened due to similarity of appearance with other rare species and is listed for its protection. These species are not biologically endangered or threatened and are not subject to Section 7 consultation.

Endangered - A taxon "in danger of extinction throughout all or a significant portion of its range."

Threatened - A taxon "likely to become endangered within the foreseeable future throughout all or a significant portion of its range."

FSC - A Federal species of concern--a species that may or may not be listed in the future (formerly C2 candidate species or species under consideration for listing for which there is insufficient information to support listing).

Species with 1 asterisk behind them indicate historic records:

* Historic record - the species was last observed in the county more than 50 years ago.

4.00 ASSESSMENT OF IMPACTS TO LISTED SPECIES

4.01 General Impacts

Dredging Equipment and Sediment Disposal Activities. Maintenance dredging and disposal of sediment from the existing Federal navigation channels in Morehead City Harbor has the potential to affect animals and plants in a variety of ways. The potential for adverse impacts may result from actions of the dredging equipment (i.e. suction, sediment removal, hydraulic pumping of water and sediment); physical contact with dredging equipment and vessels; physical barriers imposed by the presence of dredging equipment (i.e. pipelines); and disposal of dredged material (i.e. covering, suffocation) in the following areas:

1. Upland disposal area on Brandt Island,
2. USEPA designated Morehead City Ocean Dredged Material Disposal Site (ODMDS),
3. Nearshore areas off Bogue and Shackleford Banks, and
4. Atlantic Ocean beaches of Bogue Banks and Shackleford Banks.

Use of the existing disposal area on Brandt Island should not pose any adverse issues to the environment. Brandt Island is a 168-acre island, of which approximately 64 acres has been used as a disposal area since 1955. Return of effluent from Brandt Island is currently being discharged back into the inner harbor and can be controlled such that water released from the diked area has little or no suspended solids. Proper management of releases from Brandt Island will not increase turbidity levels in the area of the spillway pipe outfall above 25 NTUs.

The proposed DMMP will continue to use the USEPA designated Morehead City ODMDS. The dredged material proposed for ocean disposal has previously been evaluated for compliance with USEPA's Ocean Dumping Regulations and Criteria and are acceptable for transportation for ocean dumping under Section 103 of the Marine Protection, Research, and Sanctuaries Act of 1972, as amended. The USEPA, Region 4 has concurred with all previous Section 103 evaluations. Periodic re-evaluations will be performed as required by USEPA and USACE policy. Additionally, all disposal activities at the ODMDS must be conducted in accordance with the Site Management and Monitoring Plan (SMMP), dated February 2010 (USEPA and USACE 2010).

The DMMP proposes placement of dredged material in a new 492 acre Nearshore East placement area off Shackleford Banks and in the existing and expanded 1,050 acre Nearshore West placement area off Bogue Banks. Both nearshore placement areas are within the Beaufort Ebb Tide Delta and are about 1,000 to 2,000 feet offshore. The range in depth for the new Nearshore East is from about

-16 to -23 feet North American Vertical Datum (NAVD). The range in depth for the existing and expanded Nearshore West is from approximately -16 to -40 feet NAVD. Use of these placement areas may affect benthos. Covering of benthos and benthic habitat by discharged sediment represents a temporary resource loss since the discharge site will become a new area of benthic habitat and will be recolonized by benthic organisms. The ecological significance of temporary benthic losses is considered minor since the affected area is very small relative to the amount of benthic habitat present on the ocean bottom, the time span of loss is likely a period of months, and benthic populations in the vicinity are in a state of flux due to the dynamic sediment conditions in the area. Additionally, results of the recent survey of the new Nearshore East and the Nearshore West expansion area indicates that no hard bottoms are found in these areas.

Beach disposal of maintenance material and associated construction operations (i.e. operation of heavy equipment, pipeline route, etc.) on Bogue and Shackleford Banks, may adversely affect some species and their habitat, however the resultant constructed beach profile also promotes restoration of important habitat that has been lost or degraded as a result of erosion. Potential impacts vary according to the type of equipment used, the nature and location of sediment discharged, the time period in relation to life cycles of organisms that could be affected, and the nature of the interaction of a particular species with the dredging activities.

Noise. Within any harbor there are a number of noise sources. Ships arriving and departing (including tugs, etc.), recreational boats, dredges (cutterhead suction, mechanical, and hopper), and wharf/dock construction (pile driving, etc.), and natural (storms, biological, etc.) all make up the harbor ambient noise.

Noise in the outside environment associated with beach and nearshore placement activities would be expected to minimally exceed normal ambient noise in the project area; however, construction noise would be attenuated by background sounds from wind and surf. In-water noise would be expected in association with the dredging and the nearshore placement activities for this project. Specifically, noise associated with dredging could occur from (1) ship/machinery noise—noise associated with onboard machinery and propeller and thruster noise, (2) pump noise—noise associated with pump driving the suction through the pipe, (3) collection noise—noise associated with the operation and collection of material on the sea floor, (4) deposition noise—noise associated with the placement of the material within the barge or hopper, and (5) transport noise—noise associated with transport of material up the suction pipe. The limited available data indicate that dredging is not as noisy as seismic surveys, pile driving and sonar; but it is louder than most shipping, operating offshore wind turbines and drilling (Thomsen et al. 2009).

Dredging produces broadband and continuous, low-frequency sound (below 1 kHz) and estimated source sound pressure levels range between 168 and 186 dB reference (re) 1 μPa at 1 m, which can trigger avoidance reaction in marine mammals and marine fish. In some instances, physical auditory damage can occur. Auditory damage is the physical reduction in hearing sensitivity due to exposure to high-intensity sound and can be either temporary (temporary threshold shift) or permanent (permanent threshold Shift) depending on the exposure level and duration. Other than physical damage, the key auditory effect is the increase in background noise levels, such that the ability of an animal to detect a relevant sound signal is diminished, which is known as *auditory masking*. Masking marine mammal vocalizations used for finding prey, navigation and social cohesion could compromise the ecological fitness of populations (Compton et al. 2008).

According to Richardson et al. (1995) the following noise levels could be detrimental to marine mammals:

> Prolonged exposure of 140 dB re 1 µPa/m (continuous man-made noise), at 1 km can cause permanent hearing loss.
>
> Prolonged exposure of 195 to 225 dB re 1 µPa/m (intermittent noise), at a few meters or tens of meters, can cause immediate hearing damage.

According to Richardson et al. (1995), “Many marine mammals would avoid these noisy locations, although it is not certain that all would do so.” In a study evaluating specific reaction of bowhead whales to underwater drilling and dredge noise, Richardson et al. (1990) also noted that bowhead whales often move away when exposed to drillship and dredge sound; however, the reactions are quite variable and can be dependent on habituation and sensitivity of individual animals. According to Richardson et al (1995), received noise levels diminish by about 60 dB between the noise source and a radius of 1 km. For marine mammals to be exposed to a received level of 140 dB at 1-km radius, the source level would have to be about 200 dB re 1 µPa/m. Furthermore, few human activities emit continuous sounds at source levels greater than or equal to 200 dB re 1 µPa/m; however, supertankers and icebreakers can exceed the 195 dB noise levels.

According to Clarke et al. (2002), hopper dredge operations had the highest sustained pressure levels of 120–140 dB among the three measured dredge types; however, the measurement was taken at 40 m from the operating vessel and would likely attenuate significantly with increased distance from the dredge. On the basis of (1) the predicted noise effect thresholds noted by Richardson et al. (1995), (2) the background noise that already exists in the marine environment, and (3) the ability of marine mammals to move away from the immediate noise source, noise generated by bucket, cutterhead, and hopper dredge activities would not be expected to affect the migration, nursing/breeding, feeding/sheltering or communication of large whales. Although behavioral effects are possible (i.e., a whale changing course to move away from a vessel), the number and frequency of vessels present in a given project area is would be small, and any behavioral impacts would be expected to be minor. Furthermore, for hopper dredging activities, endangered species observers would be on board and would record all large whale sightings and note any potential behavioral impacts. Per the standard USACE specifications for all dredging projects, the USACE and the contractor would keep the date, time, and approximate location of all marine mammal sightings. Care would be taken not to closely approach (within 300 ft.) any whales, manatees, or other marine mammals during dredging operations or transportation of dredged material. An observer would serve as a lookout to alert the dredge operator or vessel pilot or both of the occurrence of the animals. If any marine mammals are observed during other dredging operations, including vessel movements and transit to the dredged material disposal site, collisions must be avoided either through reduced vessel speed, course alteration, or both. During the evening hours, when there is limited visibility from fog, or when there are sea states of greater than Beaufort 3, the dredge must slow down to 5 knots or less when transiting between areas if whales have been spotted within 15 nautical miles of the vessel's path in the previous 24 hours. Sightings of whales or manatees (alive, injured, or dead) in the work area must be reported to NMFS Whale Stranding Network.

Similar to conclusions made regarding effects of sound on marine mammals, non-injurious impacts to sea turtles may also occur because of acoustic annoyance or discomfort. It has been hypothesized, on the basis of anatomical studies that sea turtle hearing range centers around low-frequency sounds. Ridgeway et al. (1969, 1970) evaluated the frequency sensitivity of green sea turtles and found that green turtles detect limited sound frequencies (200–700 Hz) and display high level of sensitivity at the low-tone region (approx 400 Hz). According to Bartol et al. (1999), the most sensitive threshold for loggerhead sea turtles is 250–750 Hz with the most sensitive threshold at 250 Hz. Though noise generated from dredging equipment is within the hearing range of sea turtles, no injurious effects would be expected because sea turtles can move from the area, and the significance of the noise generated by the dredging equipment dissipates with an increasing distance from the noise source.

Project Area. As mentioned above, the proposed project will occur in the following areas:

1. Morehead City Harbor (including Brandt Island), located at the confluence of the Newport River and Bogue Sound;
2. within the nearshore area off Bogue and Shackleford Banks;
3. along the ocean beaches of Shackleford and Bogue Banks (from Ft. Macon State Park up to Pine Knoll Shores) in Carteret County, and;
4. in the Atlantic Ocean.

Any potential impacts on threatened and endangered species would be limited to those species, which occur in habitats provided by these areas. Therefore, the proposed work will not affect any listed species, which generally reside in freshwater, forested upland habitats (long-leaf pine savannas), including the eastern cougar, American alligator, red-cockaded woodpecker, and rough-leafed loosestrife.

Species which could be present in the project area during the proposed action are the blue whale, finback whale, humpback whale, North Atlantic right whale (NARW), sei whale, sperm whale, West Indian manatee, piping plover, roseate tern, red knot, green sea turtle, hawksbill sea turtle, Kemp's ridley sea turtle, leatherback sea turtle, loggerhead sea turtle, Atlantic sturgeon, shortnose sturgeon, smalltooth sawfish, and sea-beach amaranth.

4.02 Species Accounts

4.02.1 Eastern Cougar, American Alligator, Red-cockaded woodpecker, Rough-leaved Loosestrife and a Rare Butterfly (*Atrytonopis* new species 1).

The Eastern Cougar, American Alligator, Red-cockaded woodpecker, and Rough-leaved Loosestrife are all terrestrial, freshwater, upland woodland species (including longleaf pine savannas). Since this habitat type is not present in the areas to be affected by the proposed action, these species are unlikely to occur.

A rare butterfly that is known only from Bogue Banks and adjoining islands may occur in the project area. This species rare butterfly (*Atrytonopsis* new species 1), is associated with the Dune Grass natural community and its larvae are believed to feed solely on seaside little bluestem (*Schizachryium littorale*), a common to dominant member of that community. Most of the known populations occur in naturally vegetated dune fields located behind the primary beaches along the ocean. Populations are also known from dredged material disposal islands that support seaside little bluestem, including Brandt Island. There have been no documented populations within the current diked area at Brandt Island, however, the species has been observed to the south of the slough dividing Brandt Island from the main portion of Bogue Banks (Personal Communication, Allison Leidner, September 2008). During the proposed 20-year study timeframe of the DMMP, the USACE is not planning to expand the Brandt Island upland diked disposal area. However, if the Brandt Island disposal area is expanded, the USACE will coordinate with representatives of the USFWS to ensure that no impacts to seaside little bluestem (*Schizachryium littorale*) occur.

Effect Determination. It has been determined that the proposed action is not likely to adversely affect any of these species or their habitat.

4.02.2 Roseate Tern

Roseate terns breed primarily on small offshore islands, rocks, cays, and islets. Rarely do they breed on large islands. They have been reported nesting near vegetation or jagged rock, on open sandy beaches, close to the waterline on narrow ledges of emerging rocks, or among coral rubble (USFWS 1999b). This species is primarily observed south of Cape Hatteras, particularly at Cape Point within Cape Hatteras National Seashore, during the months of July and August. According to John Fussell, (Personal Communication, 16 August 2010), roseate terns were collected in the 1930's in the Beaufort Inlet area and they are known to migrate north through the project area in mid to late May.

According to John Fussell (2010) roseate terns are rarely found in the project area. The only time they may be found in the project area is when they migrate north in mid to late May. The DMMP impact area for these species would be considered the ocean beaches and nearshore areas off Bogue and Shackleford Banks. The roseate tern may use the beaches of Bogue and Shackleford Banks for foraging and roosting habitat. However, disposal activities on both Bogue and Shackleford Banks will only occur ether during the hopper dredge window (January 1 to March 31 of any year) and/or the pipeline disposal windows (November 16 to April 30 for Bogue Banks and November 16 to March 31 for Shackleford Banks). Additionally, the physical work area on the ocean beaches would only impact a maximum of 200 feet a day. All work and equipment (i.e., shore pipe, dozers, personnel, etc.) would be off the ocean beaches by the end of the respective disposal windows. Disposal of coarse-gained sediment along the beaches of Bogue and Shackleford Banks will have no adverse effect on this species. A recent year round study in Brunswick County, NC documents observed shorebird use there (USACE 2003). This report indicated that disposal of beach compatible sediment on the beaches in Brunswick County had no measurable impact on bird use.

Effect Determination. On Bogue Banks there is also a large population of feral cats and raccoons that would adversely impact the nesting roseate tern. Additionally, the northern migration of the roseate tern may occur in mid to late May (Personal Communication, John Fussell, August 16, 2010). All beach disposal activities will be completed by April 30 (March 31 for Shackleford Banks) and all equipment (including personnel) will be off the beach strand by this date .

For these reasons it has been determined that the project may affect not likely to adversely affect this species.

4.02.3 Piping Plover

a. Status. Threatened

b. Occurrence in Immediate Project Vicinity

The Atlantic Coast piping plover population breeds on coastal beaches from Newfoundland to North Carolina (and occasionally in South Carolina) and winters along the Atlantic Coast (from North Carolina south), the Gulf Coast, and in the Caribbean where they spend a majority of their time foraging. Since being listed as threatened in 1986, only 800 pairs were known to exist in the three major populations combined and by 1995 the number of detected breeding pairs increased to 1,350. This population increase can most likely be attributed to increased survey efforts and implementation of recovery plans (Mitchell et. al. 2000).

Piping plovers are known to nest in low numbers in widely scattered localities on North Carolina's beaches. The species typically nests in sand depressions on unvegetated portions of the beach above the high tide line on sand flats at the ends of sand spits and barrier islands, gently sloping foredunes, blowout areas behind primary dunes, sparsely vegetated dunes, and washover areas cut into or between dunes. Piping plovers head to their breeding grounds in late March or early April (http://pipingplover.fws.gov/overview.html) and nesting usually begins in late April; however, nests have been found as late as July (Potter et al. 1980; Golder 1985). During a statewide survey conducted in 1988, 40 breeding pairs of piping plovers were located in North Carolina. LeGrand (1983) states that "all of the pipings in the state nest on natural beachfronts, both completely away from human habitation and [yet] in moderate proximity to man". The largest reported nesting concentration of the species in the State appears to be on Portsmouth Island where 19 nests were discovered in 1983 by John Fussell (LeGrand 1983). The southernmost nesting record for the state was one nest located in Sunset Beach by Phillip Crutchfield in 1983 (LeGrand 1983). Feeding areas include intertidal portions of ocean beaches, washover areas, mud flats, sand flats, wrack lines, and shorelines of coastal ponds, lagoons, or salt marshes (USFWS 1996a). Prey consist of worms, fly larvae, beetles, crustaceans, mollusks, and other invertebrates (Bent 1928).

The NC Wildlife Resources Commission database indicates that during the winter Piping Plovers were surveyed at Bear Island, Bogue Inlet Shoals, Dudley Island, and Emerald Isle, and the following numbers of wintering birds were observed: 1987–3, 1989–3, 1990–2, 1991–4, 1996–1, 1997–5, 1999–2, 2000–2, 2001–0, 2003–1, 2004–2, 2005–2, 2006–0, 2007–1 and 2008–0. More Piping Plovers were recorded during winter on Bear Island and Bogue Inlet Shoals were recorded rarely on Dudley Island. Ft. Macon survey area: 1991–0, 1996–1, 2001–0, 2006–1 (North Carolina Wildlife Resources Commission, Wildlife Diversity Program, unpublished data, accessed August 2010).

The Cape Lookout National Seashore, National Park Service in their annual Piping Plover Breeding Pairs at Cape Lookout National Seashore reports from 2001 to 2010 indicate that during this time only one pair of piping plovers nested on Shackleford Banks in 2005. This nest was located near milepost 49.8 on Shackleford Banks, which is close to Barden's Inlet and outside of the proposed 3.65 mile disposal area (see Figure J-1).

The piping plover is a fairly common winter resident along the beaches of North Carolina (Potter et al. 1980). On July 10, 2001, the USFWS designated 137 areas along the coasts of North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, and Texas as critical habitat for the wintering population of the piping plover where they spend up to 10 months of each year on the wintering grounds. Constituent elements for the piping plover wintering habitat are those habitat components that are essential for the primary biological needs of foraging, sheltering, and roosting, and only those areas containing these primary constituent elements within the designated boundaries are considered critical habitat. The USFWS has defined textual unit descriptions to designate areas within the critical habitat boundary. The USFWS has designated critical habitat for the Wintering Piping Plover (see Figure J-2) on Shackleford Banks off Beaufort Inlet (NC-9) and on Emerald Isle off Bogue Inlet (NC-10). Further discussion is found in Section D Project Impacts (2), below.

c. Current Threats to Continued Use of the Area. Loss and degradation of habitat due to development and shoreline stabilization have been major contributors to the decline of piping plovers. The current commercial, residential, and recreational development has decreased the amount of coastal habitat available for piping plovers to nest, roost, and feed. Specifically on Bogue Banks, nesting habitat continues to be degraded. Washover habitat that was created after Hurricane Fran in 1996 has since been developed with residential homes resulting in a continued decrease in nesting habitat availability. Additionally, nesting habitat along the western end of Bogue Banks, adjacent to Bogue Inlet, continues to be eroded away as result of the recent southwesterly shift of Bogue Inlet and the subsequent erosion towards the residential structures. Furthermore, long and short-term coastal erosion and the abundance of predators, including wild and domestic animals as well as feral cats, have further diminished the potential for successful nesting of this species. Since project beaches are wintering area for the piping plover, the major threat to its occupation of the area during the winter months would be continued degradation of beach foraging habitat. Similar degradation of beaches elsewhere could be a contributing element to declines in the state's nesting population.

d. Project Impacts.

(1). Habitat. The existing shorelines of Bogue Banks are heavily developed and are experiencing significant shoreline erosion. Piping plover breeding territories on the Atlantic Coast typically include a feeding area along expansive sand or mudflats in close proximity to a sandy beach that is slightly elevated and sparsely vegetated for roosting and nesting (http://www.fws.gov/raleigh/species/es_pipl.html). As erosion and development persist, piping plover breeding, nesting, roosting, and foraging habitat loss continues. Habitat loss from development and shoreline erosion and heavy public use has led to the degradation of piping plover habitat in the project area. The enhancement of beach habitat through the addition of beach fill may potentially restore lost roosting and nesting habitat; however, short-term impacts to foraging and roosting habitat may occur during project construction.

Beach compatible material will be placed along the beach strand of Fort Macon State Park, Town of Atlantic Beach, and if there is sufficient material (Section 3.4.2 Beach disposal) Pine Knoll Shores. Beach compatible material will be placed on Bogue Banks either by pipeline dredge from November 16 to April 30 or by using hopper dredges and will adhere to a January 1 to March 31 dredging window. Since piping plovers head to their breeding grounds in late March and nesting occurs in late April, beach disposal events will avoid impacts to breeding and nesting piping plovers to the maximum extent practicable. Additionally, the project construction limits do not extend into the USFWS designated critical habitat (paragraph 2, below) located across Beaufort Inlet on Shackleford Banks (see NC-8) and will therefore avoid this documented nesting habitat. However, wintering habitat for roosting and foraging may be impacted. Direct short-term foraging habitat losses will occur during construction of the project fill. Since only a small portion of the foraging habitat is directly affected at any point in time during pumpout and adjacent habitat is still available, overall direct loss of foraging habitat will be minimal and short-term. Additionally, disposal activities will be completed in three sections (i.e., Fort Macon State Park, Town of Atlantic Beach, and Pine Knoll Shores) at a rate of approximately 200 foot per day or 4-5,000 feet per month; therefore, un-impacted or recovered foraging habitat will be available throughout the disposal operation on Bogue Banks.

Every three years beach compatible material will also be placed along the 3.65 mile long beach strand of Shackleford Banks. The proposed 150 foot wide disposal berm would extend from the base of the existing frontal dune with potential impacts to the -24 foot depth of closure. Up to 33 acres (150 foot wide times 9,636 foot long divided by 43,560) of new ocean beach could be created every 3 years, east of the Shackleford spit off Beaufort Inlet. Beach compatible material will be placed on Shackleford Banks either by pipeline dredge from November 16 to March 31 or by hopper dredges and will adhere to a January 1 to March 31 dredging window. Since piping plovers head to their breeding grounds in late March and nesting occurs in late April, beach disposal events will avoid impacts to breeding and nesting piping plovers to the maximum extent practicable. Disposal activities will be completed in at a rate of approximately 200 feet per day or 4-5,000 feet per month; therefore, unimpacted or recovered foraging habitat will be available throughout the disposal operation on Shackleford Banks.

Direct short-term foraging habitat losses will occur during disposal of dredged material. Since only a small portion of the foraging habitat is directly affected at any point in time during sediment disposal activities and adjacent habitat is still available, overall direct loss of foraging habitat will be minimal and short-term.

(2) Designated Critical Habitat. The USFWS has designated critical habitat for the Wintering Piping Plover (see Figures J- 2 and J-3) on Shackleford Banks off Beaufort Inlet (NC-8) and on Emerald Isle off Bogue Inlet (NC-10). The USFWS has designated about 168 acres on Shackleford Banks as critical habitat for the Wintering Piping Plover (NC-8). Included within the designation of critical habitat are all land areas to the mean lower low water. However, USFWS has not designated critical habitat for the Wintering Piping Plover either within the existing Federal navigation channels (which range in depth from about -35 to -45 feet NGVD) or in the Atlantic Ocean placement areas (Bogue Banks beaches or the nearshore placement areas off Bogue Banks and Shackleford Banks). Water depths in the nearshore placement areas vary, but minimum depth is about -16 feet NGVD. The Nearshore Placement Areas are located about 1,000 to 2,000 feet offshore from Bogue and Shackleford Banks.

Placing beach compatible material within the proposed 3.65 mile beach disposal area on Shackleford Banks would benefit designated critical habitat for the Wintering Piping Plover by adding up to 33 acres of new ocean beach and intertidal area. Up to half of the 3.65 mile long disposal area would be impacted during any three year dredging cycle. The proposed 150 foot wide disposal berm would extend from the base of the existing frontal dune with potential impacts to the -24 foot depth of closure. As indicated in d(1) above, up to 33 acres (150 foot wide times 9,636 foot long divided by 43,560) of new ocean beach and habitat for the federally listed Wintering Piping Plover could be created every 3 years about 1 mile east of the Shackleford spit off Beaufort Inlet.

Figure J-2 USFWS General Locations of Designated Critical Habitat for Wintering Piping Plover

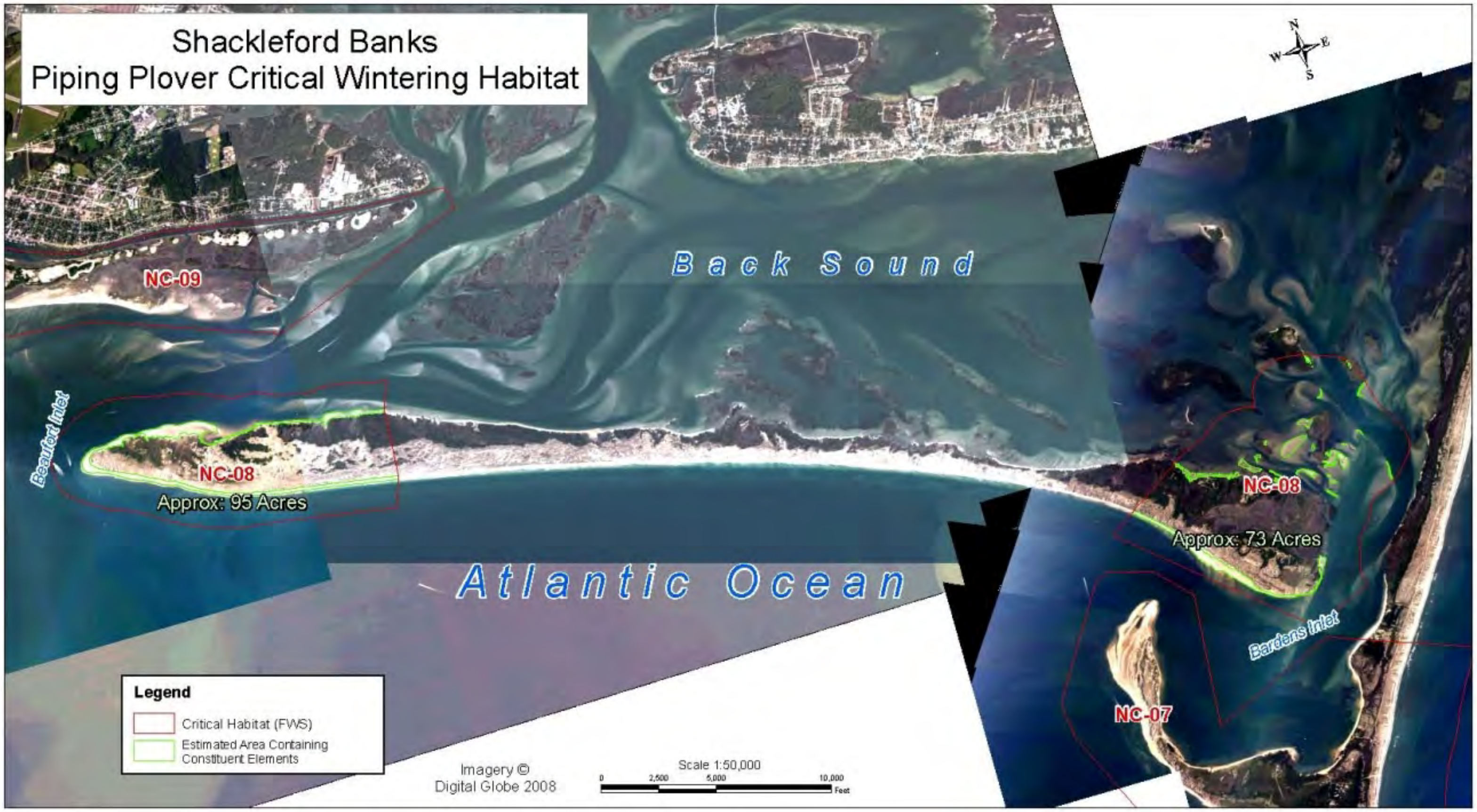

Figure J-3 USFWS Specific Locations of Designated Critical Habitat (NC-8) for Wintering Piping Plover on Shackleford Banks

Most piping plovers at Bogue Banks have been observed at the west end of Emerald Isle (which is outside of the proposed placement area) as predominantly a migratory and winter resident (Rice and Cameron 2008). When Bogue Inlet was relocated, the Town of Emerald Isle had the North Carolina Wildlife Resources Commission prepare a waterbird monitoring and management plan for the project area. The final report (Rice and Cameron 2008) states the following:

"The federally listed Piping Plover was observed along all four transects (i.e., Bear, Bogue, Dudley and the Inlet) throughout the length of the project and there has been an increase in the total number of observations in recent years (Table J-3, below). Counts of Piping Plovers initially decreased following the channel relocation, with the lowest number of observations (106) recorded in 2006. Numbers increased in 2007 (181) and again in 2008 (275). Most birds were observed along the Bear Island and Inlet transects. Birds were observed every month of the year with peak counts in September during pre-construction surveys and in March in years following construction. Bogue Inlet appears to be an important stop-over site during spring migration as birds return to their breeding grounds. It is also important for wintering plovers with between seven and eleven birds found wintering in any given year, representing approximately ten percent of the state's wintering population. The largest one day count during pre and post-construction surveys occurred in March of 2008 when 28 birds were observed on Bear Island. Piping Plover activity and habitat use is presented as percentages in Table J-3. In most years, the majority of birds were observed foraging with most observed using intertidal habitats".

Table J-3 Summary of total Piping Plover observations, 2003-2008. Taken from Rice and Cameron (2008).

	Total	Transect				% Habitat			% Activity			Peak Ct.
	Obs.	Bear	Bogue	Dudley	Inlet	Intertidal	Beach	Surf	Roosting	Foraging	Flying	(Month)
2003/04 (pre)	179	96	23	6	54	73.2	26.8	0.0	16.8	82.1	1.1	16 (Sept.)
2005 (during/post)	149	82	16	30	21	61.7	38.3	0.0	32.2	67.1	0.7	13 (Mar.)
2006 (post)	106	74	7	13	12	51.9	48.1	0.0	28.3	71.7	0.0	16 (Mar.)
2007 (post)	181	81	10	14	76	72.4	26.5	1.1	18.8	79.5	1.7	18 (Mar.)
2008 (post)	275	202	2	27	44	62.9	37.1	0.0	24.4	74.9	0.7	28 (Mar.)
Total	890	535	58	90	207	65.4	34.4	0.2	23.5	75.6	0.9	

However, Beaufort inlet also contains intertidal flats exposed at low tide that are prime feeding and roosting habitat for a variety of shorebirds and colonial waterbirds including pelicans, cormorants, terns, and gulls. These areas may be used by piping plovers as well. These shallow intertidal flats would not be adversely impacted by the continual maintenance dredging of the existing Federal navigation channels (which range in depth from about -35 to -45 feet NGVD) or the placement areas.

(3) Food Supply. Piping plovers feed along beaches and intertidal mud and sand flats. Primary prey includes polychaete worms, crustaceans, insects, and bivalves. According to Section 5 of the DMMP the benthic invertebrate community will suffer short-term impacts from the disposal of sediment on the beach; thus, a diminished prey base will subsequently impact piping plovers over the short term. However, only a portion of the beach is affected at any point in time (approximately 4-5,000 feet per month or up to 200 feet per day). Once construction passes that point, recruitment from adjacent beaches can begin. Therefore, unimpacted or recovering foraging habitat on Bogue and Shackleford Banks will be available throughout the duration of the project.

(4) Relationship to Critical Periods in Life Cycle. Beach disposal of sand derived from maintenance dredging of Morehead City Harbor is expected to occur only from November 16 to April 30 on Bogue Banks and November 16 to March 31 on Shackleford Banks (if a pipeline dredge is used) and from January 1 to March 31 (if a hopper dredge is used). Therefore, the breeding and nesting season will be avoided. However, foraging, sheltering, and roosting habitat may be temporarily impacted.

(5) Effect Determination. Short-term impacts of the proposed action on the piping plover would result from sediment placed within the 3.65 mile long area on Shackleford Banks. Coarse-grained sediment placed within the 3.65 mile long Shackleford Banks area (on average once every three years) would restore up to 33 acres of beach and intidal area for this species. Moreover all work on the ocean beaches of Shackleford Banks would not be instantaneous. Only a small portion of the beach would be impacted (up to 200 feet per day).

The long-term effects of the project may restore lost sheltering, feeding, roosting and nesting habitat through the addition of beach disposal activities within the 3.65 mile long disposal area on Shackleford Banks; however, short-term impacts (mentioned above) to foraging, feeding, sheltering, roosting habitat may occur during project construction. Therefore, it has been determined that the project may affect not likely to adversely affect the piping plover and is not likely to adversely modify USFWS designated wintering critical habitat.

4.02.4 Red Knot

a.) <u>Status</u> Federal – Proposed Threatened

b .) <u>Background</u>

The Red Knot (*Calidris canutus rufa)* is a medium-sized shorebird that undertakes an annual 30,000 km hemispheric migration, one of the longest among shorebirds. Their migration route extends from overwintering sites in the southernmost tip of South America at Tierra del Fuego, up the Eastern coast of the Americas through the Delaware Bay, and ultimately to breeding sites in the central Canadian Arctic. Red Knots break their migration into strategically timed and selected non-stop segments, of approximately 1,500 miles, throughout the entire Atlantic coast, including North Carolina. These staging areas consist of highly productive foraging locations which are repeatedly used year to year. As the Red Knot moves towards the northern extent of its migration route, the timing of departures becomes increasingly synchronized. One critical foraging stop for Red Knots occurs in the Delaware Bay where they feed almost exclusively on horseshoe crab eggs, due to their high fat content and ease of digestion, in order to reach threshold departure masses (180-200 grams) prior to heading for the Arctic breeding grounds. The arrival of the Red Knot in the Delaware Bay coincides with the spawning of the horseshoe crabs, which peaks in May and June. Birds arrive emaciated and can nearly double their mass (~4.6 grams/day) prior to departure if foraging conditions are favorable (Baker *et. al*., 2001), eating an estimated 18,000 fat-rich horseshoe crab eggs per day (Andres et al. 2003). This critical foraging stopover enables Red Knots to achieve the nutrient store levels necessary for migration, survival, and maximizing the reproductive potential of the population (Baker et. al. 2004). In order to increase their body mass at such a rapid rate during their refueling stopover in the Delaware Bay, Red Knots morph their guts during their migration route from South America to Delaware.

The Cape Lookout National Seashore, National Park Service (provided by Michael Rikard) in their annual 2006 to 2009 Red Knot Monitoring Reports at Cape Lookout National Seashore indicates the following:

<u>For Shackleford Banks</u>: In 2006, 9 birds were observed near Barden's Inlet, in 2007, 18 birds were observed between Beaufort and Barden's Inlets, in 2008, 96 birds were observed near Barden's Inlet, and in 2009, 18 birds were observed near Barden's Inlet.

Since 2006, a total of 141 red knots have been observed on Shackleford Banks (annual monitoring reports provided by Michael Rikard, NPS.).

Ms. Sara Schweitzer, North Carolina Wildlife Resources Commission, provided the following information (email dated 1 August 2011): *The data we have for Red Knots is from opportunistic counts of them, as well as counts of them during other surveys. There have not been surveys or studies on Red Knots specifically. Therefore, there may be more birds in NC than are indicated by our data.*

From the extant data, it appears that Red Knots are present in NC in greatest numbers (>100 per flock) during spring migration (April through May) during which time they may be in flocks up to 1000 birds.

Red Knots do feed extensively in the intertidal zone and on small coquina clams and horseshoe crab eggs. So they are either seen feeding voraciously or resting. Once they build up adequate fat reserves, they fly to their next stopover site. Some Red Knots have geo-locators on their leg bands and such data demonstrate that they can fly 100s of miles without stopping if they have adequate fat stores.

The best places for them to feed and rest are large intertidal areas for foraging, with foredunes in which to rest. No disturbance as these sites from pedestrians, dogs, or vehicles would be tolerated by the birds; thus, busy sites are not used. Our database indicates that sites with greatest numbers of Red Knots include:

Sunset Beach (northeast end and shoals in inlet) (private) Lea-Hutaff Island (Audubon) Masonboro Island (NERR) Topsail Beach, South end (private) Bald Head Island (foundation) Bear Island (State Park) Bogue Inlet shoals Bogue Sound-Bogue Inlet CLNS South Core Banks, North Core Banks, Shackleford Banks (NPS) New Drum Inlet shoals Clam Shoal CHNS Hatteras Island, South (NPS) CHNS, Ocracoke Island (NPS) Pea Island NWR -- N end Hatteras Island (USFWS & NPS)

Most areas where Red Knots occur in great numbers in spring migration are protected due to their ownership. However, there are areas with no protection from a conservation entity.

More recently, Niles *et. al.* (2009) reports continued shortage of horseshoe crab eggs at a critical stop in Delaware Bay for the Red Knot. Over the past 10 years, heavy commercial harvest of horseshoe crabs has caused a rapid decline in the crab's breeding population in Delaware Bay, reducing the number of eggs available to shorebirds. During this time the Red Knot population has declined from over 90,000 birds counted on Delaware Bay in 1989, to 32,000 in 2002. Similar declines have been shown in the South American wintering grounds suggesting that the viability of the Red Knot is seriously threatened. Demographic modeling predicts imminent endangerment and an increased risk of extinction without urgent management (Baker et al. 2004).

Morrison *et al*. (2004) have identified four factors that cause this vulnerability: (1) a tendency to concentrate in a limited number of locations during migration and on the wintering grounds, so that deleterious changes can affect a large proportion of the population at once; (2) a limited reproductive output, subject to vagaries of weather and predator cycles in the Arctic, which in conjunction with long lifespan suggests slow recovery from population declines; (3) a migration schedule closely timed to seasonally abundant food resources, such as horseshoe crab (*Limulus polyphemus*) eggs during spring migration in Delaware Bay, suggesting that there may be limited flexibility in migration routes or schedules; and (4) occupation and use of coastal wetland habitats that are affected by a wide variety of human activities and developments.

Considering the threat of extinction, petitions have been submitted to the United States Fish and Wildlife Service (USFWS) for emergency listing of the *rufa* subspecies of the Red Knot (*Calidris canutus rufa*) as endangered and to designate “critical habitat” under the Endangered Species Act (“ESA”). On September 12, 2006, the USFWS included the Red Knot as a candidate species that may warrant protection under the Endangered Species Act (ESA). On July 20, 2007, the Red Knot final status assessment report was made available in which the Service determined that the Red Knot warranted protection, but placing the bird on the endangered species list is precluded by higher priority listing actions for species at greater risk. Although the candidate species status does not provide any regulatory protection under ESA, the USFWS recommends that, given its candidate status, all Federal agencies funding, authorizing, or conducting actions that may affect the Red Knot or its habitat, including impacts to prey resources, give full consideration to the species in project planning.

On September 30, 2013, USFWS published in the Federal Register their proposal to list the red knot (*Calidris canutus rufa*) as Threatened species under the Endangered Species Act (ESA) of 1973 (16 U.S.C. 1531-1543).

c.) <u>Project Impacts</u>.

The disposal of sediment on the beach may have short-term impacts on benthic invertebrates. However, recovery occurs within 1-3 years depending on sediment compatibility and the frequency and size of disturbance (See Section 3.4.2 DMMP). Given their mobile foraging patterns, local disruptions to foraging habitat is likely not that disruptive to Red Knots (Harrington, Personal Communication, September 2006). Therefore, disruption from construction activities associated with beach disposal of sediment will likely result in the movement of Red Knots to an alternative foraging location. However, multiple or large scale disruptions effecting all key foraging locations at one time could have a profound impact. Though Red Knots can relocate with localized disruption, large scale disturbances that impact the entire range of foraging locations may be significant. Within the limits of foraging distribution, beach disposal activities should be constructed in a manner as to allow for unimpacted foraging habitat locations and avoid large scale disruption to benthic invertebrates to the maximum extent practicable. Additionally, beach placement on Shacklefored Banks will only take place from November 16 to March 31 of any year.

Roosting Red Knots prefer wide stretches of beach with limited disturbance. Contrary to their ability to tolerate disturbance while foraging and move among foraging habitats, Red Knots will avoid or abandon available roosting habitat adjacent to areas of disturbance. Furthermore, large scale development and continued beach erosion along the wintering and stopover range along the Atlantic has limited the availability of habitat that contains the necessary features for a suitable roosting environment. Beach disposal actions that occur within these limited roosting locations should avoid roosting time frames or implement appropriate buffer requirements during construction to the maximum extent practicable in order to minimize impacts. Beach disposal of sediment may have a beneficial effect on the Red Knot's roosting habitat in areas where significant erosion is occurring.

d.) Effect Determination. Short-term impacts of the proposed action on the Red Knot would result from the disposal of coarse-grained sediment within the 3.65 mile long Shackleford Banks area (on average once every three years). This activity would restore up to 33 acres of beach and intertidal area for this species. Moreover all work on the ocean beaches of Shackleford Banks would not be instantaneous. Only a small portion of the beach would be impacted (up to 200 feet per day. Additionally, beach placement on Shacklefored Banks will only take place from November 16 to March 31 of any year.).

The long-term effects of the project may restore lost sheltering, feeding, roosting and nesting habitat through the addition of beach disposal activities within the 3.65 mile long disposal area on Shackleford Banks; however, short-term impacts (mentioned above) to foraging, feeding, sheltering, and roosting habitat may occur during project construction.

Considering that construction activities will (1) avoid large scale disturbance within the limits of Red Knot foraging distribution and allow for areas of un-impacted or recovered foraging habitat within a given year, (2) avoid roosting timeframes or provide appropriate buffers around existing roosting habitat during construction operations, and (3) beach placement on Shackleford Banks will only take place from November 16 to March 31 once every three years, the disposal of sediment on the Bogue and Shackleford Banks beaches may affect not likely adversely affect the Red Knot.

4.02.5 West Indian Manatee

a. Status. Endangered.

b. Occurrence in Immediate Project Vicinity. The manatee is an occasional summer resident off the North Carolina coast with presumably low population numbers (Clark 1987). The species can be found in shallow (5 ft to usually <20 ft), slow-moving rivers, estuaries, saltwater bays, canals, and coastal areas (USFWS 1991). The West Indian manatee is herbivorous and eats aquatic plants such as hydrilla, eelgrass, and water lettuce (USFWS, 1999a). Manatees are thermally stressed at water temperatures below 18ºC (64.4ºF) (Garrot et al. 1995); therefore, during winter months, when ambient water temperatures approach 20ºC (68ºF), the U.S. manatee population confines itself to the coastal waters of the southern half of peninsular Florida and to springs and warm water outfalls as far north as southeast Georgia. During the summer months, sightings drop off rapidly north of Georgia (Lefebvre et al, *2001*) and are rare north of Cape Hatteras (Rathbun *et al, 1982*; Schwartz 1995). However, they are sighted infrequently in southeastern North Carolina with most records occurring in July, August, and September, as they migrate up and down the coast (Clark 1993). The Species is considered a seasonal inhabitant of North Carolina with most occurrences reported from

June through October (USFWS 2001). According to Schwartz (1995), manatees have been reported in the state during nine months, with most sightings in the August-September period. Manatee population trends are poorly understood, but deaths have increased steadily. A large percent of mortality is due to collisions with watercrafts, especially of calves. Another closely related factor in their decline has been the loss of suitable habitat through incompatible coastal development, particularly destruction of sea grass beds by boating facilities (USFWS 2001).

Manatees are rare visitors to Morehead City Harbor area. According to Schwartz (1995), a total of 68 manatee sightings have been recorded in 11 coastal counties of North Carolina during the years 1919-1994. Therefore, it is likely that manatees transit through the DMMP study area during the warm water months. Manatees are known to infrequently occur within nearly all North Carolina ocean and inland waters (Schwartz 1995) with four North Carolina records having been from inlet-ocean sites and six from the open ocean (Rathbun et al. 1982). According to the existing literature, specific numbers of manatees using the region are not known but are presumed to be very low. More research is needed to determine the status of the species in North Carolina and identify areas (containing food and freshwater supplies), which support summer populations.

c. Current Threats to Continued Use of the Area. Current threats to this species in the project area cannot be clearly assessed due to our lack of knowledge regarding its population, seasonality, distribution, and the habitat components in the project area that may be needed for its use. However, considering that manatees become thermally stressed at water temperatures below 18ºC (64ºF) (Garrot et al. 1995), cold winter temperatures keep the species from over wintering in the project area.

d. Project Impacts.

(1) Habitat. Impacts to estuarine and nearshore ocean habitat of the area associated with the disposal of sediment on the beach should be minor. With the current state of knowledge on the habitat requirements for the manatee in North Carolina, it is difficult to determine the magnitude of such impacts. Studies currently underway by the USFWS using animals fitted with satellite transmitters will hopefully provide data on the nature of these seasonal movements and habitat requirements during migrational periods.

(2) Noise. Section 4.01 General Impacts, describes the noise impacts on marine mammals.

(3) Food Supply. Foods, which are used by the manatee in North Carolina, are unknown. In Florida, their diet consists primarily of vascular plants. The proposed action will involve minimal change to the physical habitat of the estuary with no known impacts to vascular plants and overall estuarine and nearshore productivity

should remain high throughout the project area. Therefore, potential food sources for the manatee should be unaffected.

(4) Relationship to Critical Periods in Life Cycle. Since the manatee is considered to be an infrequent summer resident of the North Carolina coast, the proposed action should have little effect on the manatee since its habitat and food supply will not be significantly impacted. In regards to vessel collisions, the proposed maintenance dredging of the Morehead City Harbor federal navigation channels will occur in the estuarine or inlet habitat area and direct impacts from collision could take place. The USACE will implement precautionary measures for avoiding impacts to manatees from associated transiting vessels during construction activities, as detailed in the "Guidelines for Avoiding Impacts to the West Indian Manatee" established by the USFWS.

(5) Effect Determination. Since the habitat and food supply of the manatee will not be significantly impacted, overall occurrence of manatees in the project vicinity is infrequent, the maintenance dredging of the Federal navigation channels will occur in the estuarine or inlet habitat area and direct impacts from collision could take place, and precautionary measures for avoiding impacts to manatees, as established by USFWS, will be implemented for transiting vessels associated with the project, the proposed action may affect, not likely to adversely affect the manatee.

4.02.6 Blue Whale, Finback Whale, Humpback Whale, North Atlantic Right Whale (NARW), Sei Whale, and Sperm Whale

a. Status. Endangered

b. Occurrence in Immediate Project Vicinity. These whale species all occur infrequently in the ocean off the coast of North Carolina. Of these, only the NARW and the humpback whale routinely come close enough inshore to encounter the project area. Humpback whales were listed as "endangered" throughout their range on June 2, 1970 under the Endangered Species Act and are considered "depleted" under the Marine Mammal Protection Act. Humpbacks are often found in protected waters over shallow banks and shelf waters for breeding and feeding. They migrate toward the poles in summer and toward the tropics in winter and are in the vicinity of the North Carolina coast during seasonal migrations, especially between December and April. Since 1991, humpback whales have been seen in nearshore waters of North Carolina with peak abundance in January through March (NMFS 2003). In the Western North Atlantic, humpback feeding grounds encompass the eastern coast of the United States, the Gulf of St. Lawrence, Newfoundland/Labrador, and western Greenland. Major prey species include small schooling fishes (herring, sand lance, capelin, mackerel, small Pollock, and haddock) and large zooplankton, mainly krill (up to 1.5 tons per day) (http://www.nmfs.noaa.gov). Based on an increased number of sightings and stranding data, the Chesapeake and Delaware Bays and the U.S. mid-Atlantic and southeastern states, particularly along Virginia and North Carolina coasts, have become increasingly important habitat for juvenile humpback whales (Wiley et al. 1995).

There are 6 major habitats or congregation areas for the western NARW; these are the coastal waters of the southeastern United States, the Great South Channel, Georges Bank/Gulf of Maine, Cape Cod and Massachusetts Bays, the Bay of Fundy, and the Scotian Shelf. However, the frequency with which NARWs occur in offshore waters in the southeastern U.S. remains unclear (NMFS 2003). While it usually winters in the waters between Georgia and Florida, the NARW can, on occasion, be found in the waters off North Carolina. NARWs swim very close to the shoreline and are often noted only a few hundred meters offshore (Schmidly 1981). NARWs have been documented along the North Carolina coast, as close as 250 meters from the beach, between December and April with sightings being most common from mid to late March (Dr. Frank J. Schwartz, Personal Communication, January 19, 1996). Sighting data provided by the NARW Program of the New England Aquarium indicates that 93 percent of all North Carolina sightings between 1976 and 1992 occurred between mid-October and mid-April (Slay 1993). The occurrence of NARWs in the State's waters is usually associated with spring or fall migrations. Due to their occurrence in the nearshore waters, the transport of hopper dredges to and from the USEPA approved ODMDS could result in an encounter with humpback and NARW species.

c. Project Impacts.

(1) Habitat. No critical habitat has been designated for NARWs and humpback whales within the proposed project area.

(2) Noise. Section 4.01 General Impacts, describes the noise impacts on marine mammals.

(3) Food Supply. North Atlantic right whales feed primarily on copepods (*Calanus* sp.) and euphausids (krill) (NMFS 1991) and humpback whales feed on small fish and krill. The proposed DMMP will not diminish productivity of the nearshore ocean; therefore, the food supply of these species should be unaffected.

(4) Relationship to Critical Periods in Life Cycle.

North Atlantic Right Whale (NARW).

Detailed life history information for NARWs and potential effects from dredging activities area provided within the following Section 7 consultation documents:

National Marine Fisheries Service. 1997. Regional Biological Opinion for the Continued Hopper Dredging of Channels and Borrow Areas in the Southeastern United States. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Silver Spring, Maryland

USACE. September 2008. Regional Biological Assessment for Dredging Activities in the Coastal Waters, Navigation Channels (including designated Ocean Dredged

<u>Material Disposal Sites (ODMDS)), and Sand Mining Areas in the South Atlantic Ocean</u>. USACE, Wilmington District. Submitted to NMFS on 12 September 2008.

The referenced September 2008 Section 7 consultation document discusses in detail the June 26, 2006 proposed regulations by NMFS to implement mandatory vessel speed restrictions of 10 knots or less on vessels 65 ft. or greater in overall length in certain locations and at certain times of the year along the east coast of the U.S. Atlantic seaboard. Following the release of the referenced USACE consultation document, NMFS announced the release of the Final Rule and subsequent OMB approval of the collection-of-information requirements. Specifically, on October 10, 2008 NMFS published a final rule implementing speed restrictions to reduce the incidence and severity of ship collisions with North Atlantic right whales (73 FR 60173) with an effective date of December 9, 2008 through December 9, 2013. That final rule contained a collection-of-information requirement subject to the Paperwork reduction Act (PRA) that had not yet been approved by the Office of Management and Budget (OMB). Specifically, 50 CFR 224.105(c) requires a logbook entry to document that a deviation from the 10-knot speed limit was necessary for safe maneuverability under certain conditions. On October 30, 2008, OMB approved the collection-of-information requirements contained in the October 10, 2008, final rule. On December 5, 2008, NMFS announced that the collection-of-information requirements were approved under Control Number 0648–0580, with an expiration date of April 30, 2009 (15 CFR Part 902).

Humpback Whales.

The overall North Atlantic population of humpback whales is estimated at 10,600 individuals and is increasing (Waring et al. 1999); however the minimum population estimates for the Gulf of Maine stock is 647 individuals with a steadily increasing trend (NMFS 2003). For the period 1993-1997, the total estimated human-caused mortality and serious injury from fishery interactions and vessel collisions is estimated at 4.4 per year (NMFS 2003). According to Jensen and Silber's (2003) large whale ship strike database, of the 292 records of confirmed or possible ship strikes to large whales, 44 records (15%) were of humpback whales, the second most often reported species next to finback whales (75 records) (26%). Of the 5 documented ship strikes resulting in serious injury or mortality for North Atlantic humpback whales from January 1997-December 2001, 3 where located in North Carolina and South Carolina waters. Though the total level of human-caused mortality and serious injury is unknown, current data indicate that it is significant; furthermore, mortality off the U.S. Mid-Atlantic States continues to increase (NMFS 2003).

(5) <u>Effect Determination</u>. Of the six species of whales being considered, only the NARW and humpback whale would normally be expected to occur within the project area during the project construction period. Therefore, the proposed project is not likely to adversely affect the blue whale, finback whale, sei whale, and sperm whale. Conditions outlined in previous consultations in order to reduce the potential for accidental collision (i.e. contractor pre-project briefings, large whale

observers, slow down and course alteration procedures, etc.) will be implemented as a component of this project. Based on the implementation of these conditions, dredging activities associated with the proposed project may affect not likely to adversely affect the NARW and humpback whale species.

4.02.7 Loggerhead, Hawksbill, Kemp's Ridley, Green, and Leatherback Sea Turtles

a. Status.

Loggerhead	*Caretta caretta*	Threatened
Hawksbill	*Eretmochelys imbricata*	Endangered
Kemp's Ridley	*Lepidochelys kempii*	Endangered
Green	*Chelonia mydas*	Threatened[1]
Leatherback	*Dermochelys coriacea*	Endangered

[1]Green turtles are listed as threatened, except for breeding populations in Florida and on the Pacific Coast of Mexico, which are listed as endangered.

b. Critical Habitat. Critical habitat has not been designated in the continental U.S. for the Hawksbill, Kemp's Ridley, Green, and Leatherback sea turtles identified to occur within the proposed project vicinity. Therefore, the proposed action would not result in an adverse modification to identified critical habitat for these four species. However, on March 25, 2013, the USFWS published in the Federal Register (50 CFR Part 17) their proposal to designate specific areas in the terrestrial environment as critical habitat for the Northwest Atlantic Ocean Distinct Population Segment of the threatened loggerhead sea turtle (*Caretta caretta*) under the Endangered Species Act (ESA) of 973, as amended (16 U.S.C. 1531–1543). The proposed critical habitat is located in coastal counties in North Carolina, South Carolina, Georgia, Florida, Alabama, and Mississippi.

Within the proposed dredged material disposal areas for the Morehead City Harbor DMMP, the beaches of Bogue Banks have been designated in the proposed USFWS Critical Habitat Rule as the Northern Recovery Unit, North Carolina, LOGG-T-NC-01 (Bogue Banks in Carteret County) for the loggerhead sea turtle. This unit extends from Beaufort Inlet to Bogue Inlet and includes terrestrial lands from the Mean High Water (MHW) line landward to the toe of the secondary dune or developed structures.

Additionally, on July 18, 2013, the NMFS published in the Federal Register (50 CFR 226) their proposal to designate specific areas in the marine environment as critical habitat for the Atlantic Ocean loggerhead sea turtle Distinct Population Segment (DPS) (*Caretta caretta*) within the Atlantic Ocean under the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531–1543). In the Morehead City Harbor project area, NMFS is proposing to designate two unit descriptions for the loggerhead sea turtle: LOGG-N-2 – Southern Portion of the North Carolina Winter Concentration Area and LOGG-N-3 – Bogue Banks and Bear Island, Carteret and Onslow Counties, NC. The LOGG-N-2 unit is winter habitat only and includes waters from 20 meters (65.6 feet) to

100 meter (328 feet) depth contours. The LOGG-N-3 unit contains nearshore reproductive habitat only and consists of the nearshore ocean from Beaufort Inlet to Bogue Inlet and seaward 1.6 km (1 mile). This unit contains an area adjacent to high density nearshore reproductive habitat (Beaufort Inlet to Bogue Inlet) as well as an area of high density nearshore reproductive habitat (Bogue Inlet to Bear Inlet). Only the LOGG-N-3 unit would be applicable to the proposed Morehead City Harbor DMMP since all existing Federal navigation channels (i.e., Ranges A, B, and C, Cutoff and inner harbor channels) and disposal areas are in water depths less than 20 meters (65.6 feet).

Currently, both USFWS' and NMFS' proposals for designating critical habitat for the threatened loggerhead sea turtle have not been finalized. Moreover, the above mentioned unit descriptions for both USFWS and NMFS could change prior to the final critical habitat designations.

c. Background. Detailed life history information associated with the in-water life cycle requirements for sea turtles and a subsequent analysis of impacts from the proposed dredging activities is provided within the following NMFS Section 7 consultation documents:

National Marine Fisheries Service. 1997. Regional Biological Opinion for the Continued Hopper Dredging of Channels and Borrow Areas in the Southeastern United States. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Silver Spring, Maryland

USACE. September 2008. Regional Biological Assessment for Dredging Activities in the Coastal Waters, Navigation Channels (including designated Ocean Dredged Material Disposal Sites (ODMDS)), and Sand Mining Areas in the South Atlantic Ocean. USACE, Wilmington District. Submitted to NMFS on 12 September 2008

A summary of project specific information associated with beach and in-water habitat use is provided in the ensuing text.

1.) Occurrence in Immediate Project Vicinity. All five species of sea turtles identified above are known to occur in both the estuarine and oceanic waters of North Carolina. According to Epperly et al. (1994), inshore waters, such as Pamlico and Core Sounds, are important developmental and foraging habitats for loggerheads, greens, and Kemp's ridleys. Nearly all sea turtles found within these sounds are immature individuals immigrating into the sounds in the spring and emigrating from the sounds in the late fall and early winter (Epperly et al. 1995). Loggerhead, green, and Kemp's ridley sea turtles are known to frequently use coastal waters offshore of North Carolina as migratory travel corridors (Wynne 1999) and commonly occur at the edge of the continental shelf when they forage around coral reefs, artificial reefs, and boat wrecks.

Hawksbill and leatherback sea turtles infrequently enter inshore waters (Epperly et al, 1995) and are normally associated solely with oceanic waters (Schwartz 1977).

However, Lee and Palmer (1981) document that leatherbacks normally frequent the shallow shelf waters rather than those of the open sea, with the exception of long-range migrants.

Of the five species of sea turtles considered for this project, only the loggerhead sea turtle (*Caretta caretta*), the green sea turtle (*Chelonia mydas*), and the leatherback sea turtle (*Dermochelys coriacea*) nest regularly on North Carolina beaches and have the potential to nest within the project area. There are no documented nesting attempts of hawksbill and Kemp's ridley sea turtles on the project beaches; however, Kemp's ridley nests have been documented twice in North Carolina, once on Oak Island in 1992 and once on Cape Lookout in 2003 (Matthew Godfrey, Sea Turtle Program Coordinator, North Carolina Wildlife Resources Commission, Personal Communication, 2006). With a few exceptions, the entire Kemp's ridley population nests on the approximately 15 miles of beach in Mexico between the months of April and June (USFWS 1991). The hawksbill sea turtle nests primarily in tropical waters in south Florida and the Caribbean. Considering the infrequency of Kemp's ridley nesting occurrence throughout North Carolina and the lack of historical nesting of Kemp's ridley and hawksbill sea turtles on Bogue Banks, these species are not anticipated to nest within the project area. The loggerhead is considered to be a regular nester in the state, while green sea turtle nesting is infrequent and primarily limited to Florida's east coast (300 to 1,000 nests reported annually). According to Rabon et al. (2003), seven leatherback nests have been confirmed in North Carolina since 1998 constituting the northernmost nesting records for leatherbacks along the East Coast of the United States. Though almost all confirmed nesting activity in North Carolina has been between Cape Lookout and Cape Hatteras, the potential for leatherback nesting within the project area is likely.

Table J-4 shows the total number of recorded loggerhead, green, and leatherback sea turtle nests on Bogue Banks (includes Fort Macon State Park, Atlantic Beach, Pine Knoll Shores, Indian Beach/Salter Path, and Emerald Isle) beaches from 1997 to 2010. Both the Towns of Indian Beach/Salter Path and Emerald Isle are not within the DMMP DEIS project area. Though records were kept as early as 1997, consistent turtle nesting data has been recorded on Bogue Banks only since 2003. Furthermore, Standardized nest patrols were not enacted statewide until the mid 1990s; therefore, values from the first part of the 1990's to 2002 may not represent a full season of monitoring. Of the 412 nests laid within the Bogue Banks since 1997, loggerhead sea turtles laid 409 nests, 4 nests were laid by greens, and 2 nests were laid by leatherbacks (Matthew Godfrey, Personal Communication, 2010).

Table J-5, below shows the total number of recorded loggerhead, green, and leatherback sea turtle nests on Shackleford Banks between 2000 and 2009. Of the 144 nests laid on Shackleford banks since 2000, loggerhead sea turtles laid 142 nests, 1 nest was laid by a green, and 1 nest was laid by a leatherback. These numbers depicted in Table J-5 were taken from the Cape Lookout National Seashore annual sea turtle monitoring reports. All of these NPS annual reports were provided by Michael Rikard, the National Park Service, Cape Lookout National Seashore.

Year	Loggerhead (*Caretta caretta*)	Green (*Chelonia mydas*)	Leatherback (*Dermochelys coriacea)*
1997 *	33	0	0
1998 *	22	0	0
1999 *	35	0	0
2000 *	13	2	0
2001 *	21	0	0
2002 *	19	0	0
2003	38	0	0
2004	21	0	0
2005	33	1	2
2006	33	0	0
2007	27	0	0
2008	31	0	0
2009	34	1	0
2010 **	49	0	0
TOTALS	409	4	2

Table J-4. Total sea turtle nest numbers for Bogue banks from 1997-2010, which was provided by Matthew Godfrey, NC Wildlife Resources Commission. Loggerhead, green, and leatherback sea turtles are the only species with recorded nesting activity on Bogue Banks beaches.

* The entire Bogue Banks area was not monitored (i.e., incomplete numbers)
** Preliminary data for 2010 (as of 13 August 2010)

Table J-5. Total sea turtle nest

Year	Loggerhead (*Caretta caretta)*	Green (*Chelonia mydas*)	Leatherback (*Dermochelys coriacea)*
2000	16	0	0
2001	19	0	0
2002	10	1	0
2003	20	0	0
2004	10	0	0
2005	16	0	1
2006	14	0	0
2007	8	0	0
2008	18	0	0
2009	11	0	0
TOTALS	142	1	1

numbers for Shackleford Banks from 2000-2009, which was provided by Jon NPS. Loggerhead, green, and leatherback sea turtles are the only species with recorded nesting activity on Shackleford Banks.

2.) <u>Current Threats to Continued Use of the Area</u>. In addition to affecting the coastal human population, coastal sediment loss also poses a threat to nesting sea turtles. A large percentage of sea turtles in the United States nest on nourished beaches (Nelson and Dickerson 1988a), therefore, nourishment has become an important technique for nesting beach restoration (Crain *et al.* 1995). The DMMP is not a nourishment project, however, beach disposal of coarse grained sediment from the navigation channel on the beaches of Bogue Banks and Shackleford Banks will function much like a nourishment project.
Since consistent turtle nesting surveys began on Bogue Banks in 2003, the average numbers of nests laid per year have remained largely constant with some minor fluctuations.

The primary threats facing these species worldwide are the same ones facing them in the project area. Of these threats, the most serious seem to be loss of breeding females through accidental drowning by shrimpers (Crouse et al*.* 1987) and human encroachment on traditional nesting beaches. Research has shown that the turtle populations have greatly declined in the last 20 years due to a loss of nesting habitat along the beachfront and by incidental drowning in shrimp trawl nets. It appears that the combination of poorly placed nests coupled with unrestrained human use of the beach by auto and foot traffic has impacted this species greatly. Other threats to these sea turtles include excessive natural predation in some areas and potential interactions with hopper dredges during the excavation of dredged material. With the exception of hopper dredges, none of the dredge plants (i.e., pipeline dredges or bucket and barge dredges) proposed for the maintenance of the existing navigation channel are known to take sea turtles.

d. <u>Project Impacts.</u>

In order to avoid periods of peak sea turtle abundance during warm water months and minimize impacts to sea turtles in the nearshore and offshore environment, the proposed hopper dredging window for this project is January 1 through 31 March. The pipeline dredging window with disposal on the adjacent beaches is from November 16 to April 30 on Bogue Banks and November 16 to March 31 on Shackleford Banks. By adhering to this dredging window to the maximum extent practicable, beach disposal will occur outside of the North Carolina sea turtle nesting season of May 1 through November 15. The limits of the nesting season window are based on the known nesting sea turtle species within the State and the earliest and latest documented nesting events for those species.

Considering that the proposed beach disposal windows for Bogue and Shackleford Banks will avoid the nesting season, direct impacts associated with construction activities during the nesting season are not anticipated and will be avoided to the maximum extent practicable.

Indirect impacts associated with changes to the nesting and incubating environment, from the disposal of sediment from alternate sources on the beach, are expected. The following section discusses both potential direct and indirect impacts to nesting sea turtles associated with the proposed project:

Section 4.01 General Impacts, describes the noise impacts on sea turtles.

(1) Beach disposal of Sediment Impacts.

Post-nourishment monitoring efforts have documented potential impacts on nesting loggerhead sea turtles for many years (Fletemeyer 1984; Raymond 1984; Nelson and Dickerson 1989; Ryder 1993; Bagley et al. 1994; Crain et al. 1995; Milton et al. 1997; Steinitz et al. 1998; Trindell et al. 1998; Davis et al. 1999; Ecological Associates, Inc. 1999; Herren 1999; Rumbold et al. 2001; Brock 2005). Results from these studies indicate that, in most cases, nesting success decreases during the year following nourishment as a result of escarpments obstructing beach accessibility, altered beach profiles, and increased compaction. A comprehensive post-nourishment study conducted by Ernest and Martin (1999) documented an increase in abandoned nest attempts on nourished beaches compared to control or pre-nourished beaches as well as a change in nest placement with subsequent increase in wash-out of nests during the beach equilibration process. Contrary to previous studies, this study suggests that a post-nourishment decline in nest success is more likely a result from changes in beach profile than an increase in beach compaction and escarpment formation. According to Brock (2005), the sediment used for the nourishment of Brevard County beaches in Florida offered little or no impediment to sea turtles attempting to excavate an egg chamber. Furthermore, the physical attributes of the nourished sediment did not facilitate excessive scarp formation and; therefore, turtles were not limited in their ability to nest across the full width of beach. However, a decrease in nest success was still documented in the year following nourishment with an increase in loggerhead nesting success rates during the second season post-nourishment. This was attributed to increased habitat availability following the equilibration process of the seaward crest of the berm. This study suggests that, if compatible sediment and innovative design methods are utilized to minimize post-nourishment impacts documented in previous studies, than the post-nourishment decrease in nest success without the presence of scarp formations, compaction, etc. may indicate an absence of abiotic and or biotic factors that cue the female to initiate nesting.

As suggested by the historical literature, there are inherent changes in beach characteristics as a result of mechanically placing sediment on a beach from alternate sources. The change in beach characteristics often results in short-term decreases in nest success and/or alterations in nesting processes. Based on the available literature, it appears that these impacts are, in many cases, site specific. Careful consideration must be placed on pre- and post-project site conditions and resultant beach characteristics after beach-fill episode at a given site in order to thoroughly understand identified post-project changes in nesting processes. By better understanding potential project specific impacts, modifications to project templates and design can be implemented to improve habitat suitability. The following sections review, more specifically, documented direct or indirect impacts to nesting females and hatchlings.

a. Pipe Placement.

Any sediment placed along the beaches will take place from November 16 to April 30 on Bogue Banks and November 16 to March 31 on Shackleford Banks. No work associated with beach disposal, including pipeline placement on the beach or in the water, staging of equipment on the beach, nor construction operations will take place outside of this window.

b. Slope and Escarpments.

The proposed beach disposals of dredged materials are designed and constructed to equilibrate to a more natural profile over time relative to the wave climate of a given area. Changes in beach slope as well as the development of steep escarpments may develop along the mean high water line as the constructed beach adjusts from a construction profile to a natural beach profile (Nelson et al. 1987). For the purposes of this assessment, escarpments are defined as a continuous line of cliffs or steep slopes facing in one general direction, which is caused by erosion or faulting. Depending on shoreline response to the wave climate and subsequent equilibration process for a given project, the slope both above and below mean high water may vary outside of the natural beach profile; thus resulting in potential escarpment formation. Though escarpment formation is a natural response to shoreline erosion, the escarpment formation as a result of the equilibration process during a short period following a beach disposal event may have a steeper and higher vertical face than natural escarpment formation and may slough off more rapidly landward.

Adult female turtles survey a nesting beach from the water before emerging to nest (Carr and Ogren 1960; Hendrickson 1982). Parameters considered important to beach selection include the geomorphology and dimensions of the beach (Mortimer 1982; Johannes and Rimmer 1984) and bathymetric features of the offshore approach (Hughes 1974; Mortimer 1982). Beach profile changes and subsequent escarpment formations may act as an impediment to a nesting female resulting in a false crawl or nesting females may choose marginal or unsuitable nesting areas either within the escarpment face or in front of the escarpment. Often times these nests are vulnerable to tidal inundation or collapse of the receding escarpment. If a female is capable of nesting landward of the escarpment prior to its formation, as the material continues to slough off and the beach profile approaches a more natural profile, there is a potential for an incubating nest to collapse or fallout during the equilibration process. Loggerheads preferentially nest on the part of the beach where the equilibration process takes place (Brock 2005; Ecological Associates, Inc. 1999) and are more vulnerable to fallout during equilibration. However, according to Brock (2005), the majority of green turtle nests are placed on the foredune and; therefore, the equilibration process of the beach disposal event substrate may not affect green turtles as severely.

A study conducted by Ernest and Martin (1999) documented increased abundance of nests located further from the toe of the dune on nourished vs. control beaches. Thus, post beach disposal event nests may be laid in high-risk areas where vulnerability to sloughing and equilibration are greatest. Though nest relocation is not encouraged, considering that immediately following beach disposal event the likelihood of beach profile equilibration and subsequent sloughing of escarpments as profile adjustment occurs, nest relocation may be used as a last alternative to move nests that are laid in locations along the beach that are vulnerable to fallout (i.e. near the mean high water line). As a beach disposal event beach is re-worked by natural processes and the construction profile approaches a more natural profile, the frequency of escarpment formation declines and the risk of nest loss due to sloughing of escarpments is reduced. According to Brock (2005), the return of loggerhead nesting success to equivalent rates similar to those on the adjacent non-nourished beach and historical rates two seasons post-nourishment were observed and are attributed to the equilibration process of the seaward crest of the berm.

Though the equilibration process and subsequent escarpment formation are features of most beach projects, management techniques can be implemented to reduce the impact of escarpment formations. For completed sections of beach during beach disposal events, and for subsequent years following as the construction profile approaches a more natural profile, visual surveys for escarpments could be performed. Escarpments that are identified prior to or during the nesting season that interfere with sea turtle nesting (exceed 18 inches in height for a distance of 100 ft.) can be leveled to the natural beach for a given area. If it is determined that escarpment leveling is required during the nesting or hatching season, leveling actions will be directed by the NCWRC and USFWS.

c. Incubation Environment.

Physical changes in sediment properties that result from the placement of sediment, from alternate sources, on the beach pose concerns for nesting sea turtles and subsequent nest success. Constructed beaches have had positive effects (Broadwell 1991; Ehrhart and Holloway-Adkins 2000; Ehrhart and Roberts 2001), negative effects (Ehrhart, 1995 Ecological Associates, Inc. 1998), or no apparent effect (Raymond 1984.; Nelson et al. 1987; Broadwell 1991; Ryder 1993; Steinitz et. al. 1998; Herren 1999) on the hatching success of marine turtle eggs. Differences in these findings are related to the differences in the physical attributes of each project, the extent of erosion on the pre-existing beach, and application technique (Brock 2005).

If nesting occurs in new sediment following beach construction activities, embryonic development within the nest cavity can be affected by insufficient oxygen diffusion and variability in moisture content levels within the egg clutch (Ackerman 1980; Mortimer 1990; Ackerman *et al*. 1992); thus, potentially resulting in decreased hatchling success.

Ambient nest temperature and incubation time are affected by changes in sediment color, sediment grain size, and sediment shape as a result of beach nourishment (Milton *et al.* 1997) and; thus, affect incubation duration (Nelson and Dickerson 1988*a*). Sexual differentiation in chelonians depends on the temperature prevailing during the critical incubation period of the eggs (Pieau 1971; Yntema 1976; Yntema and Mrosovsky 1982; Bull and Vogt 1979), which occurs during the middle third of the incubation period (Yntema 1979; Bull and Vogt 1981; Pieau and Dorizzi 1981; Yntema and Mrosovsky 1982; Ferguson and Joanen 1983; Bull 1987; Webb et al. 1987; Deeming and Ferguson 1989; Wibbels *et al*. 1991), and possibly during a relatively short period of time in the second half of the middle trimester (Webster and Gouviea 1988). Eggs incubated at constant temperatures of 28°C or below develop into males. Those kept at 32°C or above develop into females. Therefore, the pivotal temperature, those giving approximately equal numbers of males and females, is approximately 30°C (Yntema and Mrosovsky 1982). Estimated pivotal temperatures for loggerhead sea turtles nesting in North Carolina, Georgia, and southern Florida are close to 29.2°C (Mrosovsky and Provancha 1989). Therefore, fluctuation in ambient nest temperature on constructed beaches could directly impact sex determination if nourished sediment differs significantly from that found on the natural beach. Since, the pivotal temperatures for the northern and southern geographic nesting ranges of loggerheads in the United States are similar, a higher percentage of males are produced on North Carolina beaches and a higher percentage of females on Florida beaches. Hatchling sex ratios are of conservational significance (Mrosovsky and Yntema 1980; Morreale *et al*. 1982) since they may affect the population sex ratio and thus could alter reproductive success in a population (Herren et al. 1999).

d. Nest Relocation.

Relocation of sea turtle nests to less vulnerable sites was once common practice throughout the southeastern U.S. to mitigate the effects of natural or human induced factors. However, the movement of eggs creates opportunities for adverse impacts. Therefore, more recent USFWS guidelines are to be far less manipulative with nests and hatchlings to the maximum extent practicable. Though not encouraged, nest relocation is still used as a management technique of last resort where issues that prompt nest relocation cannot be resolved. Potential adverse impacts associated with nest relocation include: survey error (Shroeder 1994), handling mortality (Limpus et al*.* 1979; Parmenter 1980), incubation environment impacts (Limpus *et al*. 1979; Ackerman 1980; Parmenter 1980; Spotila et al. 1983; McGehee 1990), hatching and emergence success, and nest concentration.

Beach disposal event efforts associated with this project are scheduled, to work outside of the sea turtle nesting season in order to avoid impacts to nesting females and the nest incubation environment. Therefore, we are not proposing to relocate any sea turtle nests in the project area.

e. Beach Compaction and Hardness.

Sediment placed on the beach, as a component of shoreline protection projects, beach disposal, sand-bypassing, etc. is often obtained from three main sources: inlets, channels, or offshore borrow sites (Crain et al. 1995) with occasional use of upland sources. Significant alterations in beach substrate properties may occur with the input of sediment types from other sources. Sediment density (compaction), shear resistance (hardness), sediment moisture content, beach slope, sediment color, sediment grain size, sediment grain shape, and sediment grain mineral content can be changed by beach nourishment.

Current sea turtle literature has attributed post-nourishment beach hardness to sand compaction but it should be more appropriately attributed to sediment shear resistance. Increased shear resistance can be due to increased sand compaction (density), but it can also be due to other factors such as sand particle characteristics (size, shape) and interactions between the particles (Spangler and Handy 1982;Nelson et al. 1987; Nelson and Dickerson 1989; Ackerman 1996). Shear resistance describes the ability of the beach sand to resist sliding along internal surfaces. A measure of shear resistance can be described as a measure of beach hardening or strength. The sand particle surface characteristics contribute to the sliding friction ability of the sand particles. Various parameters (chemical composition, cohesion, moisture content, sediment layering and mixing) contribute to the interlocking ability of the sand particles. Sliding friction, interlocking, and compaction of the sand particles all contribute to a measure of shear resistance. Thus, a measurement of increased shear resistance does not necessarily mean that the beach is also compacted (Ackerman 1996).

Factors which may contribute to increased beach hardness (shear resistance) on nourished beaches include a high silt component, angular fine-grained sand, higher moisture content, equipment and vehicular traffic, and hydraulic slurry deposition of sediments (Nelson 1985; Nelson et al, 1987; Nelson and Dickerson 1988a; 1989; Ackerman 1996). Beach fill can vary in amount of carbonate sand, quartz sand, shell, coral, silt, and clay content (National Research Council 1995). Sediments used for beach fill with clay or silt contents higher than 5-10% may cause high beach hardness once the sediment dries (Nelson 1985; Dean 1988). Harder nourished beaches typically result from angular, finer grain sand dredged from stable offshore borrow sites; whereas, less hard or “softer” beaches result from smoother, coarse sand dredged from high energy locations (e.g. inlets) (Spangler and Handy 1982; Nelson et al, 1987; Nelson and Dickerson 1988a; 1989). Nourished beaches may result in sediment moisture content more than 4% higher than adjacent, natural beaches (Ackerman 1996, Ackerman et al. 1992). Placement of fill material with heavy equipment imparts a component of “compactness” that should not occur on natural beaches. The natural process of beach formation, over an extended period of time, results in extensive sorting of the sand both by layers and within layers. Layer orientation is determined by the wave wash which is not the same for nourished beaches (National Research Council 1995).

Hard sediment can prevent a female from digging a nest or result in a poorly constructed nest cavity. Females may respond to harder physical properties of the beach by spending more time on the beach nesting, which may result in physiological stress and increased exposure to disturbances and predation; thus, in some cases leading to a false dig (Nelson and Dickerson 1989). Although increased shear resistance does not occur with every nourishment project, higher shear resistance measurement values have been more frequently reported over the past 30 years from nourished beaches than on natural beaches of the same area (e.g. Mann 1977; Fletemeyer 1983; Raymond 1984; Nelson et al. 1987; Moulding and Nelson 1988; Nelson and Dickerson 1988a; Ryder 1995; Bagley et al. 1994; Crain et al. 1995; Ernest et al. 1995; Foote and Truitt 1997; Milton et al. 1997; Steinitz et al. 1998; Trindell et al. 1998; Davis et al. 1999; Herren 1999; Allman et al. 2001; Rumbold et al. 2001; Piatkowski 2002; Scianna et al. 2001; Brock, 2005). Results have varied tremendously on the nesting success reported in these studies when comparing nourished and natural beaches of different shear resistance values. The natural variance in shear resistance values and the nesting success related to these values is still poorly understood. Due to the many variables involved from natural and non-natural causes, it is extremely difficult to identify impacts from nourishment projects by only evaluating nesting success data. Analyses of shear resistance values and nesting success have yet to determine a consistent relationship (Trindell et al. 1998). It is difficult to define absolute or optimal shear resistance values until these relationships are better understood throughout the sea turtle nesting range in the United States (Gulf and South Atlantic states). Crain et al. (1995) also recommended this as a research priority for beach nourishment impact studies.

Measuring shear resistance has become a common procedure of most beach nourishment projects and is usually done with a hand-held cone-penetrometer (Crain et al 1995). While holding the instrument in a vertical orientation, measurements are obtained by manually pushing it into the beach sediment. Based on data collected during the 1980's from nourished and non-nourished projects on the Atlantic coast of Florida, the USACE provided initial guidelines on maximum cone-penetrometer values (600) below which might be more compatible with natural nesting beaches (Nelson et al. 1987; Moulding and Nelson 1988; Nelson et al. 1987; Nelson and Dickerson 1988a; 1989). The USFWS later adopted these guidelines into permitting regulations for all nourished projects along the U.S. Atlantic and Gulf of Mexico coasts with potential sea turtle nesting habitat. These requirements are still in effect to date and are outlined in state construction permit requirements and Biological Opinions issued by USFWS dated 22 July 2003. According to the general USFWS compaction measurement guidelines for NC outlined below, compaction measurements of 500 PSI establishes the level of beach hardness when post-nourishment beach tilling should be done to reduce the shear resistance measurements.

General USFWS Compaction Guidelines

1. Compaction sampling stations will be located at 500-foot intervals along the project area. One station will be at the seaward edge of the dune line (when material is placed in this area); and one station must be midway between the dune line and the high water line (normal wrack line).

At each station, the cone penetrometer will be pushed to a depth of 6, 12, and 18 inches three times (three replicates). Material may be removed from the hole if necessary to ensure accurate readings of successive levels of sediment. Layers of highly compact material may lie over less compact layers. Replicates will be located as close to each other as possible, without interacting with the previous hole and/or disturbed sediments. The three replicate compaction values for each depth will be averaged to produce final values for each depth at each station. Reports will include 18 values for each transect line, and the final 6 averaged compaction values.

2. If the average value for any depth exceeds 500 pounds per square inch (psi) for any two or more adjacent stations, then that area must be tilled prior to May 1. If values exceeding 500 psi are distributed throughout the project area, but in no case do those values exist at two adjacent stations at the same depth, then consultation with the Fish and Wildlife Service will be required to determine if tilling is required. If a few values exceeding 500 psi are randomly present within the project area, tilling will not be required. For all circumstances where tilling is implemented, the designated area shall be tilled to a depth of 36 inches. Tilling will be performed (i.e. overlapping rows, parallel and perpendicular rows, etc.) so that all portions of the beach are tilled and no furrows are left behind All tilling activities must be completed prior to May 1 in accordance with the following protocol.

Readings of cone index values can be roughly equated to pounds per square inch (psi). However, this is a relative value and caution should be used when attempting to compare cone index values in pounds per square inch to other sources of data (Moulding and Nelson 1988). Ferrel et al. (2002) and Piatkowski (2002) used a Lang penetrometer, as opposed to the cone-penetrometer, because readings are not influenced by the mass of the user. This is an issue when multiple people of varying mass and strength are conducting the measurements. Much of the variation in the compaction data could be due to variability inherent in the use of the cone-penetrometer itself. Ferrell *et al.* (2002) investigated the strengths and weaknesses of several different types of instruments that measure sediment compaction and shear resistance suggesting that other instruments may be more suitable for measuring beach compaction relative to sea turtle nesting behavior. Because of instrument error and given that turtles do not dig vertically in the same fashion as a penetrometer moves through the sediment layers, some have concluded that penetrometers are not appropriate for assessing turtle nesting limitations (Davis et al. 1999). However, even with this limitation, the hand-held cone-penetrometer remains the accepted method for assessing post-nourishment beach hardness.

According to Davis et al. (1999), on the Gulf Coast of Florida (1) there was no relationship between turtle nesting and sediment compactness, (2) the compactness ranges and varies widely in both space and time with little rationale, (3) tilling has a temporary influence on compactness and no apparent influence on nesting frequency, (4) and current compactness thresholds of 500 pounds per square inch (psi) are artificial. According to Brock (2005), the physical attributes of the fill sand for Brevard

County beaches did not result in severe compaction and therefore did not physically impede turtles in their attempts to nest. Therefore, additional studies should be considered to evaluate the validity of this threshold (500 PSI) and its general application across all beaches as a means to assess beach-tilling requirements. If sediment characteristics are similar to the native beach and sediment grain sizes are homogenous, the resultant compaction levels will likely be similar to the native beach and tilling should not be encouraged. A study by Nelson and Dickerson (1988b) documented that a tilled nourished beach will remain un-compacted for up to one year; however, this was a site-specific study and for some beaches it may not be necessary to till beaches in the subsequent years following nourishment.

Beach hardness impacts can be minimized by placing sand similar to the native beach In some cases, though sediment placed on the beach is similar to the native sediment characteristics and the resultant compaction is similar to the native beach, tilling is still encouraged regardless of compaction levels. It has been suggested that, in some cases, the process of tilling a beach, with compaction levels similar to native beach, may have an effect on sea turtle nesting behavior and nest incubation environment. Research on evaluating tilling impacts to nesting turtles is limited. Therefore, the idea of not tilling beaches (immediately following and/or during consecutive years after construction operations) where compatible sediments are used and compaction levels are similar to the native beach should be taken into consideration on a case-by-case basis in order to account for potential impacts of tilling activities on nest success.

Recognizing the recent literature on beach compaction measurements and associated tilling, as well as and the current concerns with the existing compaction evaluation and subsequent tilling process outlined in the USFWS general compaction guidelines, the USACE, in coordination with NCWRC and USFWS, has initiated a more qualitative approach for post construction compaction evaluations on North Carolina beaches where sediment meets the state compatibility standard. Results from this effort have recognized a reduction in the need for post construction tilling for many disposal and nourishment projects. Considering that only beach quality sediment will be placed on the beach as a component of this project, the USACE will continue to work with the Cape Lookout National Seashore (National Park Service), NCWRC and USFWS in this qualitative post construction compaction and tilling evaluation in order to assure that impacts to nesting and incubating sea turtles are minimized.

f. Lighting.

During beach disposal operations associated with the proposed project, lighting is required during nighttime activities at both the dredging site and the location on the beach where sediment is being placed. In compliance with the USACE Safety and Health Requirements Manual (2003), a minimum luminance of 30 lm/ft^2 is required for dredge operations and a minimum of 3 lm/ft^2 is required for construction activities on the beach. For dredging vessels, appropriate lighting is necessary to provide a safe working environment during nighttime activities on deck (i.e. general maintenance work deck, endangered species observers, etc.). During beach disposal operations, lighting is generally associated with the active construction zone around outflow pipe and the use of heavy equipment in the construction zone (i.e. bulldozers) in order to maintain safe operations at night.

Since all beach disposal events for the DMMP will take place outside the sea turtle nesting season (November 16 to April 30), the presence of artificial lighting on or within the vicinity of nesting beaches would not be detrimental to nesting female emergence, nest site selection, and the nocturnal sea-finding behavior of both hatchlings and nesting females.

g. Sediment Grain Size Analysis and Color of Maintenance Material Dredged from the Morehead City Harbor Navigation Channel Sediment Placed on Shackleford And Bogue Banks.

From the sediment analysis and surveys (USACE 2008, USACE 2002, and USACE 2011) the following conclusions can be made.

a. Grain size analysis. On Shackleford Banks, the mean grain size of beach sediments from the DB to the mean low water contour and from the trough to the -24 foot depth is 0.532 mm and 0.250 mm respectively. The maintenance sediment from the Morehead City Harbor navigation channels had a mean grain size of 0.267 mm. The frequency distributions of Shackleford Banks sediments from the TR to -24 ft portion of the beach were similar to the grain size distributions of the Morehead City Harbor sediments considered for beach disposal. The DB to -24 ft grain size frequency distribution for Shackleford sediments were slightly more negatively skewed (coarser) and flatter (less kurtosis) than the Harbor sediment distribution. Shackleford Banks sediments above the bar were typically coarser than Outer Harbor sediments and particularly so in the surf zone. The Shackleford Banks dune, dune base, and berm crest (mean grain sizes of 0.306 mm, 0.338 mm, and 0.359 mm respectively) were also coarser than Morehead City Harbor sediments (0.267 mm) but not as different as the beach sediments that included surf zone portions of the beach. The Morehead City Harbor sediments had slightly more slit content (passing #230 sieve) at 3.6% vs. 1.0 % from the Shackleford Banks DB to -24 ft sediment. The maintenance sediment from the navigation channel has slightly more visual shell content (16.0 % vs. 13.9 % DB to the -24 foot depth on Shackleford) than the native beach on Shackleford Banks.

On Shackleford Banks, the standard deviation of the native sediment from the base of the dune to the mean low water contour and from the trough to the -24 foot depth is 1.29 phi and 0.88 phi, respectively. The Harbor sediments had a standard deviation of 0.84 phi. These differences mean that both sediments are moderately sorted and the Shackleford sediments are less sorted than the Outer Harbor sediments.

Sediments used to replace natural beach sand should match the natural beach as closely as possible in order to minimize environmental effects. While the scientific literature agrees with this statement in principle, there is little data available to quantify precisely what similarity (or difference) is ecologically significant. Outer Harbor sediments at the time of disposal would be similar in terms of grain size distributions to portions of the Shackleford beach profile (specifically the submarine portions of the beach profile) and finer than other portions (specifically the subaerial portions of the beach). Harbor sediments placed on Shackleford Banks would be mobilized and redistributed under a variety of environmental conditions including winds, waves, longshore currents, offshore currents, and tides. As sand travels from the beach to the dunes, the coarse end of the placed sediment would likely lag behind, rendering the size curves better sorted and also positively skewed.

Over the long term, the speed and degree of ecological recovery largely depend on the physical characteristics of the beach habitat, mainly determined by (1) sediment quality and quantity, (2) the nourishment technique and strategy applied, (3) the location and the size of nourishment and (4) the physical environment prior to nourishment (Speybroeck, J. et al. 2006).

b. Color analysis. The maintenance sediment from the Morehead City Harbor navigation channel is slightly redder in hue (10 YR vs. 2.5 Y), slightly lighter in value (8 vs. 7), and slightly grayer in chroma (1 vs. 2) than the Shackleford Banks native beach.

The majority of the sediment from the navigation channel is only one increment higher or lighter than the native Shackleford beach (i.e., 8 vs. 7 on the native beach).

From the Munsell hue, value, and chroma measurements, there does not appear to be a significant difference between the color of the Shackleford native beach and the dredged sediment from the navigation channel.

Other Considerations

Two other considerations discussed in the following paragraphs were used to provide additional perspectives regarding the sediment proposed for disposal on Bogue Banks and Shackleford Banks and the sand of the receiving beaches. However, neither of these considerations represent requirements that directly apply to the DMMP disposal of dredged material from the Morehead City Harbor federal navigation project .

1. NC Technical Standards. Within the State of North Carolina's Coastal Management Program including !5A NCAC 07H .0312 TECHNICAL STANDARDS FOR BEACH FILL PROJECTS (hereafter the NC Technical Standards). These NC Technical Standards regard disposal of sediment along the oceanfront shoreline, referred to as beach fill. Beach fill projects include beach nourishment, dredged material disposal, habitat restoration, storm protection, and erosion control. The NC Technical Standards provide requirements for these projects to be permitted particularly with regard to characterization of sediment on the recipient beach and the sediment being placed. Within the NC Technical Standards, characterization of the recipient beach is not required for the disposal of sediment directly from and completely confined to a federally or state maintained navigation channel. For this reason, the NC Technical Standards do not specifically apply to the disposal of dredged material from the Morehead City Harbor federal navigation project.

The Shackleford Banks beach was sampled using methods similar to those specified in the NC Technical Standards (07 H.0312 (1)(c) and (d). The sampling of Shackleford included about 14 sediment samples were taken along each of 46 shore-perpendicular transects (from the beach dune to -30 foot elevation) about every 1,000 feet of shoreline on Shackleford Banks from Barden (Transect 00) to Beaufort (Transect 460) Inlets. Five samples were taken above MLW and eight samples were taken below MLW on Shackleford. The NC Technical Standards require a minimum of 5 shore perpendicular transects evenly spaced throughout the entire project area (but spaced no more than 5000 feet apart). The NC Technical Standards require transect to extend from the frontal dune crest seaward to a depth of -20 feet (6.1 meters) or to the shore-perpendicular distance 2,400 ft seaward of mean low water, whichever is in a more landward position. The total number of samples taken landward of MLW shall equal the total number of samples taken seaward of MLW.

Specific grain size analysis categories and composite approaches are required by the NC Technical Standards. These were performed for the Shackleford samples.

The NC Technical Standards indicate that sediment is compatible for use as beach fill if the following five criteria (i.e., a through e, below) are met:

a. Fine grained (less than 0.0625 mm) sediment is less than 10%,

b. The average percentage of fine grained (less than 0.0625 mm) sediment is less than 5% of the recipient beach, and

c. The average percentage of calcium carbonate (% shell) does not exceed 15% of the recipient beach.

d. The average percentage by weight of granular sediment (greater than or equal to 2 mm and less equal to 4.76 mm) in a borrow site shall not exceed the average percentage by weight of coarse sand sediment of the recipient beach characterization plus 5%.

e. The average percentage by weight of gravel (greater than or equal to 4.76 mm) in a borrow site shall not exceed the average percentage by weight of gravel sized sediment for the recipient beach characterization plus 5%.

Table J-6 below summarizes information applicable to the NC Technical Standards and all data found in Table J-6 is summarized from USACE 2002, USACE 2008, and USACE 2011. For all sediment samples on Bogue Banks, Shackleford Banks, and the Morehead City Harbor dredged material the percentage of visual shell (% visual shell) was visually estimated during the sieving procedure. The following paragraphs describe how the proposed action complies with the NC Technical Standards:

a. and b. The Morehead City Harbor sediments contain less than 10% fines (3.6% passing the #230 sieve (0.063 mm). For this comparison with the NC Criteria, the Shackleford dune (DN) to -24 ft data composite best matches the frontal dune to -20 ft depth sampling composite described in the NC Technical Standards. This Shackleford composite (recipient beach) contained 1.0% #230 fines. The Harbor sediment is less than 5% of the Shackleford sediment (i.e., 3.6% is less than 6% (1% plus 5% = 6%)).

c. The Morehead City Harbor sediments contains 16.0% visual shell. The Shackleford dune (DN) to -24 ft data composite best matches the frontal dune to -20 ft depth sampling composite described in the NC Technical Standards. This Shackleford composite (recipient beach) contained 13.9% visual shell. The Harbor sediment does not exceed 15% of the recipient beach (i.e., 16.0% is less than 28.9% (13.9% + 15% = 28.9%)).

d. Sediment which is greater (coarser) than or equal to 2 mm and less (finer) than 4.76 mm is the difference between that retained by the # 10 sieve (2.0 mm) and the #4 sieve (4.76 mm). For the Morehead City Harbor sediments the percent passing #4 sieve is 98.1% and passing #10 is 95.4%, a difference of 2.7%. For Shackleford Banks (DN to -24 depth) the percent passing the #4 sieve is 96.6% and passing the #10 sieve is 92.5%, a difference of 4.1%. The Harbor sediment is less than 5% of the Shackleford sediment (i.e., 2.7% is less than 9.1% (4.1% plus 5% = 9.1%)).

e. The sieve size of gravel (greater than or equal to 4.76 mm) is greater than the #4 sieve. The Morehead City Harbor sediment percent passing the #4 sieve is 98.1 and Shackleford Banks (DN to -24 foot depth) is 96.6. That means that the Harbor sediment is 1.9% (100 - 98.1 = 1.9%). Shackleford Banks is 3.4% (100 - 96.6 = 3.4%). Again the Harbor sediment is less than 5% of the Shackleford sediment (i.e., 1.9% is less than 8.4% (3.4% plus 5% or 8.4%).

Based on the sediment analysis, the Morehead City Harbor maintenance sediment meets the North Carolina compatibility criteria for disposal on Shackleford Banks.

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Sediment	No. of Samples	mm	phi	Std Dev phi	% Passing #4 sieve nominal size 4.76 mm	%Passing #10 sieve nominal size - 2.00 mm	% Passing #200 sieve nominal size - 0.074 mm	% Passing #230 sieve nominal size - 0.063 mm	%Visual Shell
Morehead City Outer Harbor Channel Sediments	130	0.267	1.90	0.84	98.1	95.4	3.6	3.6	16.0
Shackleford Banks Data All	647	0.323	1.63	1.10	96.7	92.9	1.9	1.5	12.3
Shackleford Banks Data DN to -24 ft	598	0.339	1.56	1.13	96.6	92.5	1.2	1.0	13.0
Shackleford Banks Data DB to -24 ft	552	0.344	1.54	1.20	96.3	91.9	1.3	1.0	13.9
Shackleford Banks Data DB to MLW	230	0.532	0.91	1.29	94.2	87.1	0.4	0.4	22.2
Shackleford Banks Data TR to -24 ft	322	0.25	2.00	0.88	97.8	95.3	1.9	1.5	8.0
Ft Macon	34	0.213	2.23	0.80	NR	99.0	1.6	NR	10.9
Atlantic Beach	82	0.183	2.45	0.79	NR	98.7	3.4	NR	7.1
Pine Knoll Shores	102	0.188	2.41	0.81	NR	98.4	3.6	NR	8.9
Indian Beach	34	0.205	2.28	0.93	NR	98.2	3.2	NR	10.9
East Emerald Isle	47	0.203	2.30	0.74	NR	98.8	2.6	NR	6.3
West Emerald Isle	67	0.193	2.37	0.68	NR	98.7	2.4	NR	4.9
Bogue Inlet Area	51	0.189	2.40	0.52	NR	98.9	1.9	NR	4.0

Table J-6. Summarizes Sediment Data Applicable to the North Carolina Technical Standards. All sediment data taken from USACE 2002, USACE 2008, and USACE 2011

Overfill Ratio [1]	MEAN (phi)	STD DEV (phi)	EPM [2]	ESM [3]
Morehead City Outer Harbor	1.90	0.84	NA	NA
Shackleford Banks Native Data DN to -24	1.56	1.13	1.22	1.49

[1] Assumed: Berm Height = 6' Berm Width = 150' Significant Wave Height = 6.2'
[2] Dean's (1991) Equilibrium Profile Method
[3] Pilarczyk et al. (1986) Equilibrium Slope Method

Table J-7. Summary of Overfill Ratios Calculated for the Disposal of Sediment on Shackleford Banks. All calculations used sediment data from USACE 2008 and 2011.

2. Overfill Ratio or Factor. Once Harbor sediment is placed on Shackleford beach, waves and currents will redistribute the material offshore and alongshore until a stable configuration is achieved. Depending on local conditions, sediment placed on Shackleford Banks may take several months or years to reach the equilibrium condition. The overfill ratio or factor is defined as the volume of material required to produce a unit volume of stable beach with the same grain size distribution as the native beach material.

An overfill factor is commonly used to evaluate the compatibility of the sediments and to relate the volume of borrow site sediment required for a project to perform similarly or comparably to the native beach sand. Thus, an "overfill" factor of 1.0 indicates direct compatibility (that is, borrow and native sands are identical) and an "overfill" factor of 1.1 indicates that the borrow site material is finer and thus 10 percent additional material disposal (coverage) is required to compensate for the incompatibility and expected loss of fine sediments. In other cases, the sediment size is predetermined because the sand is a by-product of an inlet channel maintenance project, and thus the design professional is evaluating only the expected longevity of the project.

There are a number of methods used to compute the overfill ratios, these include: Dean's (1991) Equilibrium Profile Method (EPM) and Pilarczyk, Van Overeem, and Bakker's (1986) Equilibrium Slope Method (ESM). These methods are briefly discussed below.

The Dean's equilibrium profile method (Dean 1991) determines the volume of recharged sand of a given grain size to increase the width of dry beach by a given amount. Dean (1991) proposed that beach profiles develop a characteristic parabolic equilibrium profile.

The equilibrium slope method by Pilarczyk, van Overeem and Bakker (1986) bases the recharged profile on the present native profile. However if the grain size of the harbor sediment is different from the native beach, the profile steepness is altered.

Table J-7, above shows the results of the Dean's (1991) EPM and Pilarczyk et al. (1986) ESM methods of calculating the overfill ratios for the disposal of Morehead City Harbor sediment on Shackleford Banks. Both EPM and ESM overfill ratios used the sediment data taken from USACE 2008 and USACE 2011. The range of the overfill ratio's are from 1.22 to 1.49. The USACE believes that Dean's (1991) EPM overfill ration of 1.22 is considered to be the most reliable overfill ration based on previous engineering experience and results. Dean's (1991) EPM includes mathematical terms which take into consideration the fill height, the fill width, the significant wave height along with the native beach, and fill grain size mean and standard deviation.

(2) Dredging Impacts.

a. Food Supply.

After leaving the nesting beach, hatchling green and loggerhead turtles head towards the open ocean pelagic habitats (Carr 1987) where their diet is mostly omnivorous with a strong carnivorous tendency in green turtles (Bjorndal 1985). At about 20-25 cm carapace length Atlantic green turtles enter benthic foraging areas and shift to an herbivorous diet, feeding predominantly on sea grasses and algae but may also feed over coral reefs and rocky bottoms (Mortimer 1982). At about 40 to 50 cm carapace length, loggerheads move into shallow water where they forage over benthic hard and soft bottom habitats (Carr 1986). Loggerhead sea turtles feed on benthic invertebrates including mollusks, crustaceans, and sponges (Mortimer 1982) but have also been found to eat fish, clams, oysters, sponges, jellyfish, shrimp, and crabs when near shore. Hawksbill and Kemp's ridley sea turtles are carnivorous (Mortimer 1995) with a principal food source of crustaceans, mollusks, other invertebrates, and fish (Schwartz 1977). Hawksbills feed on encrusting organisms such as sponges, tunicates, bryozoans, mollusks, and algae; whereas Kemp's ridleys feed predominantly on portunid crabs (Bjomdal 1985). Leatherback sea turtles are carnivorous (Mortimer 1995) and feed primarily on cnidarians and tunicates (salps, pyrosomas) throughout the water column but are commonly observed feeding at the surface (Bjomdal 1985).

Dredging will be performed only within the existing authorized navigation channels within the Inner and Outer Morehead City Harbor and will not affect these resources in the inshore environment. Impacts on benthic habitat within the Nearshore Placement Areas off Bogue and Shackleford Banks will be minor as dredging will only affect a limited portion of the offshore benthic habitat. Hardbottom surveys and subsequent mapping were performed within all proposed placement areas (i.e., within the -25 foot depth of closure from Bogue to Beaufort Inlets and nearshore shore placement areas off Bogue and Shackleford Banks) and diver ground truth surveys were performed to characterize select sites within the -25 foot depth of closure from Bogue to Beaufort Inlets and side scan sonar surveys were completed within the nearshore placement areas. Impacts to sandy bottom foraging habitat are expected to be isolated and short term in duration. Therefore, the project should not significantly affect the food supply of benthic foraging sea turtles along the beach strand or in the offshore placement areas. Considering that leatherbacks feed primarily within the water column on non-benthic organisms, the project should not significantly affect the food supply of this species

b. Relationship to Critical Periods in Life Cycle.

Sea turtles migrate within North Carolina waters throughout the year, mostly between April and December. The dredging of sediment from designated and existing federal navigation channels will be performed using either a pipeline dredge, bucket and barge dredge or a hopper dredge. Hopper dredges potentially pose the greatest risk to benthic oriented sea turtles through physical injury or death by entrainment as the hopper dredge drag heads remove sediment from sea bottom.

In order to minimize potential impacts, hopper dredges will be used from January 1 to March 31, the timeframe when water temperatures are cooler and sea turtle abundance is low, generally <14°C (57.2°F). This hopper dredging window is more stringent than the December 1 to March 31 dates specified in the 1997 Regional Biological Opinion for the Continued Hopper Dredging Of Channels And Borrow Areas In the Southeastern United States. Minor deviations in the January 1 to March 31 dredging window (less than 1 week on either end of the window) may occur if approved by the Wilmington District Commander. However, because some sea turtle species may be found year-round in the offshore area, hopper-dredging activities may occur during low levels of sea turtle migration. Therefore, the proposed hopper dredging activities may adversely affect loggerhead, green, hawksbill, and Kemp's ridley sea turtles. Based on historic hopper dredging take data, leatherback sea turtles are not known to be impacted by hopper dredging operations. The USACE will abide by the provisions of the September 25, 1997 Regional Biological Opinion for The Continued Hopper Dredging Of Channels And Borrow Areas In The Southeastern United States or any superseding RBO provided by NMFS. To reduce impacts, the USACE anticipates taking certain precautions as prescribed by NMFS and USACE under standard hopper dredging protocol and will maintain observers on hopper dredges for the periods prescribed by NMFS to document any takes of turtle species and to ensure that turtle deflector drag heads are used properly.

(3) Summary Effect Determination.

All five species are known to occur within oceanic waters of the Federal navigation channels; however, only the loggerhead, green, and leatherback sea turtles are known to nest within the limits of the project beach disposal area. Therefore, species specific impacts may occur from both the beach disposal and dredging operations. The proposed DMMP disposal windows for Bogue and Shackleford Banks are: a pipeline dredge would work between the dates of November 16 and April 30 on Bogue Banks and November 16 and March 31 on Shackleford Banks (inclusive); and a hopper dredge would work between January 1 and March 31(inclusive). Considering the proposed dredging window to avoid the sea turtle nesting season to the maximum extent practicable, the proposed project may affect not likely to adversely affect nesting loggerhead, green, and leatherback sea turtles by altering nesting habitat. Since the Kemp's Ridley and Hawksbill sea turtles are not likely to nest on the beaches in the project area, the proposed DMMP is not likely to adversely affect these species.

Though significant alterations in beach substrate properties may occur with the input of sediment types from other sources, re-establishment of a berm and dune system with a gradual slope can enhance nesting success of sea turtles by expanding the available nesting habitat beyond erosion and inundation prone areas. As previously stated, in regards to suitability for nesting, turtles continue to nest on disposal beaches of Bogue Banks with hatch rate successes similar to non-disposal beaches (Matthew Godfrey, Personal Communication, 2010).

In the Morehead City Harbor, hopper dredging takes place only from January 1 to March 31 of any year and complies with the terms and conditions of the Regional Biological Opinion on hopper dredging by NOAA Fisheries, dated September 25, 1997 (NMFS 1997). NMFS Biological Opinion dated September 25, 1997 authorizes the continued hopper dredging of channels and borrow areas in the southeastern United States.

On 18 September 2008, the USACE provided NMFS with a revised Draft South Atlantic Regional Biological Assessment (SARBA). The USACE' SARBA would authorize the following activities: "*Dredging activities in the coastal waters, navigation channels (including designated Ocean Dredged Material Disposal Sites (ODMDS)), and sand mining areas in the South Atlantic Ocean from North Carolina/Virginia Border through and including Key West, Florida and the Islands of Puerto Rico and the U.S. Virgin Islands (USVI)*". Once NMFS provides the USACE with their Biological Opinion, any new conditions or restrictions would supersede the 1997 NMFS Biological Opinion. Hopper dredging within the Morehead City Harbor would comply with any new conditions and/or restrictions of the new NMFS BO.

As indicated in Section 5.00 of this BA (Commitments to Reduce Impacts), the USACE will comply with all previous agreements with the resource agencies. With these commitments in place, for any USFWS terrestrial environment designated as critical habitat, such as LOGG-T-NC-01(Northern Recovery Unit, North Carolina) , the proposed project will not result in an adverse modification of critical habitat for the threatened loggerhead sea turtle.

Additionally, pursuant to the NMFS Biological Opinion (BO) dated September 25, 1997 and the 2008 USACE revised Draft South Atlantic Regional Biological Assessment (SARBA), the continued hopper dredging of existing navigation channels is authorized and the USACE would comply with all conditions and/or restrictions. Hopper dredging activities will not result in an adverse modification of the NMFS' proposed critical habitat for the threatened loggerhead sea turtle (LOGG-N-3).

The proposed dredging and disposal activities associated with the DMMP may occur in areas used by migrating turtles. Hopper dredges pose a risk to benthic oriented sea turtles through physical injury or death by entrainment. Though the January 1 to March 31dredging window will avoid periods of peak turtle abundance during the warm water months, the risk of lethal impacts still exist as some sea turtle species may be found year-round in the offshore area. Therefore, the proposed hopper dredging activities may affect, likely to adversely affect the loggerhead, green, hawksbill, and Kemp's ridley sea turtles. Based on historic hopper dredging take data, leatherback sea turtles are not known to be impacted by hopper dredging operations.

4.02.9 Atlantic Sturgeon

a. Status. Endangered. Within Federal Register dated January 6, 2010 (Volume 75, Number 3), NMFS announced a 90-day finding on a petition to list Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*) as endangered, or to list multiple distinct population segments (DPSs) as threatened or endangered and designate critical habitat under the Endangered Species Act. NMFS found the petition presents substantial scientific or commercial information indicating that the petitioned actions may be warranted. NMFS published the Final Listing for the Atlantic Sturgeon in the Federal Register dated February 6, 2012. NMFS has listed the Carolina and South Atlantic populations of Atlantic Sturgeon as endangered under the Endangered Species Act of 1973, as amended. This final rule is effective April 6, 2012. However, NMFS has not designated any "*critical habitat*" for this species. Since the Atlantic sturgeon is found within the project area, the purpose of this section is to address project impacts on this listed species.

b. Occurrence in Immediate Project Vicinity. Although specifics vary latitudinally, the general life history pattern of Atlantic sturgeon is that of a long lived, late maturing, estuarine dependent, an adromous species. The species' historic range included major estuarine and riverine systems that spanned from Hamilton Inlet on the coast of Labrador to the Saint Johns River in Florida (Murawski and Pacheco 1977; Smith and Clungston 1997).

Atlantic sturgeon spawn in freshwater, but spend most of their adult life in the marine environment. Spawning adults generally migrate up river in the spring/early summer; February-March in southern systems, April-May in mid-Atlantic systems, and May-July in Canadian systems (Murawski and Pacheco 1977; Smith 1985; Bain 1997; Smith and Clungston 1997; Caron et al. 2002). In some southern rivers, a fall spawning migration may also occur (Rogers and Weber 1995; Weber and Jennings 1996; Moser et al. 1998).

Atlantic sturgeon spawning is believed to occur in flowing water between the salt front and fall line of large rivers, where optimal flows are 46-76 cm/s and depths of 11-27 meters (Borodin 1925; Leland 1968; Crance 1987; Bain *et al*. 2000). Sturgeon eggs are highly adhesive and are deposited on the bottom substrate, usually on hard surfaces (e.g., cobble) (Gilbert 1989; Smith and Clungston 1997).

Upon reaching a size of approximately 76-92 cm, the subadults may move to coastal waters (Murawski and Pacheco 1977; Smith 1985), where populations may undertake long range migrations (Dovel and Berggren 1983 and Bain 1997). Tagging and genetic data indicate that subadult and adult Atlantic sturgeon may travel widely once they emigrate from rivers. Subadult Atlantic sturgeon wander among coastal and estuarine habitats, undergoing rapid growth (Dovel and Berggren 1983; Stevenson 1997). These migratory subadults, as well as adult sturgeon, are normally captured in shallow (10-50m) near shore areas dominated by gravel and sand substrate (Stein et al. 2004). Coastal features or shorelines where migratory Atlantic sturgeon commonly aggregate include the Bay of Fundy, Massachusetts Bay, Rhode Island, New Jersey, Delaware, Delaware Bay, Chesapeake Bay, and North Carolina, which presumably provide better foraging opportunities (Dovel and Berggren 1983; Johnson et al. 1997; Rochard et al. 1997; Kynard et al. 2000; Eyler et al. 2004; Stein et al. 2004; Dadswell 2006).

c. <u>Current Threats to Continued Use of the Area</u>. According to the Atlantic sturgeon status review (Atlantic Sturgeon Status Review Team 2007), projects that may adversely affect sturgeon include dredging, pollutant or thermal discharges, bridge construction/removal, dam construction, removal and relicensing, and power plant construction and operation. Potential direct and indirect impacts associated with dredging that may adversely impact sturgeon include entrainment and/or capture of adults, juveniles, larvae, and eggs by dredging and trawling activities, short-term impacts to foraging and refuge habitat, water quality, and sediment quality, and disruption of migratory pathways.

d. <u>Project Impacts</u>.

(1) <u>Habitat and Food Supply</u>. It is not known how extensively the Morehead City Harbor navigation reaches are used by sturgeon as feeding areas. Furthermore, specific aggregation areas for spawning, feeding, resting, etc. have not been identified for all dredging locations throughout the distribution range for Atlantic sturgeon. However, based on the current understanding of the variables required (ie. salinity regime, depth, substrate, etc.) for various stages of the sturgeon life cycle (ie. spawning, migrating, foraging, etc.), dredging activities presumably create some level of disruption based on their location relative to the life stage requirements. Channels maintained at frequent dredging intervals are not expected to be used extensively for feeding or other activities. As identified in the 2007 Status Review of Atlantic Sturgeon, "Hatin *et al.* (*in press*) tested whether dredging operations affected Atlantic sturgeon behavior by comparing Catch Per Unit Effort (CPUE) before and after dredging events in 1999 and 2000. The authors documented a three to seven-fold reduction in Atlantic sturgeon presence after dredging operations began, indicating that sturgeon avoid these areas during operations." Dredging activities performed in areas identified as

known high aggregation areas for spawning, feeding, resting, etc., which require specific measures to minimize impacts, may require separate consultation.

Dredging activities can impact benthic assemblages either directly or indirectly and may vary in nature, intensity, and duration depending on the project, site location, and time interval between maintenance operations. Direct catastrophic impacts include physical removal or smothering by the settlement of suspended materials (Morton 1977; Guillory 1982). Suspended materials may also interfere in the feeding respiration or reproduction of filter feeding benthos and nekton (Sherk and Cronin 1970). Though initial loss of benthic resources are likely, quick recovery between 6-months (McCauley et al. 1977; Van Dolah et al. 1979; Van Dolah et al*.* 1984; and Clarke and Miller-Way 1992) to two years (Bonsdorff 1980; Ray 1997) is expected; thus, the impacts to sturgeon foraging habitat are expected to be short-term. Recent benthic studies in Savannah Harbor, just prior to annual maintenance dredging, have shown primarily healthy benthic communities both inside and outside the channel. For most sediment types, average abundance and biomass were found to be higher inside the channel compared to locations outside the channel with the exception of silt-sand substrates (USACE 2008). Sturgeon foraging sites with soft mud bottoms and oligohaline or mesohaline salinities tend to recover quickly, likely due to the dominance of opportunistic species assemblages (e.g., *Streblospio benedicti, Capitella capitata, Polydora Ligni*) (Ray 1997). Recovery in dredged sites occurs by four basic mechanisms: remnant (undredged) materials in the sites, slumping of materials with their resident fauna into the site, adult immigration, and larval settlement. Remnant materials, sediments missed during the dredging operation, act as sources of “seed” populations to colonize recently defaunated sediments. Adult immigration can occur as organisms burrow laterally throughout the sediments, drift with currents and tides, or actively seek out recently defaunated sediments (Ray 1997). Likewise materials slumping or falling into the site from channel slopes provide organisms for colonization (Kaplan et al. 1975). During periods of extreme conditions (i.e. extreme temperature regimes, low dissolved oxygen, etc.), sturgeon may become relatively immobile and forage extensively in one area. Therefore, considering that limited mobility would not allow for sturgeon to move to more productive foraging grounds following dredging activities, it is possible that reduced benthic assemblages during site and time specific conditions could have a more significant impact to foraging behavior.

For benthic assemblages in estuarine and riverine systems, the distribution of individual species is consistent with their known sediment and salinity preferences (polyhaline, mesohaline, and oligohaline). The distribution of each of these assemblages varies depending on the intensity of river flow, often correlated with season (Ray 1997; Posey *et al*. 1996). Therefore, in addition to the anthropogenic dredging impacts to benthic assemblages, natural community shifts are correlated with river flow rates. Considering the ephemeral nature of this environment, the benthic assemblages consist of opportunistic species which are capable of adapting to natural fluctuations in the environment (Ray 1997). Furthermore, assuming that natural benthic community shifts are an inherent component of sturgeon foraging behavior, it is possible that post dredging movements to more productive foraging grounds are not far outside of the normal foraging behavior response to natural benthic community shifts.

Extensive studies have been done on the behavioral responses of fish to increased turbidity. These studies measured reactions such as cough reflexes, swimming activity, gill flaring, and territoriality that may lead to physiological stress and mortality; however, specific studies on sturgeon responses are limited. The effects of suspended sediment on fish should be viewed as a function of concentration and exposure duration (Wilber and Clarke 2001). The behavioral responses of adult salmonids for suspended sediment dosages under dredging-related conditions include altered swimming behavior, with fish either attracted to or avoiding plumes of turbid water (Newcombe and Jensen 1996)

Water quality impacts to sturgeon as a result of proposed dredging activities are expected to be temporary, with suspended particles settling out within a short time frame. These sediment disturbance impacts are expected to be minimal in nature and are not expected to have a measurable effect on water quality beyond the frequent natural increases in sediment load. Considering that no new work or deepening beyond existing authorizations will occur as part of this action, no significant changes in salinity and tidal amplitude are expected within channels that have been dredged to their fully authorized channel depths and widths.

(2) Relationship to Critical Periods in Life Cycle. Assuming that channel shoaling is a result of transport of sediment from littoral drift or other nearby areas, the composition of maintenance material dredged from the channel is expected to be the same as that remaining upon completion of dredging. Therefore, no impacts to sturgeon from alterations to hydrodynamic regime or additional loss of physical habitat (i.e. changes in benthic substrate) are expected. Understanding that the existing Federal navigation channels will not be deepened and/or widened, no suspension of contaminants is expected from the dredging of previously undisturbed sediments.

(3) Effect Determination. Based on the history of incidental take data collected, both hydraulic (cutterhead and hopper) and mechanical dredge techniques have been documented to directly impact Atlantic sturgeon species through entrainment of the cutterhead or drag head or capture in the clamshell bucket. Hydraulic and mechanical dredging techniques may also indirectly impact sturgeon species through (1) short-term impacts to benthic foraging and refuge habitat, (2) short-term impacts to water and sediment quality from re-suspension of sediments and subsequent increase in turbidity/siltation, and (3) disruption of spawning migratory pathways. Therefore, all proposed hydraulic and mechanical dredging activities, may affect likely to adversely affect the Atlantic sturgeon species either directly or indirectly,

Endangered species observers (ESOs) on board hopper dredges will be responsible for monitoring for incidental take of Atlantic sturgeon. For hopper dredging operations, drag heads as well as all inflow and overflow screening will be inspected for sturgeon species following the same ESO protocol for sea turtles. Furthermore, all ESOs on board the dredge will be capable of identifying Atlantic sturgeon as well as following safe handling protocol as outlined in Moser *et. al.* 2000.

4.02.10 Shortnose Sturgeon

a. Status. Endangered

b. Occurrence in Immediate Project Vicinity. This species ranges along the Atlantic seaboard from southern Canada to northeastern Florida (USFWS 1999b). The shortnose sturgeon feeds on invertebrates and stems and leaves of macrophytes. From historical accounts, it appears that this species was once fairly abundant throughout North Carolina waters, however, many of these early records are unreliable due to confusion between this species and the Atlantic sturgeon (*Acipenser oxyrhynchus*). Because of the lack of suitable freshwater spawning areas in the project area and the requirement of low salinity waters by juveniles, any shortnose sturgeons present would most likely be non-spawning adults. This species ranges along the Atlantic seaboard from the Saint Johns River in New Brunswick, Canada, to the Saint Johns River, Florida. The distribution of the shortnose sturgeon in the Newport and White Oak Rivers is not known. No known records of the shortnose sturgeon have been documented in the project area. According to Kynard (1997), “No known populations occur from the Delaware River, New Jersey to the Cape Fear River, in North Carolina.”

c. Current Threats to Continued Use of the Area. Pollution, blockage of traditional spawning grounds, and over fishing is generally considered to be the principal causes of the decline of this species. The prohibition on taking any sturgeon in North Carolina should help to protect the species from commercial and recreational fishing pressure.

d. Project Impacts.

(1) Habitat. Spawning habitat for the shortnose sturgeon should lie well outside of the project area and should not be affected by the DMMP. Habitat conditions suitable for juveniles and adults could occur within the project area. The presence of juvenile shortnose sturgeon is not likely due to high salinity. Adults are found in shallow to deep water (6 to 30 feet) and will be expected to occupy the river channel during the day and the shallower areas adjacent to the channel during the night.

(2) Food Supply. The shortnose sturgeon is a bottom feeder, consuming various invertebrates and occasionally plant material. Adult foraging activities normally occur at night in shallow water areas adjacent to the deep-water areas occupied during the day. Juveniles are not known to leave deep-water areas and are expected to feed there.

All estuarine bottoms dredged as a part of maintenance will suffer temporary declines in benthic fauna populations in comparison to adjacent undisturbed areas. Existing channel bottoms will continue to be dredged at the same frequency as under existing conditions and will be expected to continue to support benthic populations similar to the existing populations.

Because most of the available shallow water feeding areas adjacent to the channel will not be affected by the project and channel benthic populations should continue to have their existing levels of production, it is believed that the food supply of the shortnose sturgeon will remain essentially at current levels with implementation of the DMMP.

(3) Relationship to Critical Periods in Life Cycle. Because of the mobility of adult and juvenile shortnose sturgeon and infrequent occurrence in the harbor, direct mortality as a result of dredging is not likely to occur.

(4) Effect Determination. Because no known shortnose sturgeon have been documented in the project area, it has been determined that the proposed action is not likely to affect any of this species or its habitat. It is unlikely that the shortnose sturgeon occurs in the project area (F. Rohde, Biologist NMFS, August 13, 2010, pers. comm. and Kynard 1997). However, should it occur, its habitat would be only minimally altered by dredging and disposal of maintenance dredged material. This species feeds on a wide variety of invertebrates and while some food resources may be initially affected by either burial associated with beach disposal, most invertebrates will quickly reestablish from adjacent unaffected areas.

Endangered species observers (ESOs) on board hopper dredges will be responsible for monitoring for incidental take of shortnose sturgeon. For hopper dredging operations, drag heads as well as all inflow and overflow screening will be inspected for shortnose sturgeon species following the same ESO protocol for sea turtles. Furthermore, all ESOs on board the dredge will be capable of identifying shortnose sturgeon as well as following safe handling protocol as outlined in Moser *et. al.* 2000.

Although hopper dredges have been known to impact shortnose sturgeons, this species is not likely to be present in the project area and, therefore, impacts from dredges are not anticipated to occur. Because of the unlikelihood of shortnose sturgeon being present in the project area and because of the precautions being taken with the hopper dredges, it has been determined that the actions of the proposed project are not likely to adversely affect the shortnose sturgeon.

4.02.11 Smalltooth Sawfish

Detailed life history information associated with the life cycle requirements for smalltooth sawfish and a subsequent analysis of impacts from the proposed dredging activities are provided within the following Section 7 consultation document:

USACE. September 2008. <u>Regional Biological Assessment for Dredging Activities in the Coastal Waters, Navigation Channels (including designated Ocean Dredged Material Disposal Sites (ODMDS)), and Sand Mining Areas in the South Atlantic Ocean</u>. USACE, Wilmington District. Submitted to NMFS on 12 September 2008

A summary of project specific information and associated impacts is provided in the ensuing text.

a. <u>Status</u>. Endangered. The U.S. smalltooth sawfish distinct population segment (DPS) was listed as endangered under the ESA on April 1, 2003 (68 FR 15674) and is the first marine fish to be listed in the United States.

b. <u>Occurrence in Immediate Project Vicinity</u>. Historic records suggest that during the 19th century the smalltooth sawfish was a common resident of the Atlantic and Gulf coastal waters of the southeastern United States. Throughout the 20th century it was recorded with declining frequency and today it can be no longer considered a functional member of the nearshore coastal community of the northwest Atlantic. Historic records indicate that the smalltooth sawfish abundantly occurred in the mid-Atlantic region only during the summer months (Adams and Wilson 1995). The smalltooth sawfish range has subsequently contracted to peninsular Florida and, within that area, can only be found with any regularity off the extreme southern portion of the state between the Caloosahatchee River and the Florida Keys (Figure J-4). Smalltooth sawfish are most common within the boundaries of the National Everglades National Park and the Florida Keys, and become less common with increasing distance from this area (Simpfendorfer 2002).

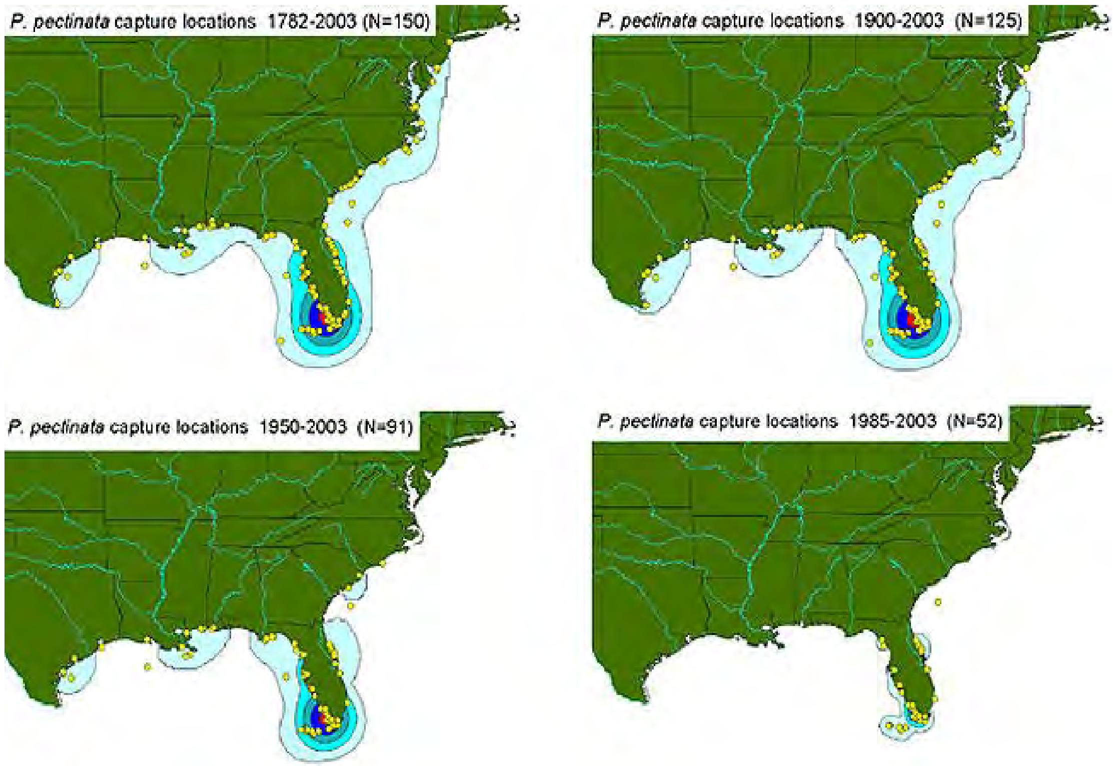

Figure J-4. Historic and Current Distribution of Smalltooth Sawfish in the U.S. (Burgess et al*.* 2003).

c. Current Threats to Continued Use of the Area. The principal habitats for smalltooth sawfish in the southeast U.S. are the shallow coastal areas and estuaries, with some specimens moving upriver in freshwater (Bigelow and Schroeder 1953). The continued urbanization of the southeastern coastal states has resulted in substantial loss of coastal habitat through such activities as agricultural and urban development; commercial activities; dredge and fill operations; boating; erosion and diversions of freshwater run-off (SAFMC 1998). Smalltooth sawfish may be especially vulnerable to coastal habitat degradation due to their affinity to shallow, estuarine systems. Smalltooth sawfish have historically been caught as by-catch in various fishing gears throughout their historic range, including gillnet, otter trawl, trammel net, seine, and to a lesser degree, hand line. Today, they are occasionally incidentally caught in commercial shrimp trawls, bottom longlines, and by recreational rod-and-reel gear. With the K-selected life history strategy of smalltooth sawfish, including slow growth, late maturation, and low fecundity, long-term commitments to habitat protection are necessary for the eventual recovery of the species. A complete review of the factors contributing to the decline of the smalltooth sawfish can be found in the "Status Review of Smalltooth Sawfish (*Pristis pectinata*)", (NMFS 2000). The Draft Recovery plan for smalltooth sawfish

(NMFS 2006) also presents a detailed threats assessment with four major categories of threats: 1) Pollution; 2) Habitat degradation or loss; 3) Direct injury and 4) Fisheries Interactions. Neither of these discussions will be repeated in detail in this assessment, but are incorporated herein by reference.

d. Project Impacts. As identified in the August 2006 Draft Smalltooth Sawfish Recovery Plan, "habitat effects of dredging include the loss of submerged habitats by disposal of excavated materials, turbidity and siltation effects, contaminant release, alteration of hydrodynamic regimes, and fragmentation of physical habitats (SAFMC 1998). Cumulatively, these effects have degraded habitat areas for smalltooth sawfish." The current range of sawfish has contracted to peninsular Florida and can only be found with any regularity off the extreme southern portion of the state. Smalltooth sawfish occur in shallow estuarine environments and juvenile sawfish are particularly dependent on mangrove habitat.

In the Gulf of Mexico Regional Biological Opinion (GRBO) issued by NMFS on November 19, 2003 (as amended in 2005 and 2007), in the section entitled "Species Not Likely to Be Affected," NMFS concludes the following: **"**Smalltooth sawfish (*Pristis pectinata*) are tropical marine and estuarine fish that have the northwestern terminus of their Atlantic range in the waters of the eastern U.S. Currently, their distribution has contracted to peninsular Florida and, within that area, they can only be found with any regularity off the extreme southern portion of the state. The current distribution is centered in the Everglades National Park, including Florida Bay. They have been historically caught as by-catch in commercial and recreational fisheries throughout their historic range; however, such by-catch is now rare due to population declines and population extirpations. Between 1990 and 1999, only four documented takes of smalltooth sawfish occurred in shrimp trawls in Florida (Simpfendorfer 2000). After consultation with individuals with many years in the business of providing qualified observers to the hopper dredge industry to monitor incoming dredged material for endangered species remains (Personal Communication, Chris Slay, Coastwise Consulting, August 18, 2003) and a review of the available scientific literature, NOAA Fisheries determined that there has never been a reported take of a smalltooth sawfish by a hopper dredge, and such take is unlikely to occur because of smalltooth sawfishes affinity for shallow, estuarine systems."

(e) Effect Determination. Based on the current South Atlantic distribution of smalltooth sawfish and only one sighting in North Carolina since 1999, dredging impacts to smalltooth sawfish within the project area are unlikely. Additionally, the take of a smalltooth sawfish by any dredge is unlikely considering the smalltooth sawfishes affinity for shallow, estuarine systems as well as the fact that there has never been a reported take of a smalltooth sawfish by a dredge. Therefore, implementation of the DMMP is not likely to adversely affect smalltooth sawfish.

4.02.12 Seabeach Amaranth

a. Status. Threatened

b. Occurrence in Immediate Project Vicinity. Seabeach amaranth is an annual herb that occurs on beaches, lower foredunes, and overwash flats (Fussell 1996). Weakley (1986) found that in North Carolina the plant is most common on overwash flats on accreting ends of barrier islands. This species occupies elevations ranging from 0.2 to 1.5 m above mean high tide (Weakley and Bucher 1992). Historically, seabeach amaranth was found from Massachusetts to South Carolina. But according to recent surveys (USACE 1992-2002), its distribution is now restricted to North and South Carolina with several populations on Long Island, New York. The decline of this species is caused mainly by development of its habitat, such as inlet areas and barrier islands, and increased ORV and human traffic, which tramples individuals (Fussell 1996). Seed dispersal of seabeach amaranth is achieved in a number of ways, including water and wind dispersal (USFWS 1995).

Seabeach amaranth usually grows between the seaward toe of the dune and the limit of the wave uprush zone. Greatest concentrations of seabeach amaranth occur near inlet areas of barrier islands, but in favorable years many plants may occur away from inlet areas. It is considered a pioneer species of accreting shorelines and stable foredune areas.

Since 1991, the USACE has surveyed Bogue Banks for seabeach amaranth. Table J-8 indicates numbers of plants were found on Bogue Banks.

Table J-8. Number of seabeach amaranth growing on Bogue Banks.

Year - Number of Plants	Year - Number of Plants
1992 - 2,557	2002 – 2,001
1993 – 3,762	2003 – 5,330
1994 – 1,181	2004 – 2,935
1995 – 14,776	2005 – 10,712
1996 – none (Hurricanes Bertha & Fran),	2006 – 251
1997 – 81	2007 – 130
1998 – 3,973	2008 – 313
1999 – 218	2009 – 281
2000 – 20	2010 – 69
2001 – 347	

These numbers include the Towns of Emerald Isle and Indian Beach/Salter Path, which is not within the project area. Between 1996 and 2010, at least seven hurricanes (Bertha, Fran, Bonnie, Dennis, Floyd, Irene, and Isabel) have affected this area. Seabeach amaranth populations on Bogue Banks may have fluctuated because of these named storms.

The Cape Lookout National Seashore, NPS also monitors seabeach amaranth growing on Shackelford Banks. The following information in Table J-9 is provided from their annual monitoring reports (provided by Michael Rikard, NPS):

Table J-9. Number of seabeach amaranth growing on Shackleford Banks.

Year	Number of Plants
1993	975
1994	948
1995	1155
1996	3
1997	51
1998	369
1999	9
2000	13
2001	126
2002	261
2003	1354
2004	58
2005	671
2006	30
2007	125
2008	76
2009	100

c. Current Threats to Continued Occurrence in the Project Area. Beach erosion is probably the primary threat to the continued presence in the area since the population was thriving prior to the recent frequent occurrence of hurricanes. However beach bulldozing and sand fencing by private interests may have affected the population on Bogue Banks.

d. Project Impacts.

(1) Habitat. The proposed 3.65 mile long beach disposal area on Shackleford Banks is not currently conducive to the growth of seabeach amaranth due to the high erosion and inundation throughout its habitat. Beach disposal would restore approximately 33 acres (150-foot wide times 9,636 foot long divided by 43,560) of new ocean beach on Shackleford Banks, which provides much of the habitat requirements for seabeach amaranth. Indeed, new populations have been observed to follow sand disposal on other beaches where sand has been placed by the USACE.

Beach disposal will not occur in the inlet areas where amaranth most commonly occurs.

(2) Relationship to Critical Periods in Life Cycle. Beach disposal would be conducted only from November 16 to April 30 on Bogue Banks and from November 16 to March 31 on Shackleford Banks. However, only a portion of the beach is affected at any point in time (approximately 4-5,000 feet per month). Once disposal passes that point, recovery can begin to occur. All of Fort Macon State Park, Shackleford Banks and the majority of Atlantic Beach will have dredged material placed during the colder months when the plants have not germinated. If there is sufficient material, beach disposal activities to Pine Knoll Shores will take place during the warmer months (within the beach disposal window). While such disposal is not an ideal management practice for the species, the restoration of the habitat is of prime importance. The project area would be included in the USACE monitoring program during the seabeach amaranth growing season for the life of the beachfill.

(3) Effect Determination. While beach disposal of dredged material once every three years within the 3.65 mile long area on Shackleford Banks will restore about 33 acres of oceanfront habitat lost to erosion, disposal on a portion of the beaches in the growing season may slow population recovery over the short term. Therefore, the project "may affect not likely to adversely affect" seabeach amaranth.

5.00 COMMITMENTS TO REDUCE IMPACTS TO LISTED SPECIES

The following is a summary of environmental commitments to protect listed species related to the construction and maintenance of the proposed project. These commitments address agreements with resource agencies and construction practices:

1. The USACE will strictly adhere to all conditions outlined in the most current National Marine Fisheries Service RBO for dredging of channels and borrow areas in the southeastern United States. Furthermore, as a component of this project, hopper dredging activities occur within the dredging window of January 1 to March 31 in order to avoid periods of peak sea turtle abundance. The use of turtle deflecting dragheads, inflow and/or overflow screening, and NMFS certified turtle and whale observers will also be implemented.

2. NMFS certified endangered species observers (ESOs) will be on board all hopper dredges and will record all large whale sightings and note any potential behavioral impacts. The USACE and the Contractor will keep the date, time, and approximate location of all marine mammal sightings. Care will be taken not to closely approach (within 300 feet) any whales, manatees, or other marine mammals during dredging operations or transportation of dredged material. An

observer will serve as a lookout to alert the dredge operator and/or vessel pilot of the occurrence of these animals. If any marine mammals are observed during other dredging operations, including vessel movements and transit to the dredged material disposal site, collisions shall be avoided either through reduced vessel speed, course alteration, or both.

3. The USACE will avoid the sea turtle nesting season. Disposal of beach compatible sediment on Bogue Banks will take place from November 16 to April 30 and on Shackleford Banks from November 16 to March 31 (if a pipeline dredge is used) and from January 1 to March 31 (if a hopper dredge is used).

4. The beach will be monitored for escarpment formation by the Contractor prior to completion of beach disposal activities. Escarpments which exceed 18 inches in height for a distance of 100 ft. will be leveled by the Contractor. . If it is determined that escarpment leveling is required during the nesting or hatching season, leveling actions should be directed by the USFWS and the Cape Lookout National Seashore (National Park Service).

5. Only beach quality sediment will be placed on the beach as a component of the DMMP. Post nourishment beach compaction (hardness) will be evaluated by the USACE, in coordination with the Cape Lookout National Seashore (National Park Service), NCWRC and USFWS, using qualitative assessment techniques to assure that impacts to nesting and incubating sea turtles are minimized and, if necessary, identify appropriate mitigation responses.

6. Monitoring for seabeach amaranth on Bogue Banks will be implemented to assess the post nourishment presence of plants. This survey will broken down into survey reaches for each town in accordance with the designated USACE sea beach amaranth survey reaches from 1991-2010 in order to maintain consistent data and survey techniques over time and results will be provided to USFWS. Monitoring for seabeach amaranth on Shackleford Banks will be implemented by the Cape Lookout National Seashore (National Park Service).

7. The USACE will implement precautionary measures for avoiding impacts to manatees during construction activities as detailed in the “Guidelines for Avoiding Impacts to the West Indian Manatee in North Carolina Waters” established by the USFWS.

SUMMARY EFFECT DETERMINATION

Threatened and endangered species summary effect determination for beach disposal and dredging activities associated with the proposed project area (No Effect (NE – green); May Affect Not Likely to Adversely Affect (MANLAA – orange); May Affect Likely to Adversely Affect (MALAA – red), and Not Likely to Adversely Modify (NLAM - orange) Critical Habitat.

	Listed Species Within Project Area	Effect Determination	
		Beach Placement Activities (USFWS)	In-Water Dredging Activities (NMFS)
Sea Turtles	Leatherback	MANLAA	MANLAA
Sea Turtles	Loggerhead	MANLAA	MALAA
Sea Turtles	Green	MANLAA	MALAA
Sea Turtles	Kemp's Ridley	NE	MALAA
Sea Turtles	Hawksbill	NE	MALAA
Large Whales	Blue, Finback, Sei, and Sperm	NE	NE
Large Whales	NARW	NE	MANLAA
Large Whales	Humpback	NE	MANLAA
	West Indian Manatee	NE	MANLAA
	Roseate Tern	NE	NE
	Red Knot	MANLAA	NE
	Piping Plover and Critical Wintering Habitat	MANLAA/NLAM	NE
	Atlantic Sturgeon	NE	MALAA
	Shortnose Sturgeon	NE	NE
	Smalltooth Sawfish	NE	NE
	Seabeach Amaranth	MANLAA	NE
	Rough-Leaved Loosestrife	NE	NE
	rare butterfly (*Atrytonopsis* new species 1)	NE	NE
	American Alligator	NE	NE
	Eastern Cougar	NE	NE
	Red-cockaded Woodpecker	NE	NE

Table J-10. T&E species effects determination for beach disposal and dredging activities associated with the proposed project area (Notes: No Effect (NE = green), May Affect Not Likely to Adversely Affect (MANLAA = orange), and May Affect Likely to Adversely Affect (MALAA = red).

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APPENDIX K

CUMULATIVE IMPACT ASSESSMENT

Cumulative Impact Assessment

The Council on Environmental Quality (CEQ) defines cumulative impact as:

*The impact on the environment which results from the incremental impact of the action when added to other past, present and reasonably foreseeable actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time (*40 CFR 1508.7). This analysis follows the 11-step process outlined by the Council on Environmental Quality (CEQ) in their 1997 publication Considering Cumulative Effects Under the National Environmental Policy Act (see Table K-1).

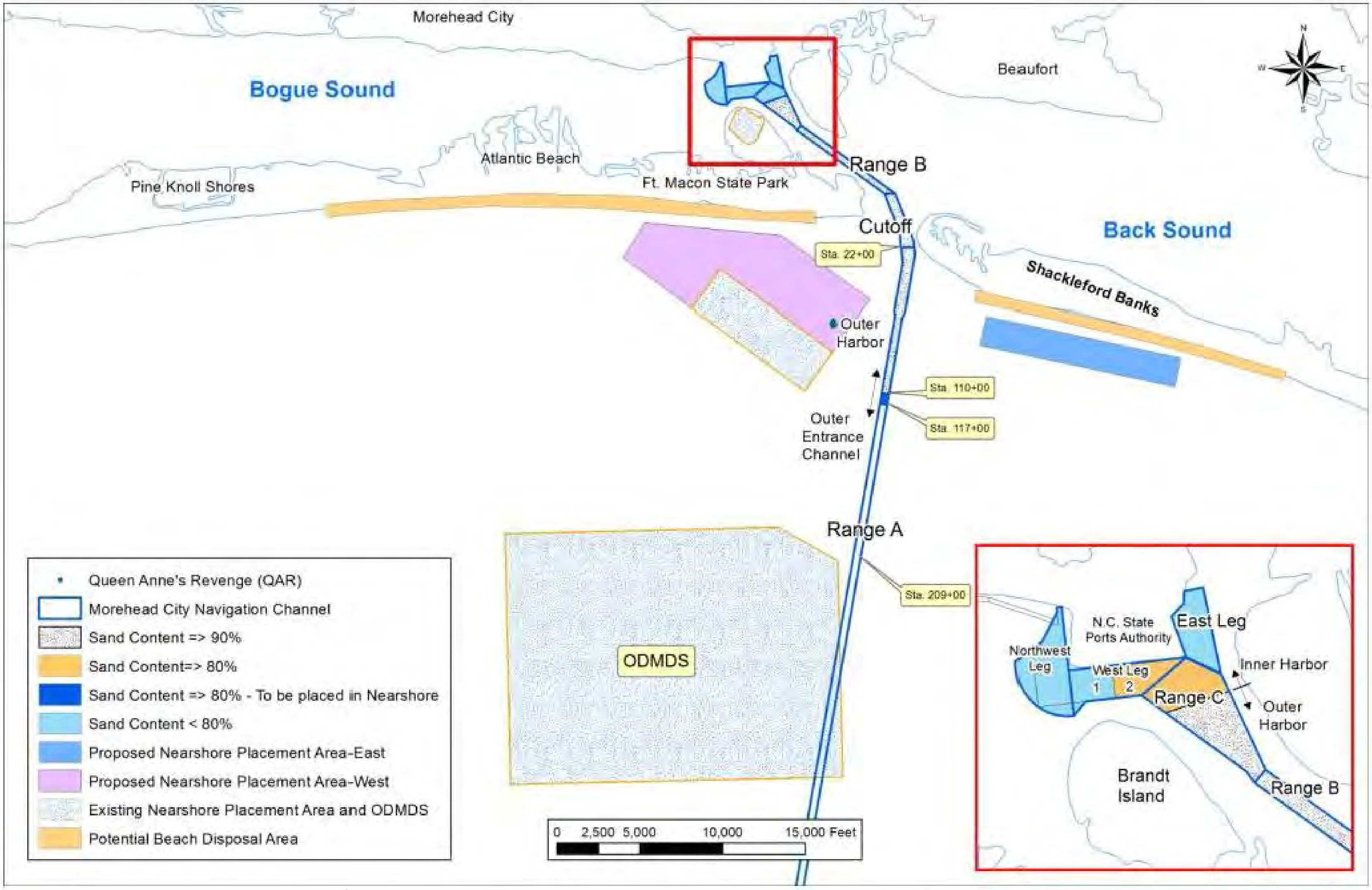

Figure K-1. Morehead City Harbor DMMP showing Ranges and Dredged Material Disposal Areas

Table K-1. Steps in the Cumulative Effects Analysis (as adapted from CEQ 1997)

Environmental Impact Assessment Components	CEQ 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.

In order to reduce duplication, additional detailed information on Scoping, the Affected Environment, and the Environmental Consequences are found in Sections 7.1, 4.0, and 5.0 of the Draft Integrated DMMP and EIS (here after referred to as the DMMP). The proposed monitoring plan is found in Appendix F of the DMMP.

I. Significant Cumulative Effects Issues

A. Introduction. This assessment of cumulative impacts will focus on impacts of the proposed action on significant coastal shoreline resources off Bogue and Shackleford Banks. Additionally, the future construction and expansion activities of the North Carolina State Port Authority in Morehead City and Carteret

County's Beach renourishment plans for Bogue Banks will be included in this assessment.

The DMMP impacts would deal with the future maintenance dredging of the existing Federal navigation channels and placement areas indicated in Figure K-1: the existing upland diked disposal area on Brandt Island, Ocean Beaches on Bogue and Shackleford Banks, nearshore areas off Bogue and Shackleford Banks, and the US EPA approved Morehead City ODMDS.

In making this assessment, the US Army Corps of Engineers, Wilmington District (USACE) has reviewed the reports mentioned in Tables K-2 and K-3. Additionally, the following reports included comprehensive assessments of state-wide cumulative impacts:

1. U.S. Army Corps of Engineers Draft Evaluation Report and Environmental Assessment, Morehead City Harbor Section 933, dated May 2003

2. U.S. Army Corps of Engineers Final Integrated General Reevaluation Report and Environmental Impact Statement, Shore Protection, West Onslow Beach and New River Inlet (Topsail Beach), North Carolina, dated March 2009,

3. U.S. Army Corps of Engineers Final Integrated General Reevaluation Report and Environmental Impact Statement, on Coastal Storm Damage Reduction, Surf City and North Topsail Beach, North Carolina, dated November 2010.

In discussing the potential cumulative impacts of the placement of sediment within the nearshore areas, and the beaches of Bogue and Shackleford Banks, the USACE considered time crowded perturbations, and space crowded perturbations, as defined below, to be pertinent to this action.

Time crowded perturbations *– repeated occurrence of one type of impact in the same area.*
Space crowded perturbations *– a concentration of a number of different impacts in the same area.*

B. Future Port Expansion and Carteret County's Renourishment Projects in the Project Area.

North Carolina State Ports Authority (NCSPA) Radio Island Expansion. The NCSPA maintains harbor facilities that are adjacent to the federally maintained navigation channel in Morehead City Harbor. These areas include berthing areas along the face of the Morehead City State Port wharfs and facilities along Radio Island. Maintenance of these facilities is required to realize the benefits of having a channel leading to the port. Maintenance of these areas is usually performed at the same time that the maintenance of the Federal portion is accomplished.

In addition, the NCSPA is pursuing port industrial development on Radio Island (NCSPA 2001). The adjacent deep-water Federal navigation channel, the short distance to the open Atlantic Ocean, and existing rail and road access contribute to the benefits of this site for port development. The North Carolina State Ports Authority (NCSPA) property also includes approximately 185 acres of Radio Island, including the former Aviation Fuel Terminal Inc. The public uses the eastern portion of Radio Island, known as East Beach, for recreational purposes. The northern end of the island contains a mix of residences, privately owned land, and marine-related businesses. The southern tip of the island is owned by the US Navy and is used for military deployment activities. A new general cargo facility is proposed for Radio Island. The new facility would include 2,000 feet of wharf, 300,000 square feet of warehouse space, support buildings, dredging from the Morehead City Channel to the face of the new wharf on Radio Island, and improvements to the road and rail access on Radio Island. The proposed Radio Island project consists of two 1,000-foot berths constructed using a sheet-pile bulkhead. The face of the wharf would be located 700 feet from the near channel line of Morehead City Channel. Dredging will be required between the existing channel and the proposed wharf to allow for the maneuvering and docking of ships at the wharf. Dredging of approximately 37 acres of estuarine bottom to a depth of 45 feet would be required to connect the proposed berths to Morehead City Channel. The construction of the proposed project will require the dredging of approximately 1.7 million cubic yards of dredge material.

Currently the NCSPA has not obtained the necessary authorizations from the Regulatory Division, Wilmington District, USACE (i.e., Section 10 of the Rivers and Harbors Act of 1899 and Section 404 of the Clean Water Act permits) and the State of North Carolina (i.e., Section 401 Water Quality Certificate, Air Quality permit, Consistency Determination, CAMA permits, etc.) to complete this activity. Moreover, funding for the proposed port expansion has not been approved by the North Carolina State Legislature. No new or existing customer of the port facility has requested to fund this proposed action (Personal Communication, Mr. Todd Walton, Environmental Supervisor, NCSPA, October 19, 2011).

At this time, the NCSPA does not know when or if this expansion project will be completed. Nor does the NCSPA know the specific disposal locations of the approximately 1.7 million cubic yards of dredged material and/or the maintenance interval of the expanded harbor channels. Discussions with representatives from the NCSPA (Personal Communication, Mr. Todd Walton, Environmental Supervisor, NCSPA, October 19, 2011) indicate that the NCSPA are still interested in pursuing this action but they don’t know when or if this will occur.

Figure K-2, below depicts the proposed NCSPA Port Expansion on Radio Island.

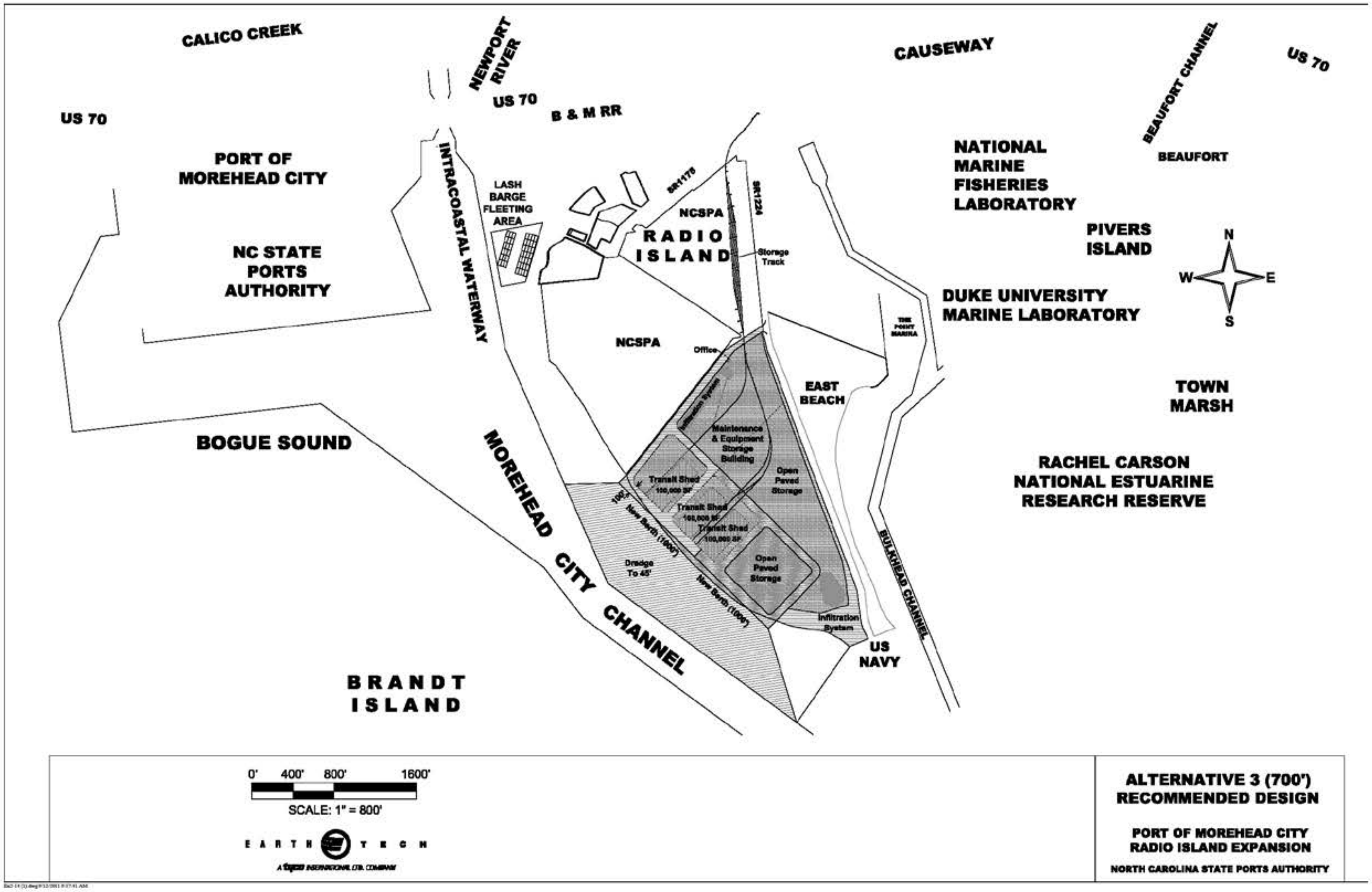

Figure K-2. Proposed NCSPA Port Expansion on Radio Island.

Carteret County's Beach Renourishment plans for Bogue Banks. The following information provides the current status of this project and was taken from Carteret County's Protect the Beach website:

The Bogue Banks Beach Master Nourishment Plan (Master Plan) was formally initiated in 2010. The anticipated completion date for the Master Plan effort (engineering report, environmental document, and final permit decision) is mid 2013.

The Master Plan will evaluate present-day beach conditions, review and reassess the effectiveness of Bogue Banks beach nourishment projects constructed the past decade and develops a new nourishment plan based on volumetric/beach elevation thresholds for Pine Knoll Shores, Indian Beach/Salter Path, and Emerald Isle. Carteret County is assuming Atlantic Beach and Fort Macon's nourishment needs will be met by utilizing dredged material from the Morehead City Harbor Federal Navigation Project. However, Atlantic Beach is included in the overall effort as a contingency wing of the Master Plan and in the spirit of developing a regional nourishment plan. If Federal operation and maintenance funding for the Morehead City Harbor dissipates in the future, then the needs for Atlantic Beach will even be more pressing and again warrant participation in regional planning.

Bogue Banks Carteret County Coastal Storm Damage Reduction Project. The U.S. Army Corps of Engineers',Bogue Banks Coastal Storm Damage Reduction Project is a Civil Works project, which is designed and partially funded by the Corps. It is often referred to as the "50-year project" because the nourishment effort includes initial construction and subsequent periodic maintenance for 50 years. The USACE is currently in the Feasibility Phase (or study phase) of the project

II. Geographic Scope of the Cumulative Impact Assessment

The geographic scope of this Cumulative Impact Assessment will be from Cape Lookout to Cape Fear, a distance of about 115 miles of beaches. The immediate project area is defined as in the vicinity of Bogue and Shackleford Banks. The following numbers are approximate and are used throughout this assessment: Of this 115 miles of beaches, approximately 8% (9 miles) are located within the National Park Service, 10% (11 miles) are within USMC, Camp Lejeune, 11% (12 miles) are State owned, 63% (74 miles) are developed, and 8% (9 miles) are privately owned/developed. Additionally, of the 115 miles of beaches in the geographic scope of this assessment approximately 47% (54 miles) have been designated within the Coastal Barrier Resource System by the USFWS. Table K-4 further discusses these beach classifications.

This analysis will focus on cumulative impacts of the dredged material disposal sites for the Morehead City Harbor DMMP. Figure K-3 shows all of these proposed DMMP sediment disposal areas. The upland diked disposal area on Brandt Island, the approximate 10.5 miles of inlet influenced ocean beach on Bogue Banks (from about Pine Knoll Shores to Fort Macon State Park), the existing 559 acre nearshore placement area off Bogue Banks, and the US EPA approved ODMDS have received dredged sediment in the past. The new or revised disposal/placement areas would be the following:

1. An additional 1,209 acres of nearshore placement area off Bogue Banks (total of 559 existing plus 1,209 or 1,768 acres),

2. A 3.65 miles disposal area within the inlet influenced ocean beach on Shackleford Banks, and

3. A 492 acre nearshore placement area off Shackleford Banks.

The entire 25 miles of Bogue Banks beaches from Emerald Isle to Fort Macon State Park have been previously renourished by the County and/or used as a sediment placement area for the maintenance of the Federal navigation channels in Morehead City Harbor.

Figure K-3. Proposed Disposal Areas for the Morehead City Harbor DMMP.

III. Time Frame

This analysis considers known past, present, and the reasonably foreseeable future, sand placement and/or beach nourishment projects within the geographic scope of the project. The geographic scope is defined from Cape Lookout to Cape Fear or about 115 miles of beaches.

The USACE has maintained the existing federal navigation channels in Morehead City Harbor since 1910. The proposed DMMP addresses dredging needs, disposal capabilities, capacities of disposal areas, environmental compliance requirements, and potential for beneficial use of dredged material and indicators of continued economic justification. This DMMP will ensure sufficient disposal capacity for the 20-year period beginning in 2015 and extending through 2034.

At the project vicinity scale the cumulative assessment considers past periodic beach disposal of Morehead City Harbor maintenance material about every 2 to 3 years along portions of Atlantic Beach and Fort Macon since about 1979. Carteret County has also constructed its own beach nourishment project along Pine Knoll Shores, Salter Path, Indian Beach, and Emerald Isle in 2001/2002 (Phase 1), in 2002/2003 (Phase 2), and in 2003/2004 (Phase 3).

This assessment also includes the one time disposal of maintenance material on Indian Beach, Salter Path, Pine Knoll Shores, Atlantic Beach, and Fort Macon under Section 933 starting in 2003/2004. In the winter of 2007, beach disposal of maintenance material along Pine Knoll Shores under Section 933 was completed.

This assessment assumes continued periodic beach disposal of maintenance material along Fort Macon and Atlantic Beach. Construction of the West Onslow Beach and New River Inlet (Topsail Beach), which are proposed beach nourishment projects. The cumulative analysis also considers the potential that future federal (i.e. Brunswick County Beaches, Bogue Banks, etc.) and non-federal (i.e. Topsail Beach, Bald Head Island, Figure Eight Island, etc.) beach nourishment projects under study could be constructed.

IV. Actions Affecting Resources of Concern

A. Actions Affecting Aquatic Resources.

Dredging the existing Morehead City Harbor Navigation Channel.

Impacts on Nekton. See Section 4.5.1 of the DMMP.

Dredging Impacts. See Section 4.5 of the DMMP.

<u>Entrainment Impacts</u>. See Section 4.5.5 of the DMMP.

Impacts on Benthic organisms. See Section 4.5.3 of the DMMP.

B. Actions Affecting Beach Resources

The Geographic Area considered in this analysis includes Cape Lookout to Cape Fear, about 115 miles of beaches. The major sources of beach impacts are local beach maintenance activities (which include local beach nourishment), disposal of dredged material from maintenance of navigation channels, and beach nourishment (berm and dune construction with long-term periodic maintenance). Of particular concern are macroinvertebrate (section 4.5 of the DMMP), fisheries (section 4.5 of the DMMP), shorebird (section 4.7 of the *DMMP*), and sea turtle species (Section 4.8 and Appendix J of the DMMP) that utilize or occur on or adjacent to ocean beaches. These resources are also impacted by natural events and anthropogenic activities that are unrelated to disposal of sand on the beach as discussed below.

Local Maintenance Activity: Under the existing condition, the 10.5 mile long potential beach disposal area off Bogue Banks is subjected to repeated and frequent maintenance disturbance by individual homeowners and local communities following major storm events. These efforts are primarily made to protect adjacent shoreline property. Such repairs consist of dune rebuilding using sand from beach scraping and/or upland fill. Limited fill and sandbags are generally used to the extent allowable by CAMA permit. Such frequent maintenance efforts could keep the natural resources of the barrier island ecosystems from re-establishing a natural equilibrium with the dynamic coastal forces of the area.

Cape Lookout National Seashore (NPS) does not maintain the existing ocean beach on Shackleford Banks. No dune rebuilding, beach scraping, or installation of sandbags takes place along the beach strand on Shackleford Banks.

Non-Federal Beach Nourishment: Local efforts (i.e., Carteret County) can also include beach nourishment such as that conducted along Pine Knoll Shores, Salter Path, Indian Beach, and Emerald Isle by local interests in 2001-2004. The number of locally funded beach nourishment activities has increased significantly since 2004 along other developed North Carolina beaches. Though non-federal beach nourishment efforts continue to increase, many of these projects are being pursued as one-time interim efforts until the federal beach nourishment projects can be implemented. Therefore, this increase permitted non-federal projects does not necessarily reflect a subsequent increase in resource acreage impacts. Many of the non-federal projects occur within projects which are under study (i.e. Bogue Banks). Beaches that have been nourished under permit, or may be permitted to be nourished, include, but are not limited to: Bogue Banks, North Topsail Beach, Topsail Beach, Figure Eight Island, and Bald Head Island (Table

K-2). Individually, these projects total approximately 47 miles of beach or about 41% (47 miles/115 miles) of North Carolina beaches within the geographic scope of the assessment area. These frequent maintenance efforts could keep the natural resources of the barrier island ecosystems from reestablishing a natural equilibrium with the dynamic coastal forces of the area.

Federal (USACE) Beach Nourishment: Federal beach nourishment activities typically include the construction and long-term (50-year) maintenance of a berm and dune. The degree of cumulative impact would increase proportionally with the total length of beach nourishment project constructed. The first federal North Carolina beach nourishment projects were constructed at Carolina and Wrightsville Beaches in 1965, and totaled approximately 6.4 miles. An additional 3.8 miles of federal beach nourishment project was constructed in 1975 at Kure Beach. Most of the remaining developed North Carolina beaches (including the proposed project area) are currently under study by the Wilmington District for potential future beach nourishment projects (Table K-2). Individually, these existing or proposed federal projects total approximately 51 miles of beach or 44% (51 miles/115 total miles) of North Carolina beaches in the geographic scope of the assessment. Considering all existing and proposed federal and non-federal nourishment projects, and recognizing that some of the projects are overlapping or represent the same project area, approximately 98 miles or 85% (98 miles/115 total beach miles) of the North Carolina coast in the geographic scope could have private or federal beach nourishment projects by 2015.

Table K-2. Summary of federal and non-federal beach nourishment projects in North Carolina (Cape Lookout to Cape Fear) that have recently occurred, are currently underway, or will occur in the reasonably foreseeable future. (This list does not include all small scale beach fill activities (i.e. dune restoration, beach scraping, etc.). (* - federal or non-federal projects which may utilize the same borrow sources and/or overlap beach disposal locations).

Federal / Non-Federal	Project	Source of Sand for Nourishment	Beachfront Nourished	Approximate Length of Shoreline (miles)	Approximate Distance From the MHC DMMP Project Area (miles)
Federal	Cape Lookout National Seashore -East Side of Cape Lookout Lighthouse	Channel	East Side of Cape Lookout Lighthouse	1	10
	*Beaufort Inlet Dredging - Section 933 Project (Outer Harbor)	Beaufort Inlet Outer Harbor	Indian Beach, Salter Path, and Portions of Pine Knoll Shores	7	5
	*Beaufort Inlet and Brandt Island Pumpout - Section 933 (Disposal on Eastern Bogue Banks)	Beaufort Inlet Inner Harbor and Brandt Island Pumpout	Fort Macon and Atlantic Beach	4	0
	*Bogue Banks, NC (Coastal Storm Damage Reduction)	Offshore Borrow Areas	Communities of Bogue Banks	24	5
	Surf City and North Topsail Beach - (Coastal Storm Damage Reduction)	Offshore Borrow Areas	Surf City and North Topsail Beach	10	40
	*West Onslow Beach New River Inlet (Topsail Beach) (Coastal Storm Damage Reduction)	Offshore Borrow Areas	Topsail Beach	6	50
	Wrightsville Beach (Coastal Storm Damage Reduction)	Masonboro Inlet and Banks Channel	Wrightsville Beach	3	80
	Carolina Beach and Vicinity, NC Carolina Beach Portion (Coastal Storm Damage Reduction)	Carolina Beach Inlet	Carolina Beach	2	85
	Carolina Beach and Vicinity, NC Kure Beach Portion (Coastal Storm Damage Reduction)	Wilmington Harbor Confined Disposal Area 4 and an Offshore Borrow Area	Kure Beach	2	85
Non-Federal	*Emerald Isle FEMA Project	Offshore Borrow Areas - Morehead City Port Shipping Channel (ODMDS)	Emerald Isle	4	10
	*Bogue Banks FEMA Project	Offshore Borrow Areas – Morehead City Port Shipping Channel (ODMDS)	Emerald Isle (2 segments), Indian Beach, Salter Path, Pine Knoll Shores	13	5
	*Bogue Banks Restoration Project – Phase I – Pine Knoll Shores and Indian Beach Joint Restoration	Offshore Borrow Areas	Pine Knoll Shores and Indian Beach	7	10
	*Bogue Banks Restoration Project – Phase II – Eastern Emerald Isle	Offshore Borrow Areas	Indian Beach and Emerald Isle	6	20
	*Bogue Banks Restoration Project – Phase III– Bogue Inlet Channel Realignment Project	Bogue Inlet Channel	Western Emerald Isle	5	15
	*North Topsail Dune Restoration (Town of North Topsail Beach)	Upland borrow source near Town of Wallace, NC	North Topsail Beach	NA	40
	*North Topsail Beach Shoreline Protection Project	New River Inlet Realignment and Offshore Borrow Area	North Topsail Beach	11	40
	*Topsail Beach - Beach Nourishment Project	New Topsail Inlet Ebb Shoal and Offshore Borrow areas	Topsail Beach	6	40
	Figure Eight Island	Banks Channel and Nixon Channel	North & South Sections of Figure Eight Island	3	70
	Rich Inlet Management Project	Relocation of Rich Inlet	Figure Eight Island	NA	60
	Mason Inlet Relocation Project	Mason Inlet (new channel) and Mason Creek	North end of Wrightsville Beach and south end of Figure Eight Island	2	65

Federal (USACE) Navigation Channel Disposal of Dredged Material: Maintenance material from dredging in the vicinity of Morehead City Harbor has historically been disposed along about 6 miles of beach including the Town of Atlantic Beach and Fort Macon. Throughout the geographic scope of this assessment, a total of approximately 17 miles of beach or about 15% or (17 miles/115 total miles) of North Carolina beaches are authorized for disposal of beach quality dredged material from maintenance dredging of navigation channels (see Table K-3). However, not all of 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 placement/disposal limits overlap with existing federal or non-federal beach projects. The USACE currently uses up to 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.

Table K-3 Summary of dredged material disposal activities on North Carolina (Cape Lookout to Cape Fear) ocean front beaches associated with navigation dredging. Projects listed and associated disposal locations and quantities may not be all encompassing and represent an estimate of navigation disposal activities for the purposes of this cumulative impacts assessment. (* - Navigation disposal sites which may overlap with existing Federal or Non-Federal beach nourishment projects).

PROJECT		DISPOSAL LOCATION	APPROVED DISPOSAL LIMITS	ESTIMATED ACTUAL DISPOSAL LIMITS	ESTIMATED QUANTITY (CY)	COMMENTS
Beaufort	***Morehead City (Brandt Island)**	2,000 ft west of inlet, Fort Macon and Atlantic Beach to Coral Bay Club, Pine Knoll Shores	7.3 miles (38,300 lf)	5.2 miles or 27,800 linear feet	3.5 million every 8 yrs	Material from Ocean Bar routinely placed in nearshore berm or ODMDS on annual basis
	***AIWW Section I, Tangent B**	Pine Knoll Shores, vicinity of Coral Bay	2 miles (10,500 lf)	0.4 miles or 2,000 linear feet	<50,000 every 5 yrs	This area is included every 8 years as part of the pumpout for Brandt Island. Also included in the area under investigation for beach nourishment at Bogue Banks.
Swansboro	***AIWW Bogue Inlet Crossing Section I, Tangent-H through F**	Approx. 2,000 feet from inlet going east to Emerald Point Villas, Emerald Isle (Bogue Banks)	1mile (5,280 lf)	0.4 miles or 2,000 linear feet	<100,000 annually	
Browns Inlet	**AIWW Section II, Tangents-F,G,H**	Camp Lejeune, 3,000 feet west of Browns Inlet extending westward	1.58 miles (6,000 lf)	1 mile or 5,280 linear feet	<200,000 every 2 yrs	
New River Inlet	***AIWW, New River Inlet Crossing Section II, Tangents I & J, Channel to Jax. Section III, tangents 1&2**	N. Topsail Beach, 3,000 feet west of inlet extending westward to Maritime Way (Galleon Bay area)	1.5 miles (8,000 lf)	0.8 miles or 4,000 linear feet	<200,000 annually	Two areas 2,000 linear feet on either side of disposal area are routinely used.
Hampstead	***AIWW, Sect. III**	Topsail Island, Queens Grant	0.6 miles (2,500 lf)	0.6 miles or 2,500 lf	<50,000 every 6 yrs	
	***AIWW, Topsail Inlet Crossing & Topsail Creek**	Topsail Beach, from a point 2,000 feet north of Topsail Inlet	1 mile (5,280 lf)	0.4 mi or 2,000 ft	<75,000 annually	
Wrightsville Beach	**AIWW Sect. III,Tang 11&12 Mason Inlet Crossing**	Shell Island (north end of Wrightsville Beach from a point 2,000 feet from Mason Inlet	0.4 miles (2,000 lf)	0.4 mi. or 2,000 lf	<100,000	Not recently required since the inlet crossing closed up. If reopened will be rescheduled if needed
	***Masonboro Sand Bypassing**	At a point 9,000 feet from jetty extending southward midway of island	1.2 miles (6,000 lf)	1 mile 5,280 lf	500,000 every 4 years	Same time as Wrightsville Beach Nourishment
Carolina Beach	**AIWW, Section IV, Tangent 1**	Southern end of Masonboro Island at a point 2,000 linear feet from Carolina Beach Inlet extending northward to Johns Bay area	1.3 miles (7,000 lf)	0.4 miles (2,000 linear feet)	<50,000 annually	This site is used alternately with Carolina Beach disposal Site on North end of Island
Bald Head	***Bald Head**	Beach front on eastern and western shoreline	3.0 miles (16,000 lf)	3.0 miles or 16,000 lf	1.1 million every 2 years (except every 6th when it goes to Caswell)	Least Costly Disposal Option From Wilmington Harbor Ocean Bar Project.

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, to the maximum extent practicable. Disposal of this sand on beaches represents return of material, which eroded from these beaches, and is, therefore, replenishment with native material. The design of beach disposal sites generally extends the elevation of the natural berm seaward.

Other factors affecting Beach Resources: Many factors unrelated to disposal of sand on the beach may affect beach resources including: benthic invertebrate resources, shorebird populations, and ocean fish stocks. The factors can be a result of natural events such as natural population cycles or as a result of favorable or negative weather conditions including droughts, floods, La Niña, El Niño, and major storms or hurricanes to name a few. A primary anthropogenic factor affecting shorebird populations is beach development resulting in a loss or disturbance of nesting habitat and invasion of domestic predators. Primary man-induced factors affecting fish stocks are over fishing and degradation of water quality due to pollution.

V. Significant Resources and Impacts

Based on scoping comments from resource agencies and others, the primary concerns with the proposed maintenance dredging and beach disposal are direct and indirect impacts to hard bottom communities, macro-invertebrates, fish, shorebirds, and sea turtles. 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, Atlantic sturgeon, shortnose sturgeon, seabeach amaranth, and piping plover. Impacts to all Federally listed protected species are provided in Appendix J Biological Assessment and summarized below and include, but are not limited to, mortality, reduction in prey species, habitat change, and disturbance during construction activities. Also discussed are the benefits of periodic disposalbeach disposals/renourishments, which are expected to enhance nesting habitat of sea turtles and to provide additional habitat for sea beach amaranth. Detailed discussions of all significant resources and associated impacts considered in this assessment for Bogue and Shackleford Banks are included in Sections 4.0 and 5.0 of the DMMP .

Beach and Dune. Terrestrial habitat types within these areas include sandy or sparsely vegetated beaches and vegetated dune communities. Mammals occurring within this environment are opossums, cottontails, gray foxes, raccoons, feral house cats, shrews, moles, voles, and house mice. Common vegetation of the upper beach includes beach spurge, sea rocket and pennywort. The dunes are more heavily vegetated, and common species include American beach grass, panic grass, sea oats, broom straw, seashore elder, and salt meadow hay. Seabeach amaranth, a federally listed threatened species, is present throughout most of North Carolina. Ghost crabs are important invertebrates of the beach/dune community. The beach and dune also provide important nesting habitat for loggerhead and green sea turtles as well as habitat for a number of shorebirds and many other birds, including resident and migratory songbirds. Disposal of material along the ocean beach enhances and improves important habitat for a variety of plants and animals, and restores lost habitat in the areas of most severe erosion. This is especially important for nesting loggerhead sea turtles and seabeach amaranth. Historic nesting data from Bogue Banks indicate that sea turtles continue to nest on disposal beaches with hatch rate successes similar to non-disposal beaches (Matthew Godfrey, Personal Communication 2010). Furthermore, new populations of seabeach amaranth have been observed to follow sand disposal on beaches where sand has been disposed by the USACE (i.e., Wrightsville Beach and Bogue Banks) (USFWS 1996b; CSA 2002).

In addition to providing important upland habitat, the cumulative effects of beach disposal projects in Bogue and Shackleford Banks is not significant and would protect public infrastructure, public and private property, and human lives.

Marine Waters (including Nearshore Placement Areas). Along the coast of North Carolina, marine waters provide habitat for a variety of ocean fish and are important commercial and recreational fishing grounds. Kingfish, spot, bluefish, weakfish, spotted sea trout, flounder, red drum, king mackerel, and Spanish mackerel are actively fished from boats, the beach, and local piers. Offshore marine waters serve as habitat for the spawning of many estuarine dependent species. Oceanic large nekton located offshore of North Carolina are composed of a wide variety of bony fishes, sharks, and rays, as well as fewer numbers of marine mammals and reptiles. Marine mammals and sea turtles that may be present are addressed in Appendix J Biological Assessment. Dredging and placement of beach/nearshore fill may create impacts in the marine water column in the immediate vicinity of the activity, potentially affecting the surf zone and nearshore ocean. These impacts may include minor and short-term suspended sediment plumes and related turbidity, as well as the release of soluble trace constituents from the sediment. Overall water quality impacts for any given project are expected to be short-term and minor.

Cumulative effects of multiple simultaneous beach and nearshore placement operations in the Bogue and Shackleford Banks could potentially impact fishes of the surf zone. However, the frequency of beach and nearshore placement (on average once every three years), the high quality of the sediment selected for beach fill and the small amount of beach affected at any point in time would not suggest that this activity poses a significant threat.

The frequency of use for the nearshore placement areas off Bogue and Shackleford Banks are in years 2 and 3 of the DMMP cycle, the Corps will ensure that the same placement locations are used time after time, No hardbottoms are located within these nearshore placement areas (see Section 5.5.6 in the DMMP). Additionally, by placing sediment on the beaches and nearshore areas of Bogue and Shackleford Banks, the deflation of the Beaufort Inlet Ebb Tide Delta will be reduced.

Therefore the use of the beach and nearshore placement areas off Bogue and Shackleford Banks will not cause a significant cumulative impact to the marine fauna.

Intertidal and Nearshore Zones. The intertidal zone within the proposed beach nourishment areas serves as habitat for invertebrates including mole crabs, coquina clams, amphipods, isopods, and polychaetes, which are adapted to the high energy, sandy beach environment. These species are not commercially important; however, they provide an important food source for surf-feeding fish and shore birds. The surf zone is suggested to be an important migratory area for larval/juvenile fish moving in and out of inlets and estuarine nurseries (Hackney et al. 1996). Disposal operations along the beach can result in increased turbidity and mortality of intertidal macrofauna, which serves as food sources for various fish and bird species. Therefore, feeding activities of these species may be interrupted in the immediate area of beach sand placement. These mobile species are expected to temporarily relocate to other areas as the project proceeds along the beach. Though a short-term reduction in prey availability may occur in the immediate disposal area, only a small area is impacted at any given time, and once complete, organisms can recruit into the nourished area. The anticipated construction timeframes for pipeline beach projects on Bogue Banks would be from November 16 to April 30 and on Shackleford Banks from November 16 to March 31 for pipeline dredges and hopper dredge projects would be from January 1 to March 31 and would avoid a majority of the peak recruitment and abundance time period of surf zone fishes and their benthic invertebrate prey source. To summarize, the impacts of beach/nearshore placement projects on the intertidal and nearshore zones are considered temporary, minor and reversible.

Cumulative effects of multiple simultaneous beach/nearshore placement operations in the Bogue and Shackleford Banks could be potentially harmful to benthic invertebrates in the surf zone; however, the frequency of sediment disposal on the beach (on average once every three years), the high quality of the sediment selected for beach fill and the small amount of beach affected at any point in time would suggest that this activity would not pose a significant threat.

The frequency of use for the nearshore placement areas off Bogue and Shackleford Banks are in years 2 and 3 of the DMMP cycle. No hardbottoms are located within these nearshore placement areas (see Section 5.5.6 in the DMMP). Additional benefits would be placement of sediment within the littoral zone could reduce the deflation of the Beaufort Inlet Ebb Tide Delta.

Therefore the use of the beach and nearshore placement areas off Bogue and Shackleford Banks will not cause a significant cumulative impact to the benthic macrofauna.

Hardbottoms. Of special concern in the offshore area are hard bottoms, which are localized areas, not covered by unconsolidated sediments and where the ocean floor is hard rock (see Sections 4.5.06 and 5.5.06 of the DMMP). Hard bottoms are also called "live bottoms" because they support a rich diversity of invertebrates such as corals, anemones, and sponges, which are refuges for fish and other marine life. They provide valuable habitat for reef fish such as black sea bass, red porgy, and groupers. Hard bottoms are also attractive to pelagic species such as king mackerel, amberjack, and cobia. Along the North Carolina coast, hard bottoms are most abundant in southern portion of the state. Review of data provided by the Southeast Monitoring and Assessment Program (SEAMAP 2001) and the results of surveys from Tidewater and Geo-Dynamics identified one area of hard bottom off Pine Knoll Shores, about 2 miles south of the project area.

Additional side-scan sonar surveys within the proposed Shackleford Banks nearshore and the proposed expanded Nearshore West revealed no evidence of hard bottoms. (USACE 2010a). This remote-sensing data confirms that proposed material placement at the sites will not have any impact on exposed hard bottoms or associated marine life.

Therefore the cumulative effects on hard bottoms from disposal of beach compatible sediment on the beaches and nearshore areas of Bogue and Shackleford Banks is not significant since there is no evidence of any hard bottoms in the project area.

Nearshore Zone. Maintenance sediment (80% or greater sand) is also to be placed in the nearshore areas off Bogue and Shackleford Banks. Benthic organisms, phytoplankton, and seaweeds are the major primary producers in this community with species of *Ulva* (sea lettuce), *Fucus*, and *Cladocera* (water fleas) being fairly common where suitable habitat occurs. Many species of fish-eating birds are typically found in this area including gulls, terns, cormorants, loons, and grebes (Sections 4.7 and 5.7). Marine mammals and sea turtles also are frequently seen in this area and are discussed in detail in Sections 4.8 and 5.8, and in Appendix J Biological Assessment of the DMMP. Fishes and benthic resources of this area are discussed in Sections 4.5 and 5.5 of the DMMP, respectively.

Cumulative effects of multiple simultaneous nearshore placement operations in Bogue and Shackleford Banks could be potentially harmful to benthic invertebrates in the nearshore area. No hardbottoms are located within these nearshore placement areas (see Section 5.5.6 in the DMMP). and the small amount of nearshore area affected at any point in time would suggest that this activity would not pose a significant threat. Additional benefits would be placement of sediment within the littoral zone could reduce the deflation of the Beaufort Inlet Ebb Tide Delta. Therefore, the cumulative effect of placement of sediment (80% or greater sand) in the nearshore areas off Bogue and Shackleford Banks is not significant.

Other Resources and Impacts

Air Quality. The ambient air quality for all of coastal North Carolina has been determined to be in compliance with the National Ambient Air Quality Standards. All coastal counties in North Carolina are designated as attainment areas and do not require conformity determinations.

Additionally, although ozone is not a significant problem in the coastal counties, ozone is North Carolina's most widespread air quality problem, particularly during the warmer months. High ozone levels generally occur on hot sunny days with little wind, when pollutants such as nitrogen oxides and hydrocarbons react in the air. The ozone season is April through October. Dredging with beach disposal or renourishment typically takes place during the cooler months of the year, during times of low biological activity and outside of the ozone season.

The project is not anticipated to create any adverse cumulative effect on the ambient air quality of this attainment area.

Social and Economic. The coastal areas of North Carolina will continue to grow and expand both with and without the Morehead City Harbor DMMP. Therefore, the economic benefit analysis for the proposed project claims no increase in benefits or hurricane and storm damage due to induced development. Development of vacant lots in Bogue Banks is limited to lots buildable under the regulations set forth by CAMA, flood plain regulations, State and local ordinances, and applicable requirements of the Federal Flood Insurance Program.

The proposed DMMP is not anticipated to create any adverse cumulative social or economic impacts. Continued maintenance of the Morehead City Harbor will provide cumulative social and economic benefits to the project area.

Wave Conditions. Placement of sediment in the nearshore areas off Bogue and Shackleford Banks is the only potential source of impacts on wave conditions. However, these changes are not expected to be significant considering the shallow nature of the proposed placement sites.

No adverse cumulative impacts are anticipated on wave conditions in the project area.

Shoreline and Sand Transport. On Bogue Banks, the 10.5 mile long placement area (from Fort Macon State Park to Pine Knoll Shores) is located within the Beaufort Inlet influence area and there is a net transport to the east. On Shackleford Banks, the 3.65 mile long disposal area is also located within the inlet influence area and the net sand drift is to the west. Both nearshore placement areas off Bogue and Shackleford Banks are located within the Beaufort Inlet influence area.

Additional information on the dynamics of the inlet and ebb tide delta is found in the Coastal Engineering Section of the DMMP. On a regional basis, placement of maintenance sediment within the inlet influence area adds material to the longshore transport system, thus providing positive impacts to the Beaufort Inlet ebb tide delta. Although a regional sediment budget analysis has not been completed, it is expected that the proposed action and the combined effects of all other existing and proposed beach projects will have a minimal effect on shoreline and sand transport.

Therefore no adverse cumulative impacts on the shoreline and sand transport in the project area are expected.

VI. 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 nearshore placement area off Bogue and Shackleford Banks 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 fish stocks. In regard to physical habitat alterations in the placement areas, it is expected that alterations in depths and bottom sediment may occur and be persistent. However, site modifications would 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.

In a 1999 Environmental Report on the use of federal offshore sand resources for beach and coastal restoration, the U.S. Department of Interior, Minerals Management Service (DOI 1999) provided the following assessment of potential impacts to beach fauna from beach disposal:

Because benthic organisms living in beach habitats are adapted to living in high energy environments, they are able to quickly recover to original levels following beach nourishment events; sometimes in as little as three months (Van Dolah et al. 1994; Levison and Van Dolah 1996). This is again attributed to the fact that intertidal organisms are living in high energy habitats where disturbances are common. Because of a lower diversity of species compared to other intertidal and shallow subtidal habitats (Hackney et al. 1996), the vast majority of beach habitats are recolonized by the same species that existed before nourishment (Van Dolah et al. 1992; Nelson 1985; Levison and Van Dolah 1996; Hackney et al. 1996).

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

VII*. Baseline Conditions*

The following DMMP section describes the status of significant resources that may be affected by this and other similar projects that are pertinent to this analysis.

Section 4.0, Affected Environment.

VIII. *Cause and Effect Relationships*

The following DMMP section describes impacts of the proposed action on significant resources. Cause and effect relationships described in the report are consistent with those that would be expected for other similar projects that are pertinent to this analysis.

Section 5.0, Environmental Effects.

IX. Magnitude and Significance of Resource Impacts

A. Morehead City Harbor Federal Navigation Channel

The USACE has maintained the Morehead City Harbor Federal navigation channel since 1910. Over time the harbor channels have been deepened and widened to their current dimensions. Actions associated with maintenance of the Morehead City Harbor have been addressed in a number of environmental and planning reports which describe the Morehead City Harbor federal navigation project, its ongoing and proposed improvements, the details of dredging and disposal operations required for its construction and maintenance, and the environmental aspects of the project (see Section 1.5 Incorporation by Reference of the DMMP). The Morehead City Harbor DMMP is not planning to deepen or widened the harbor channels but to ensure that the dredge maintenance sediment is placed within the inlet influence area which would add material to the longshore transport system, thus providing positive impacts to the Beaufort Inlet Ebb Tide Delta.

In 2010, the point of the spit on the west end of Shackleford Banks had accreted toward the navigation channel and had encroached upon the authorized channel. The Morehead City Harbor channel is a fixed channel that cannot be realigned without additional physical and environmental impact analyses and additional approvals Therefore, in order to maintain safe navigation of the authorized channel, dredging of approximately 1 acre of the upland portion of the spit was imminent (Figure 1). However, in August 2011, Hurricane Irene struck the project area and drastically changed the configuration of the spit. Aerial photography and recent hydrographic surveys indicate that the upland portion of the spit no longer encroaches into the navigation channel.

Over time, the spit on the west end of Shackleford Banks may accrete and return to a position that encroaches on the navigation channel. If so, maintenance dredging of the channel could affect upland portions of the spit. Prior to any dredging of the spit, the USACE would complete a separate NEPA document to address environmental effects. During the NEPA process, the USACE would coordinate with applicable resource agencies, including coordination with USFWS regarding potential impacts to the threatened Piping Plover and its designated critical wintering habitat, as well as coordination with the NPS to obtain the required Special Use Permit.

Site Specific Impacts:
Cumulative impacts from space crowded perturbations could occur at the local scale resulting from the periodic maintenance and sediment disposal activities of the Morehead City Harbor DMMP and Bogue Banks federal and non-federal projects.

Geographic Area Impacts:

Existing and Potential Sites: Beach compatible sediment identified for all federal and non-federal nourishment projects throughout the geographic area (from Cape Lookout to Cape Fear) is most often identified from: maintenance or deepening of navigation channels, and/or offshore borrow areas (Table K-2). For the purposes of this impact assessment, only beach and nearshore placement areas are evaluated for cumulative marine resource impacts.

Considering only the projects that are currently in use (Table K-3), significant cumulative impacts associated with time and space crowded perturbations are not expected considering that these sediment disposal areas are spread throughout the state and the acreage of impact for these disposal areas relative to the available un-impacted sites throughout the state is not significant. However, recognizing the potential for all of the federal projects identified in the geographic area (from Cape Lookout to Cape Fear) to occur within the reasonably foreseeable future (Table K-3), there is a potential for cumulative impacts for time and space crowded perturbations associated with the cyclic use of the disposal areas.

B. Beach Areas

The impacts of beach disposal on Bogue and Shackleford Banks beaches are evaluated in Section 5 of the DMMP. The degree of cumulative impact would increase proportionally with the total length of beach impacted. The most likely projects to increase the length of North Carolina beach disposal are beach nourishment projects.

As shown in Table K-4 below, the North Carolina Ocean beaches (geographic scope of the assessment is from Cape Lookout to Cape Fear, about 115 miles of beaches) can be divided up based on the potential that a beach nourishment project will be proposed for them. The Coastal Area Management Act (CAMA) applies to all 20 North Carolina Coastal Counties. Proper beach nourishment , dredged material disposal, and/or local maintenance within these counties is generally regulated under CAMA and/or USACE permitting authorities alone, and for this analysis, are labeled CAMA regulated. Approximately 63 percent of North Carolina beaches are in this category. Other North Carolina ocean beach areas which are less likely to be considered for beach disposal include those identified under the Coastal Barrier Resources Act (CBRA) of 1982 (PL 9-348), the Coastal Barrier Improvement Act of 1990 (PL 101-591), and National and State park lands. CBRA restricts federal expenditures in those areas comprising the Coastal Barrier Resources System (CBRS); thus, long term federal beach nourishment projects will not occur in defined CBRA zones. However, though long term federal beach nourishment projects are restricted from CBRA zones, non-federal permitted projects may still occur (i.e. North Topsail Beach) on a short term basis. National or state park lands are the least likely to have beach disposal projects considering that their mission is often to manage lands in their natural state and protection of infrastructure is less common. However, the National Park Service, Cape Lookout National Seashore has requested that the USACE place 90% or greater sand on a 3.65 mile disposal site on Shackleford Banks. National and state parks allow highly restricted placement under special use permits and conduct disposal only as required to protect resources, such as at Pea Island (1.5 miles) and now Shackleford Banks (3.65 miles). Only about 8 percent (9 miles /115 total miles) of beach disposal areas within the geographic scope of the cumulative assessment are designated as National Park Lands.

Beach Classification	Percentage of NC Beaches	Potential for Beach Disposal/Nourishment Activities
Coastal Barrier Resource System	47	Medium
Developed and/or CAMA Regulated	63	High
National Park Lands	8	Low
State Park Lands	11	Low

Table K-4. North Carolina beach classifications and associated potential for beach disposal/nourishment activities from Cape Lookout to Cape Fear (115 miles of beaches). Note: the percentage of NC Beach Classifications is greater than 100% since some of the beaches have multiple designations (i.e., some developed areas have been designated within the Coastal Barrier System).

X. Summary of Impacts within the Geographic Scope of the Cumulative Assessment

The following quantitative analyses of the geographic scope (Cape Lookout to Cape Fear) impacts were determined based on data provided in Tables K-2 and K-3. These data represent an estimate of the percent of North Carolina beach affected by sand disposal for maintenance of federal navigation channels, and existing, proposed, or potential federal and non-federal beach nourishment projects. Table K-5 represents the total project miles for all existing and proposed federal and non-federal beach nourishment projects and the full authorized limits for beach disposal of navigation dredged material. However, assuming all of these activities were constructed to the full extent (which is very unlikely considering funding constraints, dredging needs from navigation channels, etc.) these estimates would not represent the actual extent of North Carolina ocean beach impacted because of overlapping project areas.

Project Type	Total Project Miles	% NC Beach
Federal Beach Nourishment	51	44
Non-Federal Beach Nourishment	47	41
Federal Authorized Beach Placementl	17	15
TOTAL	**115**	**100**

Table K-5. Summary of total project miles from Cape Lookout to Cape Fear (115 miles of beaches) for existing and/or proposed federal and non-federal nourishment activities and disposal of dredged material.

Recognizing that many of the existing or proposed federal and non-federal beach nourishment project limits overlap and that some portions of the federal authorized beach disposal limits are within these project areas as well, Table K-6 provides an estimate of total mileage of North Carolina Ocean beach from Cape Lookout to Cape Fear (about 115 miles of beach) that could cumulatively be impacted by beach nourishment or navigation disposal activities without double counting the overlapping projects.

Project Type	Total Miles Impacted (*w/o double counting for overlaping projects)	% NC Beach
Federal and Non-Federal Beach Nourishment	98	85
Federal Authorized Beach Disposal	17	15
TOTAL	115	100

Table K-6. Summary of cumulative mileage of North Carolina Ocean beach from Cape Lookout to Cape Fear (115 miles of beaches) that could be impacted by beach nourishment and/or navigation disposal activities.

A. Federally Authorized Beach disposal:

17 miles or 15 percent of the North Carolina ocean beaches from Cape Lookout to Cape Fear are Federally authorized for beach disposal (see Table K-6) from Cape Lookout to Cape Fear. However, not all of these projects are routinely dredged and a majority of the authorized beach disposal limits are not actually disposed on to the full extent. Additionally, many of the authorized placement/disposal limits overlap with existing federal or non-federal beach projects. The USACE currently uses up to 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.

B. Existing Beach Nourishment:

Of the total 98 miles of potential federal and non-federal beach nourishment project miles proposed for NC ocean beaches from Cape Lookout to Cape Fear (Table K-5), a total of 34 miles (29%) have actually been constructed. However, this estimate represents actual project miles nourished and does not reflect circumstances where the projects overlap. Therefore, the total number of actual miles of beach nourished is less.

C. Cumulative Impacts:

Considering all proposed and existing disposal and nourishment impacts throughout the geographic area (from Cape Lookout to Cape Fear), a significant portion of the shoreline will have beach disposal activities in the foreseeable future, likely resulting in time and space crowded perturbations. However, recognizing the funding constraints to complete all authorized and/or permitted activities, the availability of dredging equipment, etc.; it is very unlikely that all of these proposed projects would ever be constructed all at once. Therefore, though time and space crowded perturbations are expected in the reasonably foreseeable future, assuming each project adheres to project related impact avoidance measures, it is likely that adjacent un-impacted and/or recovered portions of beach will be available to support dependent species (i.e. surf zone fish, shore birds, etc.) and facilitate recovery of individual project sites to pre-project conditions.

XI. Project Level Impacts Within the Project Vicinity on Bogue and Shackleford Banks

Bogue Banks: The proposed DMMP may impact about 10.5 miles of shoreline from Fort Macon State Park to Pine Knoll Shores. An additional 1,209 acres of nearshore placement area off Bogue Banks (total of 559 existing acres plus 1,209 or 1,768 acres) is included in the DMMP.

Shackleford Banks: The DMMP proposes to impact (for the first time) a new beach disposal area within a 3.65-mile portion of the ocean beach on Shackleford Banks and a new nearshore placement area (Nearshore East) that is 492 acres.

A. Existing Local Maintenance:

Under existing conditions, the entire study area on Bogue Banks (10.5 miles) is expected to experience frequent local maintenance, including beach scraping, bulldozing, dune restoration, beach restoration, etc. No existing local maintenance is expected by the NPS on Shackleford Banks.

B. Existing Disposal Activities:

Annual navigation disposal activities (up to about 700,000 cy) may occur from the Fort Macon State Park to Atlantic Beach.

The disposal of beach nourishment material along the 10.5-mile study area on Bogue Banks is not expected to affect the current disposal schedule.

No existing disposal activities exist on Shackleford Banks.

C. Existing Beach Nourishment:

None on Shackleford Banks. Carteret County is planning to complete the Bogue Banks Beach Master Nourishment Plan (Master Plan). The County retained Moffatt & Nichol to develop a comprehensive, multi-decadal nourishment program using objective parameters to gauge beach health and trigger future nourishment events for the entire 24-mile long island of Bogue Banks.

D. Proposed Beach Nourishment:

The entire 10.5-mile federal study area is located within the Corp's Bogue Banks Feasibility Study proposed for beach disposal. Additionally, this same 10.5 mile long disposal area is proposed to be nourished by the County's (non-Federal study) Bogue Banks Beach Master Nourishment Plan (Master Plan).

E. Cumulative Impacts (Within the Project Vicinity on Bogue and Shackleford Banks):

Bogue Banks: The currently approved 10.5 mile long beach navigation disposal area is located within the proposed project area study area. Therefore, all of the existing 10.5 mile beach disposal area has had previous used as a beach disposal area. For areas that have had local disturbances (i.e. beach bulldozing), it is possible that the proposed action will impact beach invertebrates in areas that have not fully recovered from past sand deposition, extending recovery time.

Shackleford Banks: The currently proposed 3.65 mile long beach navigation disposal area has not been used as a navigation material deposition site. The NPS does not plan any local disturbances (i.e. beach bulldozing) on this site.

Conclusion

Historically, the extent of beach disposal/nourishment activities on beaches within the geographic area from Cape Lookout to Cape Fear was limited to a few authorized federal projects including: Wrightsville Beach, Carolina and Kure Beaches. However, in the past 10 years, a significant number of federal and non-federal beach nourishment efforts were pursued to provide coastal storm damage reduction along the increasingly developed North Carolina shoreline. Additionally, the number of non-federal permitted beach nourishment projects has increased in recent years in efforts to initiate coastal storm damage reduction measures in the interim of federal projects being authorized and/or funded (i.e. North Topsail Beach, and Topsail Beach, and Bogue Banks). Furthermore, the frequency of beach disposal activities for protection of infrastructure will continue throughout the state resulting in cumulative time and space crowded perturbations. However, assuming projects continue to adhere to environmental commitments for the reduction of environmental impacts, and un-developed beaches throughout the state continue to remain undisturbed, it is likely that adjacent un-impacted and/or recovered portions of beach will be available to support dependent species (i.e. surf zone fish, shore birds, etc.) and facilitate recovery of individual project sites to pre-project conditions.

Assuming recovery of impacted beaches and the sustainability of un-developed protected beaches (i.e. National/Federal and State Parks and Estuarine Reserves) the potential impact area from the proposed DMMP on Bogue and Shackleford Banks as well as existing actions is small relative to the area of available similar habitat on a vicinity and statewide basis.

The DMMP is proposing to place only coarse grain material (i.e., 90% or greater sand) on 3.65 miles ocean beach on Shackleford Banks, which has never been designated as a disposal area. The proposed DMMP represents an approximate increase of only 3.1% (3.65 miles/115 miles) in the area of North Carolina beaches affected by sand disposal. Therefore the DMMP will not significantly increase cumulative impacts in the immediate project area or within the geographic scope of the cumulative assessment.

XII. Actions to Reduce Cumulative Impacts

The proposed DMMP will reduce cumulative impacts in the project area or within the geographic scope of the cumulative assessment by the following actions:

1. By placing sediment on the beaches and nearshore areas of Bogue and Shackleford Banks, the deflation of the Beaufort Inlet Ebb Tide Delta will be reduced. Placement of material within the Beaufort Ebb Tide Delta will also ameliorate future shoreline erosion.

2. Beach disposal of coarse grained material (i.e., 90% or greater sand) on both Bogue and Shackleford Banks will only occur once every three years, which will minimize impacts to intidal macrofauna. Moreover, the two year frequency between placement events will provide sufficient time for recovery of marine biota.

3. The USACE will stagger the beach disposal sites on Shackleford Banks in order to avoid impacting the same section of the ocean strand. Moreover, beach disposal activities on both Bogue and Shackleford Banks would be at an average rate of approximately 200 foot per day or 4-5,000 feet per month; therefore, un-impacted habitat will be available throughout the disposal operation on these ocean beaches.

4. No frontal dunes on Bogue and/or Shackleford Banks will be adversely impacted by the proposed DMMP.

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APPENDIX L

NATIONAL PARK SERVICE
WILDERNESS MINIMUM REQUIREMENTS ANALYSIS (MRA)
CAPE LOOKOUT NATIONAL SEASHORE

ARTHUR CARHART NATIONAL WILDERNESS TRAINING CENTER

MINIMUM REQUIREMENTS DECISION GUIDE

WORKSHEETS

". . . except as necessary to meet minimum requirements for the administration of the area for the purpose of this Act..."

– the Wilderness Act, 1964

CAPE LOOKOUT NATIONAL SEASHORE

Disposal of Dredged Sediment at Shackleford Banks

September 2013

Please refer to the accompanying MRDG *Instructions* for filling out this guide.

The spaces in the worksheets will expand as necessary as you enter your response.

Step 1: Determine if any administrative action is necessary.

Description: Briefly describe the situation that may prompt action.

Cape Lookout National Seashore (CALO or the Seashore) was authorized March 10, 1966 (P.L. 89-366). Congress amended this Act on October 26, 1974 (P.L. 93-477) and required the Secretary of the Interior to determine the suitability or non-suitability of Seashore lands for wilderness designation. On January 14, 1986, NPS Director William Penn Mott, Jr., signed a Wilderness Recommendation proposing that 2,990 acres of the Shackleford Banks portion of the Seashore be designated as wilderness. Since that time, the National Park Service has managed the lands proposed for wilderness designation in such a way as to preserve their wilderness character.

The United States Army Corps of Engineers (USACE) is currently preparing the Morehead City Harbor Dredged Material Management Plan (DMMP). Once completed, this document will provide a comprehensive guide for dredging and disposal activities associated with the Beaufort Inlet for a 20-year period beginning in 2015. As part of the mitigation component of the plan, the USACE is considering a “beach disposal” alternative. This alternative would include the disposal of dredged sediment onto the beaches of Shackleford Banks, within the area of proposed wilderness. (The boundary of the proposed wilderness is the mean high water line.) The disposal would entail active environmental manipulation and the use of mechanized equipment within proposed wilderness.

The beach disposal alternative would serve to reduce dredging-induced erosion along Shackleford Banks that occurs in part as a result of dredging and maintenance of the navigation channel through Beaufort Inlet. Information contained in several reports suggests that the navigation channel through Beaufort Inlet has exacerbated the erosion of Shackleford Banks, as follows:

- Since 1936, when the navigation channel at Beaufort Inlet was deepened and mostly fixed in position, the ebb tidal delta shoal located offshore of the inlet has deepened, decreased in volume, elongated and been displaced toward the sea.
- The fixed navigation channel along with the maintained depth of the channel have essentially stopped natural sediment bypassing across the inlet (MCH Section 111 Study, USACE 2001).
- Shackleford Banks has assumed a more concaved shoreline configuration compared to its pre-project shape due to build-up on the west and east ends combined with recession along the middle portion of the island. The west end of the island has extended approximately 5,000 feet into Beaufort Inlet. The changes in shoreline behavior on the west and middle portions of the island are strongly associated with the physical changes that have occurred in the shape of the Beaufort Inlet ebb tide delta as a result of the Morehead City Harbor project (MCH Section 111 Study, USACE 2001).
- Overall, from 1974 to 2009, net volumetric losses to the ebb tide delta complex as a whole were estimated to total about 13.4 M cy. Continued erosion of the ebb tide delta complex is likely to impact adjacent beaches through increased wave heights and changes to approach angles; increased shoreline erosion and volumetric losses along the beach and changes in alongshore transport rates and flow paths (Morehead City

Harbor Dredged Material Management Plan Alternative Formulation Briefing (MCH DMMP AFB), May 2010).

- The ebb tidal delta on the Shackleford Banks side (eastern side) of the inlet is also continuing to deepen and deflate based on profiles from 1991 and 2000 (MCH Section 111 Study, USACE 2001). The MCH DMMP AFB (May 2010) estimates that the central eastern portion of the ebb tidal delta has lost 7.4 M cy between 1974 and 2009.
- These profiles also indicate that the offshore portion of Shackleford Banks is getting deeper. From 1991 to 2000 there was a volumetric loss on the order of 900,000 cy/yr above the 35 ft depth contour along Shackleford Banks (MCH Section 111 Study, USACE 2001). Some of this loss is due to a channel deepening event that occurred in 1994. More recent calculations by the USACE compare survey profiles off of Shackleford Banks from 2000 to 2006, 2008 and 2009. All of these surveys have been conducted after the last channel deepening event, so they are more representative of impacts from maintenance dredging. The estimated volume loss along Shackleford Banks is an average of 177,500 cy/year.

In short, the loss of an average of 177,500 cy/year of sediment within the offshore profile during maintenance dredging operations results in an eroding shoreline within certain sections of the park.

If no action is taken, Shackleford Banks will continue to erode, due partially to the human impacts of the navigation channel. This erosion will continue to have a direct, adverse effect on the proposed wilderness at Shackleford Banks.

To determine if administrative action is necessary, answer the questions listed in A - F on the following pages.

A. Describe Options Outside of Wilderness

Is action necessary within wilderness?

Yes: ☑ **No:** ☐

Explain: Yes. Disposal of sediment within proposed wilderness is necessary to offset ongoing loss of the wilderness resource attributable in part to anthropogenic disturbance at Beaufort Inlet. The amount of equipment associated with the beach disposal would be large, due in part to the fact that there is no road on the island. However, the beach disposal is necessary to mitigate ongoing erosion and minimize loss of the wilderness resource.

Nearshore placement outside of proposed wilderness would not serve as adequate mitigation to reduce future losses of beachfront material. Monitoring of nearshore placement sites on the western half of the ebb tidal delta in both 25-ft and 30-ft mean low water depths has indicated very little movement of deposited material (MCH Section 111 Study, USACE 2001). This information suggests that nearshore placement alone may not be sufficient to minimize future sediment losses along Shackleford Banks.

NPS has asked about the possibility of using smaller dredges that could deposit sediment in the intertidal area, immediately adjacent to the park but not within the actual park boundary. In response, USACE has explained that there are compelling reasons why this is not feasible. A smaller dredge that has a shallow draft (15 ft) and can deposit sediment in the intertidal area cannot dredge in water depths greater than 17 ft. The Morehead City Navigation Channel is 45 ft deep; therefore a smaller dredge cannot complete the dredging for this project. In addition, the COLREGS Demarcation Line delineates areas where dredges must be U.S. Coast Guard Ocean-Certified. The line for the MCH project is the land boundary of Shackleford Banks, so the dredge used for this project must be a U.S Coast Guard Ocean-Certified dredge. Based on the limited number of 24" Ocean-Certified pipeline dredges on the U.S. Atlantic Coast, it is likely that this work would be performed by a 30" pipeline dredge. As a result of the sizes, pressures and volumes associated with 30" pipe, it cannot be made from HDPE or a similar light material. Heavy equipment is required to maneuver the pipe.

The potential for placement of material in shallow water using the 30" pipeline dredge was also considered. This is not operationally feasible because it is very difficult and dangerous to move the large pipeline around in shallow water and evenly distribute dredged material. Another technique used internationally is rainbowing, when the channel and placement area are very close and the dredge can shoot the material out in a line about 500 ft. The distance between the channel and placement location would prohibit this method. In addition, the equipment is not available and would need to be specially built for the project, and environmental regulatory agencies may also have concerns.

B. Describe Valid Existing Rights or Special Provisions of Wilderness Legislation

Is action necessary to satisfy valid existing rights or a special provision in wilderness legislation (the Wilderness Act of 1964 or subsequent wilderness laws) that allows consideration of the Section 4(c) prohibited uses? Cite law and section.

Yes: ☐ **No:** ☑ **Not Applicable:** ☐

Explain:

C. Describe Requirements of Other Legislation

Is action necessary to meet the requirements of other laws?

Yes: ☑ **No:** ☐ **Not Applicable:** ☐

Explain: Action is necessary to prevent or minimize loss of habitat for species listed under the Endangered Species Act. Shackleford Banks provides habitat for five threatened or endangered species, including loggerhead sea turtle, green sea turtle, leatherback sea turtle, piping plover, and seabeach amaranth.

D. Describe Other Guidance

Is action necessary to conform to direction contained in agency policy, unit and wilderness management plans, species recovery plans, or agreements with tribal, state and local governments or other federal agencies?

Yes: ☑ **No:** ☐ **Not Applicable:** ☐

Explain: Action is necessary to prevent impairment of park resources, including the wilderness resource. At current rates of erosion, there will be a permanent loss of a portion of the wilderness resource at Shackleford Banks. Ongoing erosion is attributable in significant part to anthropogenic disturbance at Beaufort Inlet. *NPS Management Policies* (2006) Section 6.3.7 provides that management intervention may be undertaken in wilderness "to the extent necessary to correct past mistakes, the impacts of human use, and influences originating of wilderness boundaries." This same section states that the National Park Service should "seek to sustain the natural distribution, numbers, population composition, and interaction of indigenous species."

E. Wilderness Character

Is action necessary to preserve one or more of the qualities of wilderness character including: untrammeled, undeveloped, natural, outstanding opportunities for solitude or a primitive and unconfined type of recreation, or unique components that reflect the character of this wilderness area?

Untrammeled: **Yes:** ☐ **No:** ☑ **Not Applicable:** ☐

Explain:

Undeveloped: **Yes:** ☐ **No:** ☑ **Not Applicable:** ☐

Explain:

Natural: **Yes:** ☑ **No:** ☐ **Not Applicable:** ☐

Explain: Action is necessary to prevent loss of natural resources due to ongoing erosion at Shackleford Banks.

Outstanding opportunities for solitude or a primitive and unconfined type of recreation:

Yes: ☐ **No:** ☑ **Not Applicable:** ☐

Explain:

Other unique components that reflect the character of this wilderness:

Yes: ☐ **No:** ☑ **Not Applicable:** ☐

Explain:

F. Describe Effects to the Public Purposes of Wilderness

Is action necessary to support one or more of the public purposes for wilderness (as stated in Section 4(b) of the Wilderness Act) of recreation, scenic, scientific, education, conservation, and historical use?

Recreation: **Yes:** ☑ **No:** ☐ **Not Applicable:** ☐

Explain: Deposition of sediment will minimize loss of additional beach due to erosion and in so doing enhance recreational opportunities.

Scenic: **Yes:** ☑ **No:** ☐ **Not Applicable:** ☐

Explain: Minimizing erosion of the beach will preserve the scenic quality of the proposed wilderness.

Scientific: **Yes:** ☐ **No:** ☑ **Not Applicable:** ☐

Explain:

Education: **Yes:** ☐ **No:** ☑ **Not Applicable:** ☐

Explain:

Conservation: **Yes:** ☑ **No:** ☐ **Not Applicable:** ☐

Explain: Action is necessary to conserve special status species by minimizing loss of habitat.

Historical use: **Yes:** ☐ **No:** ☑ **Not Applicable:** ☐

Explain:

Step 1 Decision: Is any administrative action <u>necessary</u> in

Yes: ☑ **No:** ☐ **More information needed:** ☐

Explain: Action in wilderness is necessary to prevent additional loss of the wilderness resource caused in significant part by anthropogenic disturbance outside the wilderness boundary. Action is likewise necessary to reduce further damage to natural resources within the wilderness, such as vegetation communities, shorebirds, and shellfish.

If action is <u>necessary</u>, proceed to Step 2 to determine the <u>minimum</u> activity.

Step 2: Determine the <u>minimum</u> activity.

Please refer to the accompanying MRDG *Instructions* for an explanation of the effects criteria displayed below.

Description of Alternatives

For each alternative, describe what methods and techniques will be used, when the activity will take place, where the activity will take place, what mitigation measures are necessary, and the general effects to the wilderness resource and character.

Alternative # __No Action___

Description:

Under this alternative, no deposition of sediment would take place. Elevated rates of erosion would continue at Shackleford banks, due in significant part to the maintenance of Beaufort Inlet. The result would be continuing loss and injury to the wilderness resource and related natural resources.

Effects:

Wilderness Character

"Untrammeled"

Proposed wilderness would remain untrammeled in the sense that no active manipulation would take place within the proposed wilderness boundary. However, anthropogenic activities outside wilderness would continue to result in loss of the wilderness resource.

"Undeveloped"

Proposed wilderness would remain undeveloped because no structures would be built.

"Natural"

Proposed wilderness would not be manipulated under this alternative. However, it would continue to experience unnatural rates of erosion due to human activities beyond the proposed wilderness boundary.

"Outstanding opportunities for solitude or a primitive and unconfined type of recreation"

These would continue to exist under this alternative.

Other unique components that reflect the character of this wilderness

N/A

Heritage and Cultural Resources

N/A

Maintaining Traditional Skills

N/A

Special Provisions

N/A

Economic and Time Constraints

N/A

Additional Wilderness-specific Comparison Criteria

N/A

Safety of Visitors, Personnel, and Contractors

This alternative provides the most safety because it does not entail any activity within the proposed wilderness.

Alternative # __A___

Description:

Under this alternative, the disposal of dredged material would occur once every three years, based on the USACE's most recent economic evaluation. Although the total proposed sediment disposal zone would be approximately 3.2 miles in length, each triennial sand disposal would cover approximately one linear mile at a width of approximately 75 – 100 feet. The volume of material placed on the beach would partially mitigate for the best estimate of the volume lost in the island profiles from maintenance dredging, but would not exceed the estimate of the volume lost. All these estimates are subject to further evaluation in the NEPA process. They are also dependent on the availability of Federal appropriations.

Typical equipment necessary to perform the beach disposal operations on Shackleford Banks as indicated by the USACE includes lengths of shore pipe 30 inches in diameter, bulldozers for the spreading and leveling of the beach fill material, and front-end loaders and excavators for handling, re-locating, assembling and disassembling the shore-pipe. Other materials needed include portable generators, welding machines, mobile light generating plants, portable fuel tanks, and various shore-pipe connectors. Pick-up trucks, ATV type vehicles, portable toilet facilities, a barge landing ramp and a mobile office trailer may also be needed. The window for having equipment on the beach would be limited to November 16 – March 31 of any given year to accommodate sea turtle nesting activities.

A typical Beaufort Inlet maintenance dredging project with beach disposal project would be performed with a 30-inch hydraulic cutterhead pipeline dredge. The cutterhead dredge would operate in the Federal navigation channel with its discharge pipeline extending to the sand disposal area.

The time of sand disposal is restricted by sea turtle nesting the potential for nesting birds; and can only take place in the winter months between November 16 and March 31 of any given year. Material and equipment mobilization (on the island) is typically allowed to extend one month prior to, and following, the sand disposal window. However, equipment on the beach would be limited to the November 16-March 31 sea turtle nesting window.

The proposed sand disposal zone is approximately 3.2 miles in length. Based on the Wilmington District's most recent economic evaluation, sand disposals would occur once every three years. Each sand disposal would cover approximately one linear mile (within the 3.2 mile zone) at a width of approximately 75-100 ft. All estimates are subject to further evaluation and subject to the availability of Federal appropriation.

Materials, equipment and personnel needed for sand disposal operations would be mobilized to and from Shackelford Banks via barge. Below are the typical materials and equipment necessary to perform beach disposal operations:

- 1-2 Mobile office trailer - needed to provide contractor personnel with shelter and office space to manage the beach disposal work

- 1-2 portable toilet facilities

- Sufficient lengths of 30-inch shore-pipe - needed to extend the full length of beach fill

- Various shore-pipe connectors, including: y-valves, effluent diffusers, flange plates, etc

- 2-3 large portable generators - needed for assembly and disassembly of the shore-pipe

- 1-2 Portable Welding machines - needed for assembly, disassembly and repair of the shore-pipe

- 1-2 PC-120 sized excavators - needed for handling, re-locating, assembling and disassembling of the shore-pipe

- 2-3 D-8 sized bulldozers - needed to construct effluent control toe-berms, level dredged material across the beach fill template and to aid in the landing of the pipeline from the ocean to Shackelford Banks

- 1-2 Standard pick-up trucks - needed to mobilize personnel from the vessel landing area to various areas within the beachfill template

- 1-2 Front-end loaders - needed for handling, re-locating, assembling and disassembling of the shore-pipe

- 3-4 Mobile Light Generating Plants - needed to provided sufficient lighting during nighttime operations

- 1-2 ATV type vehicles - needed for pipeline inspection, topographic surveying, etc

- 1 Barge landing ramp - needed to minimize damage to shoreline during mobilization/demobilization of material, equipment and personnel

- 2-3 Portable fuel tanks - needed to provide fuel for equipment.

Although the window of operation is between the months of November and March 31, the activities should take place in limited areas for the least amount of time. This would be consistent with the NPS Minimum Requirements policy.

Effects:

Wilderness Character

“Untrammeled”

Proposed wilderness in a 3.2-mile section of beach face would be trammeled due to the active, mechanized deposition of sediment.

“Undeveloped”

Proposed wilderness would remain undeveloped because no permanent structures would be built.

“Natural”

Proposed wilderness would lose some of its natural character under this alternative due to active manipulation of the beach front along a 3.2-mile section of beach. However, this action would prevent the loss of additional habitat at Shackleford Banks and restore habitat for certain biota.

“Outstanding opportunities for solitude or a primitive and unconfined type of recreation”

Opportunities for solitude would be substantially impacted every three years during times of active sediment deposition. The wilderness experience would be adversely affected by the presence of heavy equipment and temporary structures.

Other unique components that reflect the character of this wilderness

N/A

Heritage and Cultural Resources

N/A

Maintaining Traditional Skills

N/A

Special Provisions

N/A

Economic and Time Constraints

N/A

Additional Wilderness-specific Comparison Criteria

N/A

Safety of Visitors, Personnel, and Contractors

This alternative provides less safety for visitors, personnel, and contractors than the no action alternative because of the possibility of injury from machinery or land vehicles.

(Note: Other action alternatives such as nearshore deposition and deposition in the intertidal region have been investigated and found to be not feasible. Therefore, this document only analyzes a “no action” alternative and one action alternative, Alternative A.)

Comparison of Alternatives

It may be useful to compare each alternative's positive and negative effects to each of the criteria in tabular form, keeping in mind the law's mandate to "preserve wilderness character."

	Alternative A	Alternative B	Alternative C	No Action
Untrammeled	-			+
Undeveloped				
Natural	+			+
Solitude or Primitive Recreation	-			+
Unique components				
WILDERNESS CHARACTER				

	Alternative A	Alternative B	Alternative C	No Action
Heritage & Cultural Resources				
Maintaining Traditional Skills				
Special Provisions				
Economics & Time				
Additional Wilderness Criteria				
OTHER CRITERIA SUMMARY				

	Alternative A	Alternative B	Alternative C	No Action
SAFETY		-		+

Safety Criterion

If safety issues override impacts to wilderness character or other criteria, provide documentation that the use of motorized equipment or other prohibited uses is necessary because to do otherwise would cause increased risks to workers or visitors that cannot be satisfactorily mitigated through training, use of personal protective equipment (PPE), or other requirements to alleviate the safety risk. (This documentation can take the form of agency accident-rate data tracking occurrences and severity; a project-specific job hazard analysis; research literature; or other specific agency guidelines.)

Documentation:

The nature of the proposed action is such that it can only be accomplished using mechanized equipment.

Step 2 Decision: What is the Minimum Activity?

Please refer to the accompanying MRDG *Instructions* before describing the selected alternative and describing the rationale for selection.

Selected alternative: Alternative A is the selected alternative.

Rationale for selecting this alternative (including documentation of safety criterion, if appropriate):

Alternative A will have substantial temporary, recurring impacts to wilderness character, but will help preserve natural and wilderness resources at Shackleford Banks. The no action alternative will not achieve the objective of preventing and offsetting loss to the wilderness resource.

Monitoring and reporting requirements:

To the extent feasible, baseline information will be collected prior to sediment deposition to document "before" conditions. Sediment sampling will be conducted along Shackleford Banks to document the quantitative values of the native beach (grain size distribution, sediment color, visual shell % content) prior to the disposal of dredged material. Baseline information on shorebirds, sea turtles, and some plants has been collected through the monitoring program associated with the park's Interim Protected Species Plan. The park will continue its current monitoring program after deposition actions.

Check any Wilderness Act Section 4(c) uses approved in this alternative:

- ☑ mechanical transport
- ☑ motorized equipment
- ☑ motor vehicles
- ☑ motorboats
- ☐ landing of aircraft
- ☐ temporary road
- ☑ temporary structure or installation

Record and report any authorizations of Wilderness Act Section 4(c) uses according to agency procedures.

Approvals	Signature	Name	Position	Date
Prepared by:				
Recommended:				
Recommended:				
Approved:				

APPENDIX M

AGENCY TECHNICAL REVIEW (ATR)
OF
DRAFT DMMP AND EIS

Completion of Agency Technical Review

MOREHEAD CITY HARBOR DMMP

Wilmington, North Carolina

May, 2010

Wilmington District has completed the dredged material management plan for the Morehead City Harbor Navigation Project. Notice is hereby given that an Agency Technical Review (ATR) has been conducted that is appropriate to the level of risk and complexity inherent in the project. The dredged material management plan (DMMP) was reviewed for compliance with established principles and procedures, using clearly justified and valid assumptions. Further, methods and procedures were reviewed to determine the appropriateness, correctness, and reasonableness of results, including determination of whether the plan meets the customer's needs consistent with law and existing United States Army Corps of Engineers policy.

An independent technical review team composed of members from, Honolulu, Mobile, and Walla Walla Districts performed the review. The Deep Draft Navigation Planning Center of Expertise (DDNPCX) managed the conduct of this review using the DrChecks software. The ATR was initiated on 29 March 2010, and completed on 21 May 2010. A complete copy of the final comment report from DrChecks is enclosed.

The ATR team placed 101 comments in DrChecks. After evaluations were completed by the Project Delivery Team (PDT), there were 15 "NonConcur" during the Backcheck by the ATR team. Coordination between the ATR team and PDT on the areas of concern resulted in satisfactory resolution of these comments. All of the review comments and evaluations are found in the attached ProjNet Report.

The Cost DX at Walla Walla has certified the costs in the report. The overall report has been fully reviewed, and all associated documentation required by the National Environmental Policy Act has been complied with. We certify that the DMMP for the Morehead City Harbor Navigation Project ATR was performed as required by Engineer Circular (EC) 1165-2-209, Civil Works Review Policy, dated 31 January 2010.

Bernard E. Moseby
Deputy Director
Deep Draft Navigation
Planning Center of Expertise

Enclosure

DEPARTMENT OF THE ARMY
US ARMY CORPS OF ENGINEERS
SOUTH ATLANTIC DIVISION
60 FORSYTH STREET SW, ROOM 10M15
ATLANTA, GA 30303-8801

REPLY TO
ATTENTION OF

CESAM-PD-D (1105-2-40a) 8 November 2012

MEMORANDUM FOR MS. JENNIFER OWENS (CESAW-TS-PE) U.S. ARMY CORPS OF ENGINEERS, WILMINGTON DISTRICT, 69 DARLINGTON AVENUE, WILMINGTON, NORTH CAROLINA, 28402-1890

SUBJECT: Certification and Completion of Agency Technical Review, Morehead City Harbor Draft Integrated Dredging Material Management Plan and EIS

1. References:

a. EC 1165-2-209, Civil Works Review Policy, 31 January 2010

b. EC 1105-2-412, Assuring Quality of Planning Models, 31 March 2011

c. Memorandum, CECW-CP, 30 March 2007, Subject: Peer Review Process

d. Supplemental information for the "Peer Review Process" Memo, dated March 2007

2. In accordance with EC 1165-2-209, "Civil Works Review Policy," dated 31 January 2010, Final Agency Technical Review (ATR) of the Draft Dredging Material Management Plan (DMMP) and Environmental Impact Statement (EIS) dated August 2012, has been coordinated with and executed through the Deep Draft Navigation Planning Center of Expertise (DDNPCX).

3. ATR comments were posted in DrChecks, evaluated by the Project Delivery Team (PDT), and back checked and closed out by the ATR team for incorporation into the DMMP. The cost engineering products supporting the DMMP (estimates, schedules, risk analyses and cost roll-ups) were formally and successfully ATRd by the Cost Engineering MCX and no significant outstanding issues or concerns were found. The DDNPCX point of contact is Mr. Johnny L Grandison, CESAM-PD-D, (251) 694-3804.

for Johnny L Grandison

Encls

BERNARD E. MOSEBY
Technical Director, DDNPCX

CF:
CESAD-PDS/PAYNES
CESAD-PDS/STRATTON
CESAD-PDS/SMALL

APPENDIX N

REAL ESTATE

REAL ESTATE APPENDIX

Morehead City Harbor
Morehead City, NC
Draft Integrated Dredged Material Management Plan and Environmental Impact Statement

Table of Contents

SECTION 1. THE REAL ESTATE REPORT

1.1 Statement of Purpose

This report is tentative in nature, focuses on the Tentatively Selected Plan, and is to be used for planning purposes only. There may be modifications to the plans that occur during Pre-construction, Engineering and Design (PED) phase, thus changing the final acquisition area(s) and/or administrative and land cost. The Real Estate Appendix is intended to support the Dredged Material Management Plan (DMMP) and Environmental Impact Statement for Morehead City Harbor, Morehead City, NC. The author of this report is familiar with the Project area. The state of North Carolina is the non-Federal sponsor for the project. Date of this report is April 2013.

1.2 Study Authority

The U. S. Army Corps of Engineers (USACE) Appendix E-15 of ER 1105-2-100 provides that a DMMP be developed for federal navigation projects if a Preliminary Assessment does not demonstrate sufficient capacity to accommodate maintenance dredging for the next twenty years. The DMMP is a planning document that ensures maintenance-dredging activities are performed in an environmentally acceptable manner, use sound engineering techniques, and are economically justified. A DMMP addresses dredging needs, disposal capabilities, capacities of disposal/placement areas, environmental compliance requirements, potential for beneficial use of dredged material and indicators of continued economic justification. Beneficial use is defined as utilizing dredged sediments as resource materials in productive ways. Dredged Material Management Plans ensure that sufficient placement capacity is available for at least the next 20 years and should be updated periodically to identify any potentially changed conditions.

In addition to ER 1105-2-100, three Policy Guidance memoranda provide additional guidance regarding the preparation of DMMPs. They are: 1) Policy Guidance Letter (PGL) No. 40, dated March 1993, Development and Financing of Dredged Material Management Studies; 2) PGL No. 42, dated March 1993, Additional Guidance on Financing of Dredged Material Management Studies and 3) PGL No. 47, dated April 1998, Cost Sharing for Dredged Material Disposal Facilities and Dredged Material Disposal Facility Partnerships.

1.3 Project Location

Morehead City Harbor is a federal navigation project located in the Town of Morehead City, North Carolina, approximately 3 miles from the Atlantic Ocean through Beaufort Inlet (Figure 1.3-1). The authorized Morehead City Harbor project is divided into two parts: The deep draft portion and the shallow draft portion. As shown on Figure 1.3-2, the deep draft portion consists of three main ranges or sections: the Inner Harbor, which includes the Northwest, West, and East Legs and North Range C; the Outer Harbor, which includes South Range C, Range B, the Cutoff and Range A out to Station 110+00; and the Outer Entrance Channel, which is made up of the seaward end of Range A (from station 110+00 out); the shallow draft portion includes 3 additional ranges: the Entrance Channel, Waterfront Channel and Bogue Sound Channel. In addition to the Morehead City Harbor navigation channels, the DMMP study area also includes the adjacent mainland area, the beaches of Bogue Banks and Shackleford Banks, the nearshore Atlantic Ocean off of Bogue Banks and Shackleford Banks (ebb tide delta), the Environmental Protection Agency (EPA) designated Ocean Dredged Material Disposal Site (ODMDS), and the existing disposal sites of Brandt Island, Marsh

Island and Radio Island.

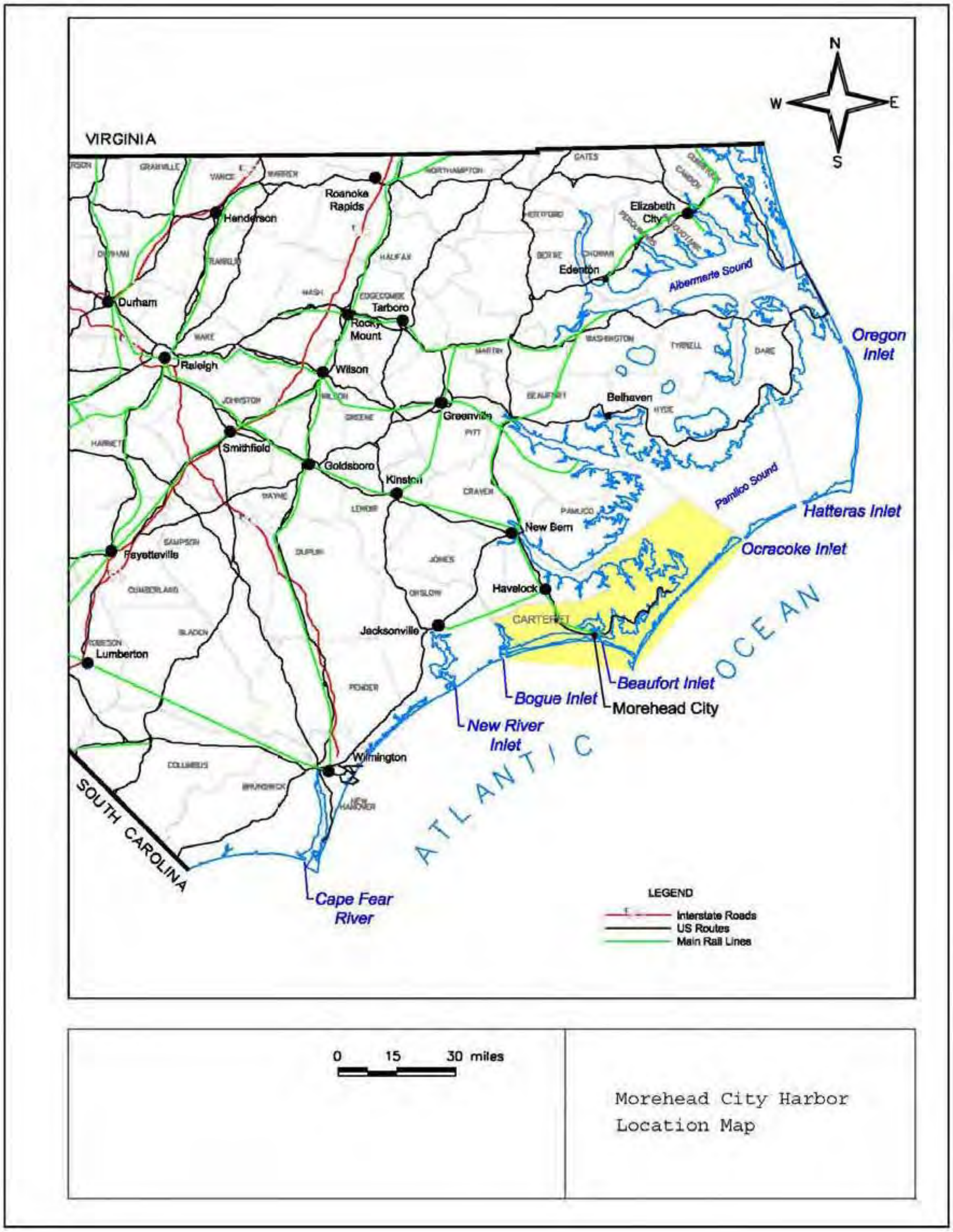

Figure 1.3-1. Project Vicinity/Location Map

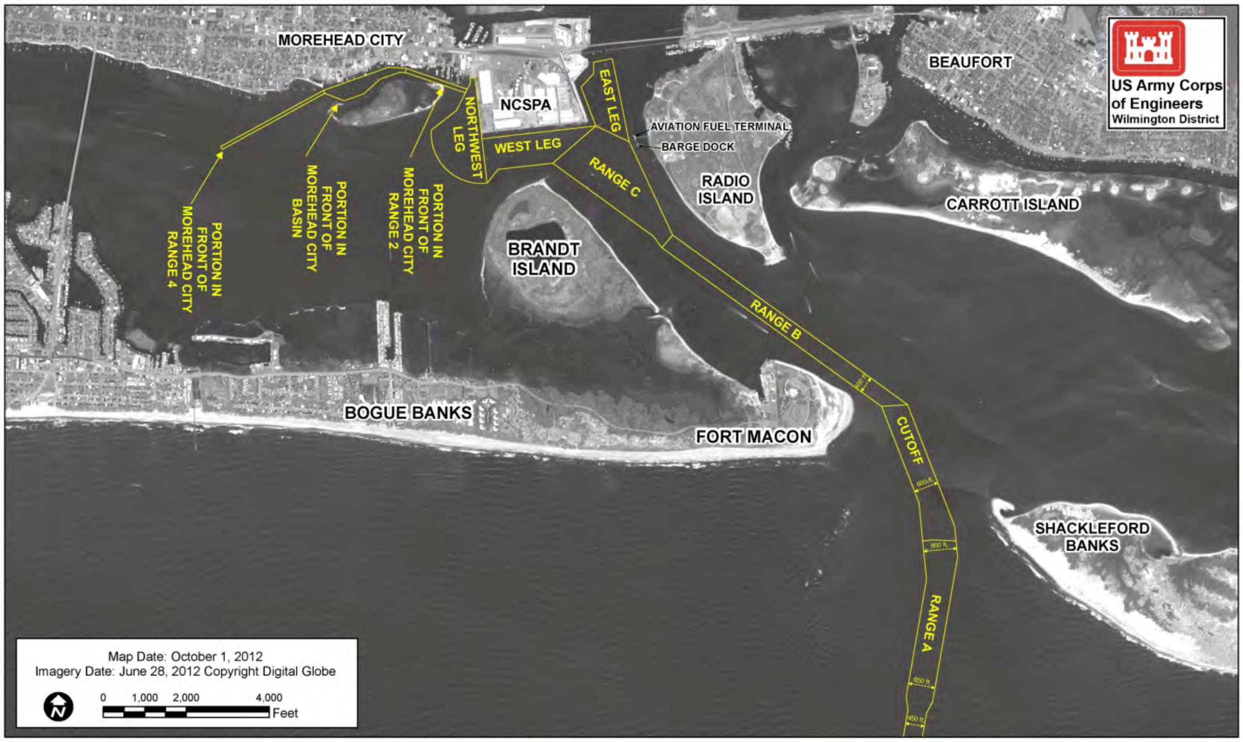

Figure 1.3-2 – Morehead City Harbor Federally Authorized Navigation Project

1.4 Project Description

The DMMP addresses dredging needs, disposal capabilities, and capacities of disposal areas with the purpose of ensuring sufficient disposal capacity for at least the next 20 years, beginning in 2015 and extending through 2034. Approximately 1 million cubic yards of dredged material are removed from the Morehead City Harbor annually. Current maintenance disposal practices, without modification, result in the need for "new" or expanded disposal sites or modified disposal options, including beneficial uses, by 2028. The proposed DMMP (base plan) provides virtually unlimited disposal capacity for the Morehead City Harbor navigation project by recommending the following: continued use of Brandt Island without expansion, placement of coarse-grained material on the beaches of Fort Macon State Park, Atlantic Beach, and Shackleford Banks, expansion of the Nearshore West placement area, a new Nearshore East placement area and continued use of the EPA designated ODMDS. The proposed DMMP (base plan) is show at Figures 1.4-1 through 1.4-3.

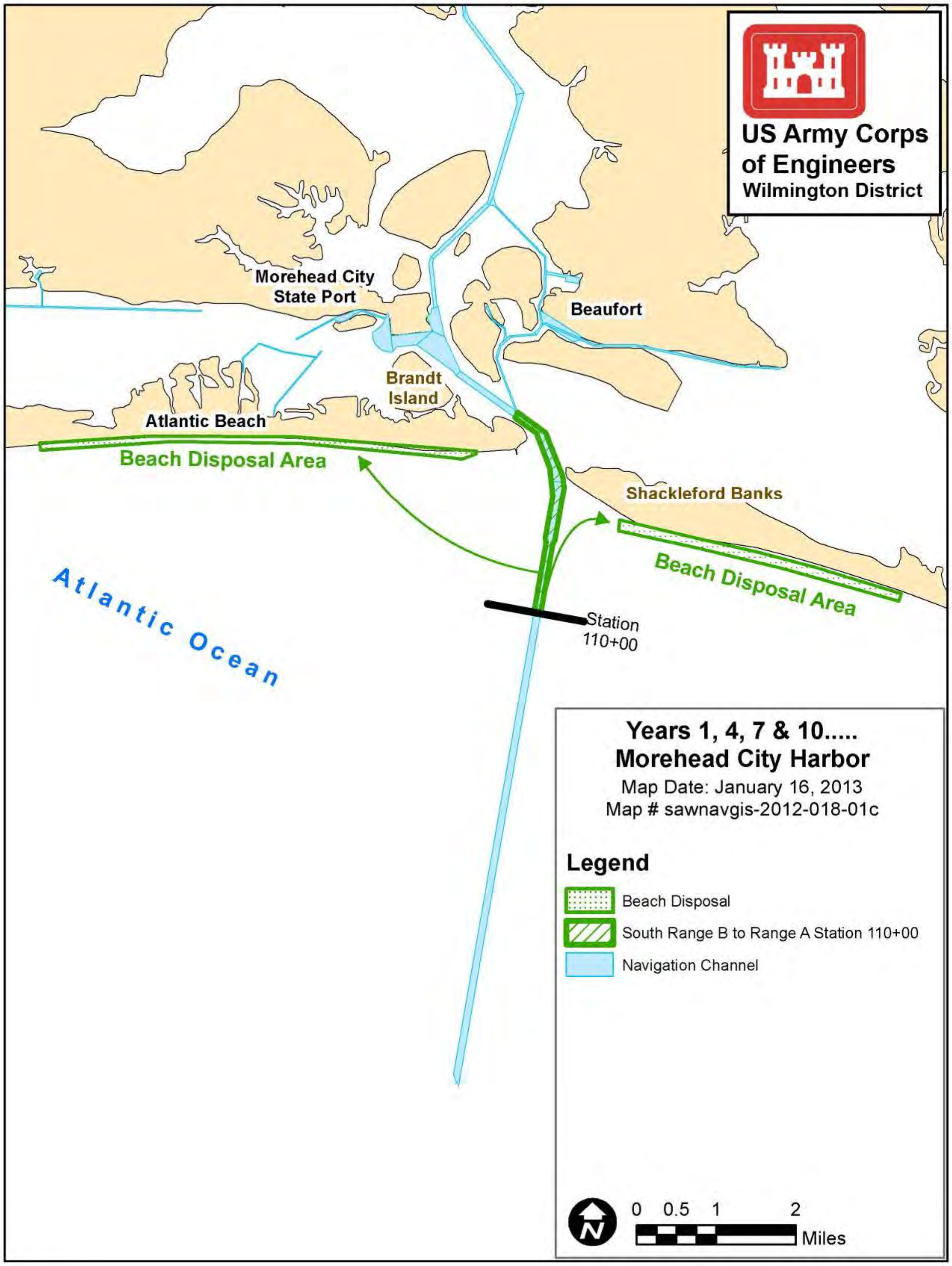

Figure 1.4-1. Proposed Base Plan – Years 1,4,7,10…….

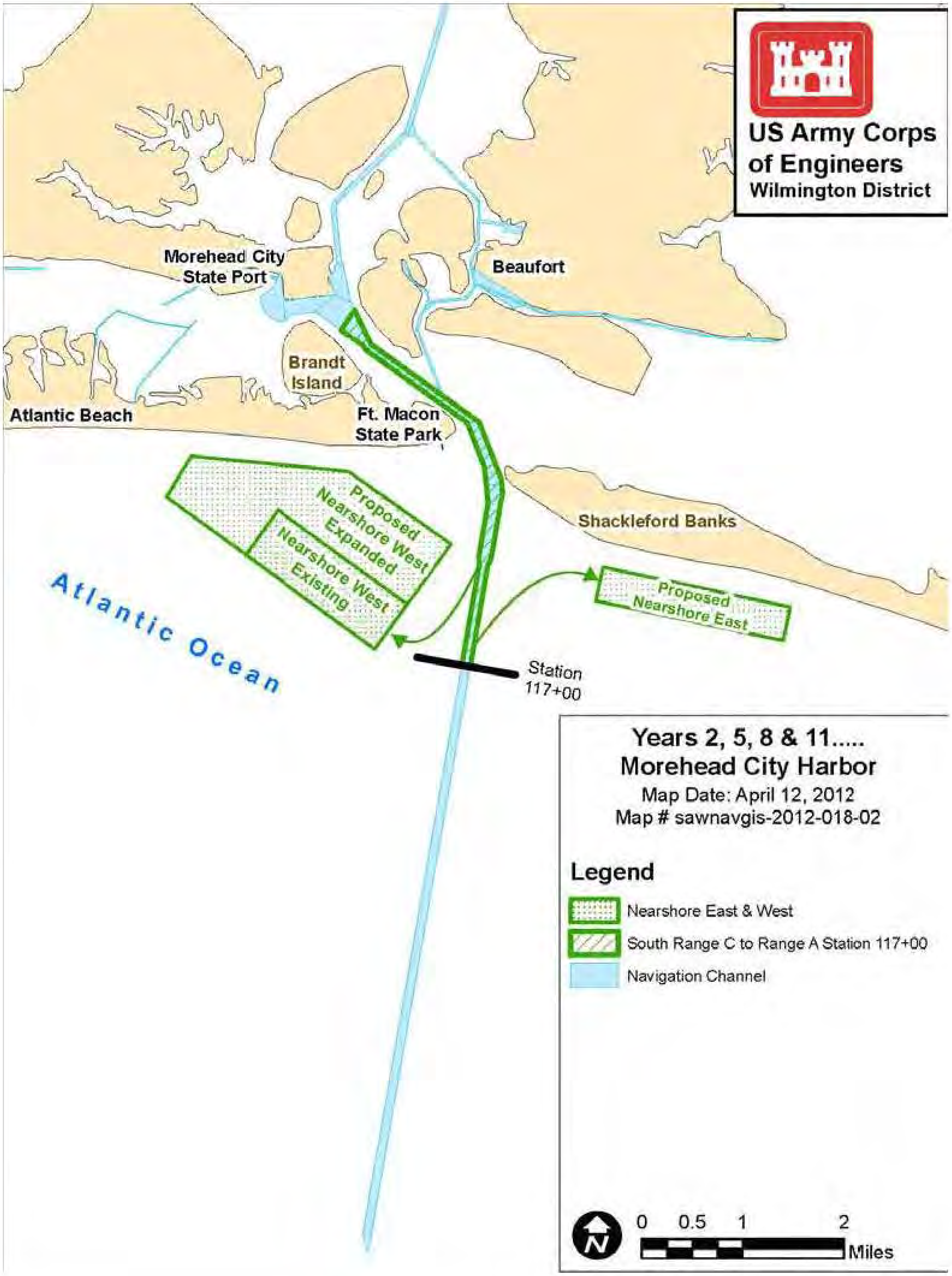

Figure 1.4-2 - Proposed Base Plan – Years 2, 5, 8, 11…..

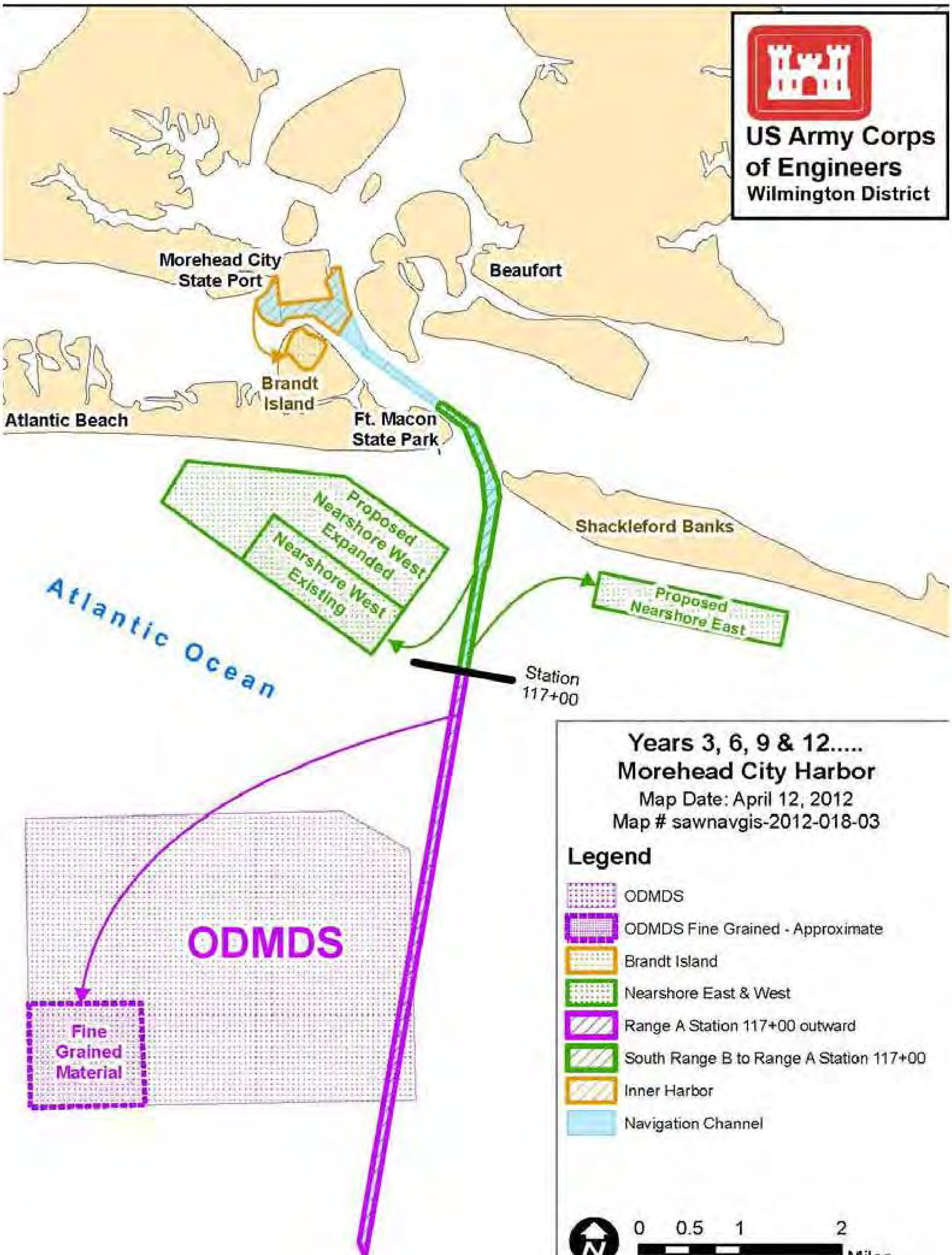

Figure 1.4-3 - Proposed Base Plan – Years 3,6,9,12………

1.5 Real Estate Requirements

Brandt Island. A large portion of the Island is owned by the State of North Carolina and since the 1950's has been dedicated for use as a disposal area. It is proposed that dredged material from the Inner Harbor be placed in Brandt Island. For past disposal events the State of North Carolina has either granted a temporary disposal easement or given a letter permit for use of the Brandt Island site. The same would be required for any subsequent use of the site.

Beaches at Fort Macon State Park. Dredged materials from the Outer Harbor will likely be placed on the beach of Fort Macon State Park which is owned by the State of North Carolina. No formal agreement exists between the USACE and the State pertaining to placement of material at Fort Macon. However, prior to each placement event, the USACE coordinates closely with the State Park regarding the details of the placement activity. Either an easement or a letter permit from the State will be required to make Fort Macon State Park available for project purposes.

Beaches of Atlantic Beach. Dredged materials from the Outer Harbor will also be placed on Atlantic Beach which is privately owned landward of mean high water (MHW). In 2005 sand was pumped from Brandt Island onto the shoreline to create more disposal capacity within the Brandt Island site. At that time, 209 parcels were impacted by the placement of fill. There were 150 perpetual easements in place and 59 temporary easements were acquired, which have since expired. The easement language used in the acquired easements was very similar to the standard "Perpetual Beach Storm Damage Reduction Easement" in Section 1.20.

An assumption is that the last sand placement created new lands which vested in state ownership. The expectation with future placement events is that fill will be placed on or below the land created at the last fill and that no further real estate interests will be required; however, this will be confirmed when surveys are completed prior to each beach placement event. Should there be areas where erosion has occurred landward of the old mean high water line, easements will be required from impacted landowners. It is suggested that the standard Perpetual Beach Storm Damage Reduction Easement be used if additional easements are required.

The worst case scenario under the recommended base plan is acquisition of approximately 59 easements. Should future beach placement occur on Bogue Banks west of the area included in the base plan, additional easements would be required, incurring additional real estate costs that cannot be accurately estimated at this time. Placement of sand along the shoreline is considered beneficial use of dredged material and is not considered a nourishment project. The sponsor will not receive credit for cost incurred in the acquisition of easements.

Beaches of Shackleford Banks. The beaches of Shackleford Banks may also receive dredged material from the Outer Harbor. Shackleford Banks is part of the Cape Lookout National Seashore, which is managed by the National Park Service. A Special Use Permit (SUP) will be required from the NPS prior to each placement event and all conditions of the SUP will be met. No other real estate is required.

The dredge contractor will not be allowed to impact the existing frontal dune along the ocean strand from the spit to the placement area on Shackleford Banks. All beach equipment (dozers, pipeline sections, etc.) will be walked during low tide along the beach strand to the placement site. This also means that no dredge pipeline from the dredge to the placement area will be aligned along the ocean beach strand from the spit to the placement area on Shackleford Banks. The end of the dredge pipeline will be submerged offshore from the dredge working in the harbor channels to the placement site on Shackleford Banks. Once the end of the dredge pipeline emerges onshore within the sediment berm placement site, the contractor will set up the dump shack, fencing, light stands and stockpile additional shore pipe within the constructed upland berm area (seaward of the existing frontal dune).

Nearshore West. The Nearshore West Placement Area is within State territorial waters and is located off Bogue Banks. Dredged material from the Outer Harbor will be disposed of in the Nearshore West site. The existing site is 559 acres but plans to expand the existing site by an additional 1,209 acres are being coordinated with all appropriate resource agencies. The site is available through navigation servitude, but a permit for use of the placement area will be obtained from the State of North Carolina.

Nearshore East. The Nearshore East site (Figure 3-23) is a newly proposed site that will consist of approximately 1,094 acres and will be located within State waters off Shackleford Banks. Dredged material from the Inner Harbor will be disposed of in the Nearshore East. The site is available through navigation servitude. Plans to construct the new site are being coordinated with all appropriate resource agencies and a permit will be obtained from the State of North Carolina for use of the site.

ODMDS. The ODMDS (Figure 3-40) is an 8 square mile area located on the Outer Continental Shelf (OCS) and is also available through navigation servitude. The site was designated by EPA as an ocean dredged material disposal site. The transportation and disposal of dredged material in ocean waters, including the territorial sea, is regulated under the Marine Protection, Research, and Sanctuaries Act of 1972 (MPRSA) (Public Law 92-532, 86 Stat. 1052, 33 U.S.C. §§1041 et seq.) as amended by Title V of the Water Resources Development Act of 1992 (WRDA 92; Public Law 102-580). Section 102(a) of MPRSA authorizes the U.S. Environmental Protection Agency (EPA) to establish and apply regulations and criteria for ocean dumping activities. Consequently, the EPA issued in October, 1973, and revised in January, 1977, Ocean Dumping Regulations and Criteria (40 CFR 220-238). These regulations establish control of ocean dredged material disposal primarily by two activities, designation of sites for ocean dumping and the issuance of permits for dumping.

The transportation of dredged material for the purpose of disposal into ocean waters (i.e. the actual use of the designated site) is permitted by USACE (or authorized in the case of federal projects) under MPRSA Section 103(e) applying environmental criteria established in EPA's Ocean Dumping Regulations and Criteria. The MPRSA Section 104(a)(3) provides that ocean disposal of dredged material can occur only at a designated site and Section 103(b) requires the USACE to utilize dredged material disposal sites designated by EPA to the maximum extent feasible. Prior to issuing a dredged material permit or authorizing a federal project involving the ocean disposal of dredged material, the USACE must notify EPA, who may disapprove the proposed disposal. Dredged material from the Inner Harbor, Outer Harbor and Outer Entrance Channel may be disposed of in the ODMDS.

No staging areas have been identified at time of this report. When specific requirements are determined, the sponsor will be responsible for providing staging areas for the project which shall be provided prior to advertisement for construction. However, should a contractor determine that another site may be more preferable and/or convenient, he will have the option to obtain an alternate site for staging.

1.6 Utility/Facility Relocation

There are no utility/facility relocations with this project

1.7 Existing Projects

The Morehead City Harbor Project and the Morehead City Section 933 are existing Federal projects.

1.8 Environmental Impacts

The proposed DMMP is not expected to adversely affect the environment. The proposed Morehead City Harbor DMMP is not expected to result in any significant adverse environmental effects. Significant resources (including terrestrial and marine biota, cultural resources, threatened and endangered species, air and water quality, socio-economics, esthetics, and recreation) will not be adversely impacted by implementation of the proposed DMMP.

1.9 Project Sponsor Responsibilities and Capabilities

The State of North Carolina will be the non-Federal Project Sponsor (NFS). The NFS has the responsibility to acquire all real estate interests required for the Project. The NFS shall accomplish all alterations and relocations of facilities, structures and improvements determined by the government to be necessary for construction of the Project. A form for the Assessment of the Non-Federal Sponsor's Capability to Acquire Real Estate is at Exhibit "A" to the Real Estate Appendix.

Prior to advertisement of any construction contract, the NFS shall furnish to the government an Authorization for Entry for Construction (Exhibit "B" to the Real Estate Appendix) to all lands, easements and rights-of-way, as necessary. The NFS will also furnish to the government evidence supporting their legal authority to grant rights-of-way to such lands

No land acquisition is required for this project. Consequently the usual requirements of the NFS pertaining to real estate acquisition are not applicable. The non-Federal sponsor is entitled to receive credit against its share of project costs for any real estate related administrative costs incurred for the project.

1.10 Government Owned Property

The State of North Carolina owns a portion of Brandt Island and also Fort Macon State Park within the project limits. Shackelford Banks is part of the Cape Fear Lookout National Seashore which is managed by the National Park Service.

1.11 Historical Significance

It is anticipated that resources in the area will be limited to shipwrecks that may be impacted by direct deposit of dredged material or by induced changes in current patterns. Direct project impacts will be limited to submerged cultural resources and are likely to be minimal. The actual extent of impact will depend on the amount of material placed on or near cultural resources and the chemical composition of the material. If beach quality or near beach quality material is deposited, chemical impacts will be minimal or non-existent. If dredged material release locations are specified in the contract and are monitored so that no mounding occurs on or near cultural resources, then effects from altered current are also likely to be minimal or nonexistent.

1.12 Mineral Rights

There are no known mineral activities within the scope of the proposed project.

1.13 Hazardous, Toxic, and Radioactive Waste (HTRW)

No HTRW sites are located in the project area and therefore neither the proposed DMMP nor the No Action plan will impact any HTRW sites. Also, neither plan would result in the placement of contaminated sediments in any disposal areas within the project area.

1.14 Navigation Servitude

The navigation servitude is the dominant right of the Government under the Commerce Clause of the U.S. Constitution (U.S. CONST. Art. I, §8, cl.3) to use, control and regulate the navigable waters of the United States and the submerged lands hereunder for various commerce-related purposes including navigation and flood control. In tidal areas, the servitude extends to all lands below the mean high water mark.

1.15 Zoning Ordinances

Zoning ordinances are not of issue with this project. Application or enactment of zoning ordinances is not to be used in lieu of acquisition.

1.16 Induced Flooding

There will be no flooding induced by the construction or the operation and maintenance of the project.

1.17 Public Law 91-646, Relocation Assistance Benefits

There are no relocations of individuals, businesses or farms for this project.

1.18 Attitude of Property Owners

The project is fully supported. There are no known objections to the project from landowners within the project area.

1.19 Acquisition Schedule

No real estate acquisition is currently required for the project. Should it later be determined that easements are required along Atlantic Beach for a least cost disposal, the locals will be responsible for acquiring those easements and a milestone schedule will be prepared at that time.

1.20 Estates for Proposed Project

Should easements be required on Atlantic Beach, the Perpetual Beach Storm Damage Reduction Easement is suggested.

PERPETUAL BEACH STORM DAMAGE REDUCTION EASEMENT

A perpetual and assignable easement and right-of-way in, on, over and across (the land described in Schedule A) (Tract No. __) for use by the (Project Sponsor), its representatives, agents, contractors, and assigns, to construct; preserve; patrol; operate; maintain; repair; rehabilitate; and replace; a public beach [a dune system] and other erosion control and storm damage reduction measures together with appurtenances thereto, including the right to deposit sand; to accomplish any alterations of contours on said land; to construct berms [and dunes]; to nourish and renourish periodically; to move, store and remove equipment and supplies; to erect and remove temporary structures; and to perform any other work necessary and incident to the construction, periodic renourishment and maintenance of the (Project Name), together with the right of public use and access; [to plant vegetation on said dunes and berms; to erect, maintain and remove silt screens and sand fences; to facilitate preservation of dunes and vegetation through the limitation of access to dune areas;] to trim, cut, fell, and remove from said land all trees, underbrush, debris, obstructions, and any other vegetation, structures and obstacles within the limits of the easement (except_____); [reserving, however, to the grantor(s), (his) (her) (its) (their) (heirs), successors and assigns, the right to construct dune overwalk structures in accordance with any applicable Federal, State or local laws or regulations, provided that such structures shall not violate the integrity of the dune in shape, dimension or function, and that prior approval of the plans and specifications for such structures is obtained from the (designated representative of the Project Sponsor) and provided further that such structures are subordinate to the construction, operation, maintenance, repair, rehabilitation and replacement of the project; and further] reserving to the grantor(s), (his) (her) (its) (their) (heirs), successors and assigns all such rights and privileges as may be used and enjoyed without interfering with or abridging the rights and easements hereby acquired; subject however to existing easements for public roads and highways, public utilities, railroads and pipelines.

1.21 Real Estate Estimate

The estimated real estate costs include federal and non-federal administrative costs. Administrative costs are those costs incurred for verifying ownership of lands, certification of those lands required for project purposes, legal opinions, analysis or other requirements that may be necessary during Planning, Engineering and Design (PED). A 10% contingency is applied to the estimated total for these items.

Table 1.21-1.

Real Estate Estimate

a. Lands		0
b. Improvements		0
(Residential)		0
(Commercial)		0
c. Mineral Rights		0
d. Damages		0
e. P.L. 91-646 Relocation costs		0
f. Acquisition Cost - Admin (permits)		5,800
Federal	2,900	
Non-federal	2,900	
	5,800	
Sub-Total		5,800
Contingencies (10%)		580
TOTAL		**6,380**
ROUNDED		**6,500**

1.22 Chart of Accounts

The cost estimate for all Federal and non-Federal real estate activities necessary for implementation of the project after completion of the feasibility study for land acquisition, construction, LERRD, and other items are coded as delineated in the Cost Work Breakdown Structure (CWBS). This real estate cost estimate is then incorporated into the Total Current Working Estimate utilizing the Microcomputer Aided Cost Engineering System (MCACES).

Table 1.22-1.

Chart of Accounts

		Federal	Non-Federal	Total
01B	LANDS AND DAMAGES			
01B40	Acquisition/Review of NFS			
01B20	Acquisition by NFS			
01BX	Contingencies (10%)			
	Subtotal			
01G	Permit/License/ROE			
01G10	By Government	2,900		2,900
01G20	By NFS		2,900	2,900
01G30	By Government on Behalf of NFS			
01GX	Contingencies (10%)	290	290	580
	Subtotal	3,190	3,190	6,380
01H	AUDIT			
01H10	Real Estate Audit			
01HX	Contingencies (10%)			
	Subtotal			
01R	REAL ESTATE LAND PAYMENTS			
01R1B	Land Payments by NFS			
01R2B	PL91-646 Relocation Payment by NFS			
01R2D	Review of NFS			
01RX	Contingencies (10%)			
	Subtotal			
	TOTALS		3,190	6,380
	ROUNDED TO			**$6,500**

Real Estate Certification

The Real Estate Appendix for the Morehead City Harbor DMMP has been prepared in accordance with policy and guidance set forth in ER 405-1-12, Chapter 12, Real Estate Planning and Acquisition Responsibilities for Civil Works Projects.

Prepared by:

Belinda Estabrook

Realty Specialist

Reviewed and approved by:

Ralph J. Werthmann
Chief, Real Estate Division

8 April 2013

Exhibits

Exhibit A – Assessment of Non-Federal Sponsor's Real Estate Acquisition Capability
Exhibit B - Authorization For Entry For Construction

Assessment of Non-Federal Sponsor's
Real Estate Acquisition Capability
Morehead City Harbor DMMP

I. Legal Authority:

a. Does the sponsor have legal authority to acquire and hold title to real property for project purposes? **YES**

b. Does the sponsor have the power to eminent domain for this project? **YES**

c. Does the sponsor have "quick-take" authority for this project? **YES**

d. Are any of the land/interests in the land required for this project located outside the sponsor's political boundary? **NO**

e. Are any of the lands/interests in land required for the project owned by an entity whose property the sponsor cannot condemn? **NO**

II. Human Resource Requirements:

a. Will the sponsor's in-house staff require training to become familiar with the real estate requirements of Federal projects including P. L. 91-646, as amended? **NO**

b. If the answer to II.a. is "yes", has a reasonable plan been developed to provide such training? (yes/no)

c. Does the sponsor's in-house staff have sufficient real estate acquisition experience to meet its responsibilities for the project? **YES**

d. Is the sponsor's projected in-house staffing level sufficient considering its other work load, if any, and the project schedule? **YES**

e. Can the sponsor obtain contractor support, if required in a timely fashion? **YES**

f. Will the sponsor likely request USACE assistance in acquiring real estate? **YES - only in advisory capacity**

III. Other Project Variables:

a. Will the sponsor's staff be located within reasonable proximity to the project site? **YES**

b. Has the sponsor approved the project/real estate schedule/milestones? **NO – Project Milestone will be developed during PED if required and will be joint effort between RE, PM and NFS**

Exhibit A
1st page

IV. Overall Assessment:

a. Has the sponsor performed satisfactory on other USACE projects?
YES

b. With regard to the project, the sponsor is anticipated to be: **Highly capable**

V. Coordination:

a. Has this assessment been coordinated with the sponsor? **YES**

b. Does the sponsor concur with this assessment? **YES**

Prepared by:

Belinda Estabrook

Realty Specialist

Reviewed and approved by:

Ralph J Werthmann

Ralph J. Werthmann
Chief, Real Estate Division

Exhibit A
2nd page

AUTHORIZATION FOR ENTRY FOR CONSTRUCTION

I ______________________________, ________________________ for the
(Name of accountable official) (Title)

(Sponsor Name) ______, do hereby certify that the ____(Sponsor Name) has acquired the real property interest required by the Department of the Army, and otherwise is vested with sufficient title and interest in lands to support construction for (Project Name, Specifically identified project features, etc.). Further, I hereby authorize the Department of the Army, its agents, employees and contractors, to enter upon ______________________
(identify tracts)

to construct (Project Name, Specifically identified project features, etc.) as set forth in the plans and specifications held in the U. S. Army Corps of Engineers' (district, city, state)

WITNESS my signature as ____________________________ for the
(Title)

(Sponsor Name) this __ day of _____________, 20_________.

BY: ______________________
(Name)

____
(Title)

ATTORNEY'S CERTIFICATE OF AUTHORITY

I, ________________________ , ______________________________ for the
(Name) (Title of legal officer)

(Sponsor Name), certify that ___________________________ has
(Name of accountable official)

authority to grant Authorization for Entry; that said Authorization for Entry is executed by the proper duly authorized officer; and that the Authorization for Entry is in sufficient form to grant the authorization therein stated.

WITNESS my signature as ______________________ for the
(Title)

(Sponsor Name), this________day of_____________, 20____.

BY: ______________________
(Name)

____
(Title)

Exhibit B