

## Holden Beach East End Shore Protection Project

### Project Review Team Meeting #1

Holden Beach Town Hall

06 September 2012 minutes

These minutes represent a summary of the first Project Review Team meeting for the Holden Beach East End Shore Protection Project. A list of participants is provided at the end of this document.

#### Introduction

**Mickey Sugg** introduced himself at 10:02 am and indicated the meeting will be informal and open discussion format. A scoping meeting took place 8 March 2012, however, **Mickey** reiterated the reason United States Army Corps of Engineers (USACE) and NC Division of Coastal Management (DCM) are involved. In the fall of 2011 Holden Beach approached the USACE to conduct shoreline protection and therefore initiated the NEPA process.

**Mickey** indicated the USACE gets involved when fill material is placed below MHW within waters of the U.S. Further discussion on the USACE's involvement included:

- Permits include Section 10 and Section 404, laws mandated by USACE regulations.
- National Environmental Policy Act (NEPA) provides guidelines for the USACE;
- The Project Review Team directly relates to NEPA and indirectly to Section 404;
- A permit proposal includes review of severity of action. An EIS is required if it is determined that the action will bring harm to human environment.
- Context of effects – national, state, and local importance, magnitude and severity of effects on aquatic resources and navigation – all these are taken into consideration for EIS determination.
- In most cases, the applicant will conduct an EA; if a determination is made for significant impacts, then an EIS is required. However, due to potential impacts, beneficial or detrimental, then an applicant will decide an EIS is the more effective route.

#### Project Review Team

The USACE has initiated the scoping process and will reach out to all agencies/stakeholders for relevant issues and potential impacts within the work area; this is why the Project Review Team (PRT) has been developed. In developing this team, **Mickey** indicated the participating parties represent large constituents within the project area and this is why many have been chosen (i.e. non-profit, environmental, homeowner, etc). The USACE/State will seek input from the PRT to help determine how the proposal will affect varied interests. The PRT is not a decision-making body, **Mickey** pointed out. The USACE is seeking input to identify relevant issues and potential problems with the proposed project.

Introductions were made and **Mickey** explained that the USACE doesn't have the in-house resources to develop the Environmental Impact Statement (EIS) on their own; therefore, a third

party contractor was hired and managed by the USACE to assist in the development of the EIS. **DC&A's** role is the third party contractor.

### **Project Purpose and Need**

**Mickey** reviewed the presentation agenda, including alternatives and engineering aspects. **Fran Way**, project engineer with Applied Technology and Management (ATM) started the presentation at 10:20 am with project purpose and needs (P&N). **Mickey** explained that the P&N drives the Town's proposal and is generally defined by the applicant. The USACE will assess the P&N and could revise or narrow them. It is typical for the USACE to request a more general purpose so that many alternatives can be assessed. The P&N can change if the project changes, there is some built-in flexibility. The purpose is meant to be a simple and brief statement, such as, "To implement an erosion control and beach/dune restoration". Project needs frames the purpose and includes measurable items to help support the purpose. By establishing a P&N, the USACE can identify the proper list of alternatives.

**Doug Huggett** then briefly described the history of the hardened structure ban and SB110 that amended CAMA, DCM's enabling legislation. SB110 allows for up to 4 terminal groins (TG) to be permitted. In addition to permitting, the bill sets forward specific requirements including:

- Preparation of an EIS to accompany any project that is trying to obtain a TG permit to meet requirements of SEPA. SEPA allows the State to defer to a NEPA document that is set-up during a joint process with USACE.
- TG must be proven necessary for imminently threatened structures.
- Non-structural alternatives must be proven as impractical (a judgment determination but no definitive formula).
- Applicant has to prepare an inlet management plan that will accompany TG permit application including plan for placement of sand concurrent with TG construction.
- Legislation requires monitoring and thresholds to be developed for a proposed project (assess TG for impacts to threatened structures) upfront so that mitigation can be implemented.
- Mitigation can include a process for beach erosion to be identified and monitoring to take place, such as removing structures, removing TG, and placing sand on beach.

**Doug** indicated that this is the first time NCDCM has had to deal with this type of project and will learn as we go. NCDCM will work with the Town to move the project forward as there are many requirements. NCDCM is not reading the bill literally and will assist applicants to move projects forward. **Doug** explained the EIS needs to answer many questions and additional information may need to be included in the permit application.

**Dr. Bill Cleary** asked in the event a scenario arises that the threshold is exceeded, who makes the decision that it is due to the TG? **Doug** said NCDCM fully understands that erosion happens with and without the groin, that there are other circumstances due to storms that cause changes to the beach independent of the groin. **Mickey** stated the responsibility will fall on the applicant to justify that erosion is not due to the TG. **Doug** iterated monitoring thresholds will need to include error bars. **Mickey** added the Town can rely on engineers to help make a determination. The applicant needs to show that effects occurred as a result of to the TG and

the reasons behind the effects. **Doug** said when the bill came out; NCDCM was more reactive versus proactive because thresholds have to be developed upfront. The NCDCM Science Panel has provided guidance however he has the same concerns as Dr. Cleary. Figure 8 Island developed a monitoring plan with criteria including: if a certain beach exceeded the erosion rate for more than two years running, then it allows for short-term nourishment events to occur. **Doug** added that mitigation is not kicked in until needed. **David Hewett** reiterated the inlet management plan requires thresholds to be set before the project is constructed.

**Dr. Cleary** explained that changes can occur very rapidly within an inlet. **Jay Holden** agreed and indicated Lockwood Folly Inlet has changed greatly within the last few months. **Dr. Cleary** indicated he sits on the Science Panel and this is a very difficult decision to make. **Doug** agreed. **Mickey** stated the USACE and NCDCM have been coordinating since the bill has been initiated, as it is a state law and mandated by NCDCM. For example, a particular requirement/condition set by NCDCM, the USACE may not enforce. However, the EIS is adopted by both the USACE and NCDCM and therefore requirements/conditions are adopted by both agencies. Some issues may not be addressed in the EIS and will be addressed in supporting documents.

**Dr. Cleary** asked if the issues consisted only of the physical aspects (i.e. shoreline changes) or were they also biological. **Doug** replied that in the past a proactive monitoring plan has been put in place to consider biological issues relating to the recreational beach, infrastructure, and the private and/or public beach. Resource agencies have the expertise to address biological issues, **Doug** added. The senate bill is focused on physical issues. **Mickey** indicated mapping and beach profiles can help us look at biological aspects.

**Kathy Matthews** (USFWS) suggested reviewing the P&N as the purpose (protection of structures and infrastructure) are not reflected in the needs. She added that scoping documents indicate the tax base is important. **Mickey** also mentioned the tourist industry. **Kathy** said many needs listed could be problematic. **Mickey** suggested the town consider other needs to include.

**Sara Schweitzer** (NCWRC) requested monitoring of coastal resources should include biological resources. **Doug** indicated every beach nourishment project allows for monitoring of potential adverse impacts to shorebirds, marsh islands, etc. **Doug** suggested not setting up impact thresholds for biological resources and allowing NCWRC to make an assessment and present mitigative measures to the Town. He added that setting up thresholds is problematic, so the past process will continue. **Sara** commented there are opportunities here for a research situation including structure impact on shorebirds, benthic communities, etc. We have a real opportunity for this type of work and can contribute to knowledge of impacts of structures whether they are positive, negative, or neutral. **Doug** responded that we plan on addressing those impacts, but will minimize application of threshold determinations. He said we should continue the development of a good biological monitoring plan on a reactive basis rather than setting up triggers upfront. **Mickey** added that before we get to monitoring, we need to assess impacts and resource to be impacted. We can't assume an impact will take place on a particular resource. He recommended a review of Chapter 6 (Avoidance and Minimization Measures) of previous projects which included a large range of biological monitoring.

## **Alternatives**

**Mickey** said alternatives are the heart of the EIS. The EIS does not include a detailed alternative analysis such as the one developed in the Record of Decision. Cost, technology,

and logistics are all included in the analysis, which results in the USACE's Least Environmentally Damaging Practicable Alternative (LEDPA). The LEDPA may be the preferred alternative, or it may be another alternative. The EIS will include the identification of the Applicant's Preferred Alternative based on purpose and needs, including the resident's needs. The USACE relies on the applicant to tell them what they want to do, as the USACE does not define or change what the Applicant's Preferred Alternative is, but the USACE can make suggested changes and provide guidance. NEPA defines alternatives in terms of reasonable alternatives.

**Mickey** continued, as the EIS is drafted, a section will be included describing the reasonable alternatives carried through analysis as well as alternatives that were not considered reasonable and applicable justifications.

The alternatives that have been drafted as of today include: 1) No Action; 2) Abandon/Relocation; 3) Inlet Relocation with Beach Nourishment; 4) Terminal Groin Structure with Beach Nourishment; and 5) Beach Nourishment only with various borrow sites.

- The No Action Alternative (#1) is interpreted as no permit (federal action) will be issued from the federal government including actions such as sandbags, dredging the AIWW, beach placement, and beach bulldozing. **Mickey** explained the other interpretation of the No Action Alternative is to continually manage as you manage the beach today (i.e. rely on USACE for AIWW dredging and beach placement, sandbag permits, trucking in from offsite area, and includes permits for smaller actions).
- The Abandon/Relocation Alternative (#2) is self-explanatory and may include those homes that may have already taken this action.
- The Inlet Relocation with Beach Nourishment Alternative (#3) is an alternative the town evaluated before the Senate Bill 110 was passed.
- The TG with Beach Nourishment Alternative (#4) will include various options of design and location.
- The Beach Nourishment Alternative (#5) can include borrow sites from AIWW, offshore, upland, etc.

**Mickey** asked the group if there were any questions or other alternatives that haven't been identified and there was no response. He reiterated the USACE will have to make the LEDPA decision defined as practicable and based on costs, logistics, and technology. The USACE will also make a determination in the ROD on the environmental alternative with the least amount of impacts on the natural and biological environment.

**Mickey** indicated the USACE has set-up a special projects page for Holden Beach which includes public notices. **Doug** mentioned North Topsail Beach has a completed EIS for a beach nourishment/inlet management project, but with no TG component. **Mickey** said these documents will provide an idea of the EIS format.

### **Overview of Engineering Presentation**

**Fran** presented the project site depicting net sand transport north to south, although there are exceptions. Offshore Holden Beach is known as sand starved; North Carolina Beach and Inlet

Management Plan defines this as hardbottoms with limited sediment cover. **Fran** showed the general section of shoreline that is of concern, specifically on the east end including Dunescape property and Avenue E.

### **Holden Beach Activities**

Ongoing Holden Beach activities include a proposed Central Reach Beach Nourishment Project. A permit has been issued by the State and a USACE Federal permit is in final review. Sediment characteristics are different in the east end as it is a highly erodible area. Hurricane Irene impacted the shoreline and the Town is conducting ongoing dune restoration. Annual monitoring is being conducted inlet to inlet.

**Fran** explained that federal projects are variable based on the availability of federal funds. Federal projects on Holden Beach include: 1) AIWW dredging to maintain navigation with beneficial use to the east end, and 2) Brunswick County 50-year project includes Holden Beach and forecasts to be completed with assessment in 2014. **Mickey** asked if the central reach permit is different than FEMA funded project. **Fran** answered yes, a total of 30,000 cy of material was lost during the past storm. The central reach project proposed to nourish with 1.3 million cy of material which is considered a large project. Holden Beach would like to activate existing permits and mobilize a dredge. **Mickey** asked if Holden Beach would implement the permit and go to construction this winter (2012). **David** answered that they would like to if they can get the Federal permit. **Fran** said the town would like the flexibility of winter placement in 2012 with the permit to have 3 to 5 years of flexibility.

**Fran** reviewed activities from 2000 to 2012 in which beach management has increased since the 90's. The central reach is the largest section of shoreline with a moderate erosion area. In 2001 and 2002, the USACE conducted beach placement with the Wilmington Harbor project; and the town conducted a gap project to help fill in spots. The east end project is approximately 3,000 to 4,000 feet in length, and is the same shoreline the USACE places material from AIWW. **Fran** continued indicating the western three miles of Holden Beach is accretional and no beach management activities have taken place. **Mickey** asked if they had identified hotspots on Holden Beach due to chronic erosion outside of the east end. **Fran** replied there was no uniform erosion, however erosion is within a range and material is placed on the eastern end of the central reach. The shoreline profiles tend to pick up the material continuing to move to the west.

**Mickey** asked how many structures have been lost on the east end. **Fran** said 24 homes from 1995 to 2001. **Kathy** asked if these structures were lost during particular events. **Fran** answered no, indicating the loss was from ongoing chronic erosion. **He** continued indicating Dr. Cleary has conducted studies in the 80's and 90's and erosion is dependent on the outer bar channel within the inlet. **Mickey** asked if all those homes were in the 3,000-foot stretch of the proposed East End project. **Fran** replied some structures were further west based on old aerials.

**Dr. Cleary** said the eastern end of the island is triggered by ebb channel orientation (ship channel) and literally wags its tail like a dog. When it is skewed in one direction, the end of the island builds up and the other side erodes. When the navigation channel was dredged, the inlet took many years to equilibrate. **Fran** added that preliminary modeling results show some sensitivity to ebb channel changes. The channel is ephemeral, although dredged quarterly. **Fran** indicated USACE federal funding has decreased and the towns/county/state had picked up the tab in 2011 for outer channel dredging. Long-term erosion trend and studies implicate

outer channel alignment and longer term erosion issues to the east end. **Kathy** asked if any houses had been lost since 2001. **Fran** replied no, and added there has been no significant storm. However, there was a dune breach in 2008 due to Hurricane Hanna. The Holden Beach dune system on the east end is minimal; as volumes are not adequate for storm protection. **Mickey** asked if the dunes built in 2005 were from a truck haul project. **Fran** said yes, post-storm Hurricane Hanna maintenance was conducted in 2008 in which the dunes were rebuilt. **He** added that the USACE AIMW project does not have a dune feature in their nourishment project. **Mike Giles** asked how many houses are currently imminently threatened. **Fran** answered on the east end there are 20 to 30 that are imminently threatened. **He** added that the NC Terminal Groin study, identified over \$34 million structures within the 30-year risk line.

## **Monitoring**

**Fran** continued with the engineering presentation and reviewed the annual monitoring analysis. Transects exist inlet to inlet to monitor volume and shoreline change to ensure adequate beach management planning and FEMA compliance. **Mickey** asked if monitoring profiles reach out to -20' or -30'. **Fran** indicated the profiles monitor the shoreline out to -25'. Monitoring transects include Oak Island and Lockwood Folly Inlet. Based on the NC Beach and Inlet Management Plan, the western end of Oak Island is not currently monitored. **Mickey** asked if the transects on the east end of Holden Beach go to the inlet and if this information will be used to develop thresholds/monitoring conditions. **Fran** responded that the USACE continues to survey the inlet. **Mickey** asked if older profiles (since 2001) include inlet shoulders. **Fran** said yes, they include the inlet shoulder.

According to **Fran**, existing biological monitoring data includes sediment compatibility, bean clams, mole crabs, and ghost crabs.

**Layton Bedsole** asked if the relic infrastructure, a result of erosion due to past storms, was still present on the shoreline. **Fran** said yes. During low tide and erosional conditions, there are old pieces of road that are uncovered. **David** stated there are no archaeological artifacts at the present-time. **Fran** indicated the east end lost up to 20 cy/ft, a significant amount of sand, as a result of Hurricane Hanna. **He** added this amount is equal to one small nourishment event completed by the USACE - Navigation.

## **Lockwood Folly Inlet**

**Fran** discussed the abundance of migrating inlets in NC, documented to move several hundred feet every year, but not the case for Lockwood Folly Inlet. Past studies have reviewed inlet movement and determined Lockwood Folly Inlet to be stable. This information will be taken into consideration in the formulation of alternatives including channel relocation vs. inlet relocation.

**Fran** explained sediment transport develops flood channels and creates erosional areas. **Mickey** asked if there is accretion on Oak Island and sediment moves across inlet, is it bypassing the east end and not welding to shoreline. **Fran** replied yes, Lockwood Folly Inlet is a smaller inlet and has smaller shoal features and they do attach on the east end, but then migrate into inlet. **Mickey** asked if there was not enough material. **Fran** answered no. **Dr. Cleary** said Nick Kraus conducted studies three or four years ago and determined littoral drift is up to 125,000 cy of material/year. **Fran** stated that in the 70's, it was established a net transport is to the east. Since the 80's, net transport is to the west. Dr. Kraus conducted a cascade model study in 2008 in which approximately 125,000 cy of material was getting trapped into the inlet. The USACE determined this is a good estimate. Sediment budgets have been calculated

for this area and funded by the USACE. ATM general modeling shows agreement with USACE's sediment budget.

**Fran** continued and indicated the outer channel orientation is affecting erosion along Holden Beach. Channel alignment to the south or southwest is more favorable and would be less erosional to Holden Beach. If alignment is to the southeast, then the east end of Holden Beach is more erosional. The shoreline is erosional in either case, but less erosional. **Fran** indicated thru the depiction of aerials the east end was very erosional in 1993 and more stable in 2004, with some structures at risk.

Based on the Brunswick County parcel map there are approximately 15 homes that are no longer on the east end as shown by the 1993 aerial. **Layton** asked about the date of parcels platted. **Jay Holden** replied 1937 as his grandfather was the one that conducted the survey.

### **Borrow Area Alternatives**

**Fran** discussed the borrow area alternatives based on potential and historic borrow areas the town has used. Upland borrow areas have been used for the past decade. According to **Fran**, the Smith Site is still available whereas Turkey Trap is owned and permitted as a borrow area. The town wants to maintain Turkey Trap for emergency/post-storm nourishment events as they can mobilize quickly and mitigate erosion losses. Additional sites include: Sheep's Island and Monks Island, upland confined disposal facilities, developed from maintenance of the AIWW. **Mickey** asked how much material is available within the Turkey Trap upland borrow area. **Fran** said approximately 400,000 cy, and it is beach compatible, however there are areas that will not be used. **Fran** confirmed upland sites will be preferentially used as they are easier to access and conduct geotechnical investigations.

Offshore borrow area studies were conducted, although related to the proposed central reach project. **Fran** explained that Dr. Cleary has conducted offshore research as well as the USACE funded large seismic and geotechnical studies to find offshore resources. In 2003, the USACE delineated a large area up to 60 million cy. The area was delineated based on geotechnical data however recently collected vibracores showed sediments with high fines. **Fran** confirmed that offshore Holden Beach there is not a lot of beach compatible sand that is worth retrieving. In 2009, ATM performed additional investigations with additional cores. **Fran** confirmed the proposed offshore borrow area is within the 3-mile limit to avoid a dual regulatory process with BOEM.

**Fran** said the general location of the proposed borrow area for the central reach project is offshore Oak Island; the other borrow areas described had certain characteristics that made them not worthwhile such as identified rock/debris and potential archaeological significance.

It was explained by **Fran**, that the Lockwood Folly Inlet/AIWW crossing and maintenance project placed approximately 140,000 cy of material in 2010. Under AIWW regulations, a bend widener can be used which is typically 150' wide; however in 2010 it was widened to 400'. The first time it was utilized by the USACE, funding was significant. The AIWW crossing is a very promising area with lots of material. In 2013, the USACE is not anticipated to conduct maintenance due to lack of funding and a small amount of material recovered in 2012. **Fran** explained that the AIWW crossing at Lockwood Folly Inlet is low priority for the USACE. **Mickey** asks if the compatibility analysis was done in 2010. **Fran** said yes, however the vibracores were collected in 2009. **Fran** reiterated the AIWW crossing contains compatible material.

**Dr. Cleary** asked how the removal of material from the AIWW crossing affects the value of the sediment transport material that was quoted as 125,000 cy. **Fran** replied that Coastal Science and Engineering conducted a Lockwood Folly River and eastern channel study in which currents and water levels were analyzed. Existing currents are 5'/second and flow is primarily thru the AIWW and then the inlet. Flows are strong and maintain current depths in the AIWW. **Fran** explained that the 400-foot bend widener is key to the proposed east end project. **Doug** asked if there is the intention of beach placement at regular intervals. **Fran** answered yes. **Doug** asked if the borrow area assessment is taking into account the need for additional material. **Jay** answered that the AIWW was dredged four consecutive winters and that is why this past year there was less material. **Fran** said that in 2007, a shallow draft report developed by the State discusses the maintenance event in which over the last decade there has been annual and biannual projects. ATM conducted a volume calculation from July 2012 and determined there is approximately 80,000 to 90,000 cy of material present within the bend widener.

**Fran** continued the borrow area discussion and described truck haul from upland sites is good for medium sized projects, including approximately 200,000 cy of material per event. Truck haul includes minor mob/demob costs as construction consists of trucks and excavators. Sediment color is not as good as the sediment within the offshore/inlets, and that has been an issue in the past. With smaller events over larger areas, the projects have to be done more frequently and the town has to take into account road wear and coordination with NCDOT.

**Rich** indicated Sheep's Island has increased in size over the last few years due to sediment accretion. **Fran** replied it could be considered as a potential borrow area but it depends on vegetation and from a permitting standpoint, it can be difficult due to importance of resources to birds. **Fran** iterated the AIWW crossing/bend widener is subtidal. **Kathy** added that the shoals around Sheeps Island are within the piping plover critical habitat area.

**Fran** continued and indicated the Turkey Trap upland borrow area contains approximately 460,000 cy based on available vibracore data. Although there are some wetlands and buffer areas, revegetation plans and ground monitoring are in-place. The Town owns the Turkey Trap borrow area, which is seen as a resource, but keeps it for emergency back-up. The Smith site is still available and has been used successfully for several nourishment events. The owner has indicated the Town could purchase a certain portion for beach compatible material.

**Fran** described the Tripp upland borrow area as a 150-foot deep lake containing beach compatible sand with appropriate color for upland sand. **Mickey** asked if there was 300,000 to 400,000 cy of material. **Fran** replied yes.

With regards to sediment criteria, **Fran** explained that the offshore borrow area has been permitted, passing all criteria. **Mickey** stated the upland sites may have an issue of color from a nesting turtle standpoint. **Mickey** asked if ATM had analyzed Munsell color characteristics. **Fran** said yes as well as a temperature sensitivity test, as it is related to turtle sex. The town ensured that different sand colors would not affect temperature. The temperature sensitivity study was conducted in 2004. **Mickey** asked if the survey was done by hand or with dataloggers. **Fran** responded that it was done by hand with probes at different depths over a range of control and impact sites.

**Dr. Cleary** asked about the longevity of inland/upland borrow areas. **Fran** replied that Turkey Trap borrow area has been used for two nourishment events whereas the Smith borrow area has been used once and the Tripp borrow area was used twice.

Conservatively, there is over 2 million cy within the offshore borrow area, **Fran** explains however cost is an issue. Mobilization for a hopper dredge has been estimated to be \$4 million. In 2009, the volumes of Sheep Island and Monk Island confined disposal facilities were calculated, but there is a layer cake of good and bad material and would require mechanical separation. As these islands are valuable habitats, they are not as practical as borrow areas.

**Fran** explained the existing inlet channel is 150 feet wide at 6 feet depth (USACE authorized), sand volume is minimal and another issue is shipwrecks. There has been a time or two where the USACE has dredged the channel close to the wrecks. **Mickey** asked if the material from the inlet is just to build the fillet. **Fran** answered yes, and a bit downstream. This is a smaller project than the proposed Figure 8 project.

### **Terminal Groins**

**Fran** indicated ATM has had some experience in SC, FL, and Caribbean permitting groins. **He** recommended to the group reviewing the discussion on terminal groins in the Journal of Coastal Research.

With regards to natural resource threats, **Fran** explained that USFWS and NMFS have a recovery plan however data is insufficient to calculate mortality of sea turtles with structures. Threat analysis is inconclusive for structures as it relates to turtles.

A low profile rock terminal groin is preferred by ATM, **Fran** said. This type of terminal groin doesn't prohibit walking and will be buried post-construction. A mitigation step for groins could include notching of the groin as has been done in GA and NJ.

**A lunch break was taken at 12:25pm, the meeting resumed at 1:35pm.**

### **Alternatives Discussion**

With regards to the No Action Alternative, **Fran** described that 24 homes have been lost to erosion on the east end from 1995 to 2001. Oak Island estimated a No Action cost of \$62 million. Road/structure debris remains (photos in 2008 on east end, old road and homes shown). **Kathy** asked which type of No Actions he was referring to. **Mickey** replied no action is defined as they are managing the oceanfront shoreline now. **Mickey** asked about individual sand bags, were they waiting for the USACE dredge to pump sand on the east end? **Fran** said yes, assuming the USACE's activities are going to continue, but it seems that these activities may not continue. **Kathy** stated she was trying to determine the difference between the alternatives, No Action and Abandon/Relocation.

**Fran** continued and reiterated inlet vs. channel relocation and this alternative is considered channel relocation, as Cleary discussed earlier. The channel orientation has been to the east side more often. The USACE follows deep water due to less resistance. Today the channel is more centrally located, based on a July 2012 survey. Sidecast dredge works the outer inlet channel bar, but is not as effective.

According to the USACE Shallow Draft Inlet report for Lockwood Folly Inlet, the outer bar channel has been maintained since the 1980's. A range of 50,000 cy has been placed annually on the east end from the USACE's navigation maintenance work. **Fran** confirmed the USACE is not conducting dredging in 2013 which is based on future funding.

With regards to the terminal groin alternatives, **Fran** explained, Alternative 1 terminal groin is similar to the terminal groin at Fort Macon and proposed for the Figure 8 project. The terminal groin has a proposed design length of 1,600 feet with the upland portion buried to prevent flanking. The active beach part is 700 feet below MHW. Alternative 2 terminal groin, as depicted in the engineering presentation, will be placed at end of existing beach structures. At this time only a conceptual rendering exists.

## Modeling

**Fran** described preliminary modeling results. The following information is brief summary points, however, additional information can be found in the engineering presentation.

- ATM utilized and applied NOAA's Wavewatch data to drive the model. ATM used various model applications such as Genesis which was secondary in nature and was primarily used for the central reach project. CMS is a relatively new model developed by Waterway Experimental Station, developed in the last five years and is under constant improvements.
- Wave height and wave period roses depict sediment transport. Longer wave periods are more efficient at driving sediment transport.
- Bathymetric and topographic data sources: CSE (2008) conducted a survey in Eastern Channel and Lockwood Folly River.
- Flow and sediment grid with bathymetry was developed. Data was calibrated to CSE 2008 data; current and flow measurements where gauges were deployed. In terms of the flow in and out of the inlet, 80% of flow goes to west, only 20% of flow runs behind Holden Beach. It's an interesting system with the largest flow going towards the river.
- Sediment transport roses shows where the sediment transport is occurring along Oak Island and Holden Beach. These numbers are in line with literature and indicate gross transport. The net is not that big, with a general range of 100,000 cy of material going into the inlet. 2008 was large for sediment transport due to Hurricane Hanna. ATM has been in contact with the Waterways Experimental Station to review model results.
- Holden Beach East sediment transport transect results indicate a lot of sand movement in this area; the key is near shore sediment transport is going towards inlet, with offshore material moving west in a regional sense. In summertime, southwest conditions prevail with more westerly transport.

## Results of Studies

**Fran** described the general results of the Alternatives modeling runs with each component analyzed separately to determine impacts. The base case included 2009 runs over 190 days. Preliminary results indicate the inlet channel is moving with varying erosion/accretion. Base run is defined as the No Action Alternative.

The short groin alternative, **Fran** explained, includes sand placed only on the western end of the groin. Results indicate there is much localized accretion due to the short groin and nourishment. The short groin alternative keeps material in place and negligible impacts are seen elsewhere. **Doug** asked if the preliminary results for the short groin were showing no change. **Fran** said there was an 80,000 cy change. **Mickey** asked if the change was over a

one-year timeframe. **Fran** replied it was only for 190 days. **He** indicated ATM will run some of the alternatives for one year, but not all of them. **Fran** stated there were no impacts to the inlet channel.

**He** continued by describing the short terminal groin with the AIWW borrow area resulted in positive effects however the inlet channel is hugging Holden Beach. Since the bend widener in the AIWW is filled, water has to make a hard left into the inlet which creates erosional pressure on the east end of Holden Beach. If the town uses the AIWW, then it will release the pressure.

The long terminal groin alternative with nourishment, **Fran** explained shows nourished material on the west end of the groin. The channel training is up to the groin, which agrees with USACE literature. The channel moves closer to Holden Beach. **Fran** confirms that the longer terminal groin alternative affects a greater area. **Doug** asked if channel migration will cut off Holden Beach as well as flanking the backside of the island. **Fran** indicated the design includes a spur on the island side which will mitigate any potential flanking. **Mickey** asked if the modeling results would change when you look at the long-term. **Mike** asked what the effect of the groin is on the long-term. **Fran** said it would be a positive effect on the west end and ATM would have to evaluate the long-term to see the effect of channel migration. The preferred alternative is leading towards a shorter groin due to localized effects seen with the preliminary modeling results.

**Mike** asked if sediment transport continues into the inlet with the shorter terminal groin alternative. **Fran** answered that sediment is distributed, and volume calculations downdrift impacts were approximately 8,000 cy. Any nourishment would have to account for that.

The alternative containing only nourishment, **Fran** described, results in more accretion spreading towards the west. The short terminal groin only (with no nourishment) is working as expected, with erosion on the downdrift. **Layton** asked if this is depicted in the offshore. **Fran** said the results include the dune, but changes are in the areas that remain wet. **Fran** explained that sediment transport into the inlet rates increase with nourishment and groin.

**Jay** asked if a short groin is built, since the net movement at the inlet is to the east, to mitigate erosion, would you pump sand east of the groin. **Fran** answered yes. The groins are impermeable in the modeling run, as conservative estimates.

**Fran** indicated the long terminal groin alternative only (with no nourishment) resulted in changes in the outer ebb channel related to relocation of channel due to a long terminal groin. Updrift accretion to the west of the groin was also depicted. **He** stated that nourishment offsets impacts of a long terminal groin. The Central Reach Project would result in spreading of material, however does not include the east end.

The Channel Relocation alternative involves filling in the existing channel artificially and relocating the channel. **Fran** pointed out there would be significant changes to the ebb shoal feature, but negligible changes near the shoreline. Within 6 months of the modeling run, the channel has moved.

**Dr. Cleary** asked what the date is of the bathymetry data used in the model runs. **Fran** said it depends on the run but predominantly ranges from 2000 to 2012. **Dr. Cleary** asked which alignment would create a more favorable result for the short terminal groin alternative. **Fran** said based on literature and model runs, if you are going to dredge an outer channel, then it should be further east. But there are not a lot of benefits to the shoreline since relocation will

last about three months; as it is ephemeral and will be hard to manage. **Mickey** asked if that is because the channel dimensions are smaller than other projects. **Fran** said yes, Shallotte Inlet is large and approximately 600,000 cy of material is removed, and it is outside the ColReg line. **Mickey** asked if the relocation would stay within the federal channel and no deeper. **Fran** answered yes, and due to historic civil war shipwrecks (2), this drives the dimensional approach. **Fran** explained that a sidecaster in 2008 did hit one of the wrecks and it is limiting factor on how big the inlet channel can be.

The accuracy of the model in quantitative terms was questioned. **Fran** confirmed the model has been field tested and was calibrated against hydrodynamic features. No statistical analysis has been done.

With the Channel Relocation Alternative, **Fran** explained, the modeling results do not depict a huge benefit. **Mickey** asked if you would expect to see changes in such a short-term timeframe (190 days). **Fran** said you need to pare down alternative components, but need to conduct longer runs. **He** confirmed that the model runs are similar to bathymetry data.

**Fran** described the trapping capacity of the long terminal groin indicating it is hard to establish a downdrift area (approximately 16,000 cy downdrift). Morphology change is a spread out effect resulting in minimal changes in currents between the No Action Alternative and the Short Terminal Groin Alternative.

Additional modeling results are described indicating there is good agreement between the model and data. Most project decisions will be made with the CMS model, **Fran** confirms, however the Genesis model will provide additional data as it runs much faster (12 years in one hr). With the preferred project, the channel relocation is not valuable at this point for the shoreline. In general, the 30-year risk line shows approximately \$34 million at the east end.

## **Cost**

**Fran** explained that annualized cost for a 500-foot long terminal groin is approximately \$1 million per year. **Doug** asked if the one million is for nourishment for every year or for an event. **Fran** said that depending on the amount of material, yes. **Doug** asked if there is enough sand identified to take care of 30 years of nourishment and mitigation that may be required. **Fran** said the recharge rate of the AWW and the benefit of the terminal groin is to increase the nourishment interval. There is a long-term erosion trend on the east end that exceeds a 7 foot/yr erosion rate. Managing the shoreline with nourishment only is not cost effective.

It was asked if ATM had included cost of maintenance or repair of the terminal groin. **Fran** replied they propose a rubble mound structure which requires little to no repair/maintenance. If they use large enough rocks that don't move, the design will minimize future repairs. The groin should not be replaced. **He** explained that sometimes rock restacking can take place, but it is minor.

**Doug** stated that SB 110 requires financial resources that deal with removal/modifications. **He** said he understands the desire to never remove or repair, but you have to plan for worst case scenario. **He** cautions the Town to move into financial considerations and take into account the required mandate. **Fran** said the maintenance plan is important. **Doug** said that maintenance or design changes need to be liberal. **Fran** stated that in SC, you have to provide a letter of financial assurance to take ownership of a groin and any adverse impacts, which is standard policy.

The study area was depicted in which **Dr. Cleary** asked what the basis was for the study area. **Mickey** said it captures all alternatives and is different than the permit area. The boundary area establishes a boundary of modeling results and captures all resources.

**Fritz** asked what area would be nourished in subsequent years. **Fran** said that dependent on monitoring and storm impacts, it can be adjusted based on volume. **Mickey** said every four years, pending storm events. The key is for cumulative impacts such as impacts to fisheries, birds, benthic. They need to come up with some window granted emergency situations.

It was asked whether nourishment would occur on the western side of the terminal groin but some material would be placed immediately to the east to start downdrift mitigation. **Doug** answered that by pre-filling the groin, it will allow sand to more immediately protect the structure and mirror natural transport.

**Mickey** said that potential mitigation may be placing material on Oak Island if monitoring shows erosion.

It was asked whether the inlet channel would have to be maintained as it is today. **Fran** said this was a big question, that there is no big value to incorporate into the preferred alternative. The town prefers to keep channel relocation as a separate project to maintain the outer navigation channel. **Mickey** asked if the USACE is going to continue navigation maintenance. **Fran** said yes, regardless of the presence of a structure. **Fran** spoke to Dave Timpy and the town is free to dredge within the federally approved footprint whereas the permit conditions for the USACE are to follow deep water. **Mickey** said they need to define the project better, as whether the channel relocation is included. **Layton** commented on Mickey's point on developing a schedule on fillet template by project. If the USACE continues to maintain AIWW crossing, **Fran** stated he assumes whatever the Town wants to do may inhibit the USACE's beneficial placement of material.

**Rich** said the closer the channel is to Oak Island, the more deleterious impacts to Holden Beach. With regards to a short terminal groin at the end of McRae St., how wide of an area would be identified? **Fran** said they analyzed the benefits of groin updrift vs placement and length. **Rich** asked if there was a chance of a short terminal groin moving east towards the inlet. **Fran** answered that the farther east you go, the longer the groin will be and the larger the structure.

It was asked whether channel relocation is part of the preferred plan. **Fran** said no, due to short-term benefits and it not being sustainable long-term. It is critical for maintenance of navigation. The USACE is still following deep water and analyzing relocation. **Mickey** said the town needs to realize that the terms channel maintenance (USACE authorized) and channel relocation (town alternative) is different and difficult to understand and should be a part of this permit application, whether it is with the groin or not.

It was asked how the use of a sidecast dredge impacts the terminal groin. **Fran** stated that it was negligible, as sand is moving 50 feet one way or another as it spreads. It does not impact the beach or in the future with the groin.

A request for data/literature citations from agencies was made as it relates to existing natural resources within the study area.

Conclusion of meeting was at 3 pm.