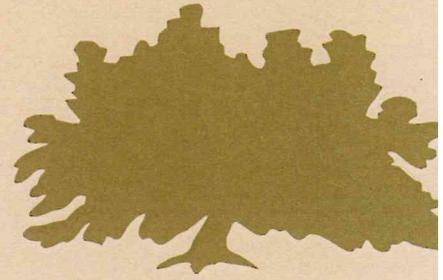


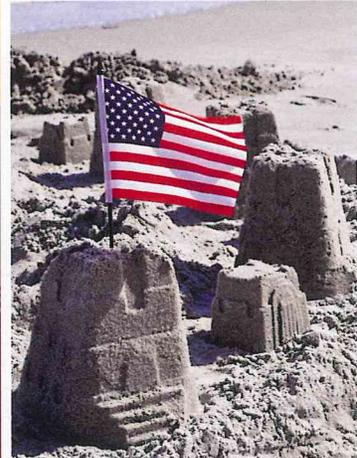


THE TOWN OF OAK ISLAND, NORTH CAROLINA



**PLANNING ANALYSIS, ENGINEERING DESIGN
AND ENVIRONMENTAL INVESTIGATIONS**
in Support of a Comprehensive Shoreline Management Plan

May 17, 2013





1616 East Millbrook Road, Suite 160
Raleigh, NC 27609

(919) 781-4626 Fax (919) 781-4869
www.moffattnichol.com

May 17, 2013

Steven H. Foster
Town of Oak Island
4601 E, Oak Island Dr.
Oak Island, NC 28465

Reference: Planning Analysis, Engineering Design and Environmental Investigations in Support of Comprehensive Management Plan

Dear Mr. Foster:

With our extensive local knowledge and recent experience working with the Towns of Oak Island and Caswell Beach, *Moffatt & Nichol understands the need to develop and implement a comprehensive shoreline and inlet management program.*

For this opportunity, the proposed project manager, *Peter Elkan, PE will lead the project and be supported by coastal engineering staff based in North Carolina.* To supplement our coastal engineering and planning staff, Moffatt & Nichol has assembled a team of colleagues to help the Town develop and implement a Beach Nourishment and Inlet Management Plan. Charles Jones, former Director of NC DCM, in collaboration with Dial Cordy and Associates, will be responsible for environmental permitting and regulatory support. Geodynamics, based in Newport, will provide coastal geology and field investigations. Together, we have established a strong working relationship, collaborating on a number of North Carolina coastal projects to provide the Town with:

- ★ **Dedicated NC experts.** We have a dedicated locally based project team with 95% of the work planned to be completed by residents of the State of North Carolina.
- ★ **Long-term commitment.** A project team led by a project manager who is a professional engineer and can provide continuity throughout this long-term project
- ★ **Strong State and USACE relationships.** Key staff with strong, long-term working relationships with the USACE, NCDENR, NCDCM, NCDWR, USCG, the NC State Ports Authority, NC Coastal Federation, and beach/dredging/navigation groups

Moffatt & Nichol is a United States based company with an extensive history working in North Carolina on coastal engineering and management issues since the Raleigh office inception in the early 1980's. We will offer the Town an approach that speaks to our team's dedication to and familiarity with the beaches of Oak Island.

We would value the opportunity to assist the Town in its efforts to establish a storm protection program and manage its coastal resources. If you have any questions regarding this response, please do not hesitate to contact our proposed Project Manager Peter Elkan, PE, or me at 919-781-4626.

Very truly yours,

MOFFATT & NICHOL

A handwritten signature in black ink that reads "Timothy R. Reid".

Timothy Reid, PE
Principal-in-Charge

COMPREHENSIVE SHORELINE MANAGEMENT PLAN

Town of Oak Island

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EXECUTIVE SUMMARY

With extensive local knowledge and experience, Moffatt & Nichol understands the challenges that the Town faces in the development and implementation of a comprehensive shoreline and inlet management program.

Our project team members have successfully developed and implemented shore protection programs for municipal clients as well as North Carolina state agencies, the US Army Corps of Engineers (USACE), other southeastern states and international governments. *Moffatt & Nichol has asked local North Carolina partners Dial Cordy and Associates (DC&A), and Charles Jones to be part of our team providing their local knowledge of the area's environmental/NEPA issues as well as Geodynamics for coastal geology and surveying.* Key strengths of our project team include:

BEACH RENOURISHMENT AND INLET MANAGEMENT

In-house, nationally recognized experts in coastal planning and management, dredging equipment, placement methods, and navigation safety that have co-authored chapters in the Handbook of Coastal Engineering along with several USACE and Navy design manuals. Moffatt & Nichol has extensive regional experience conducting beach nourishment and sand management feasibility studies. In addition, Moffatt & Nichol has completed planning and design for placement of dredged sand on beaches or in the nearshore; the sand has usually been borrowed from offshore, inlets, and upland sources.

ENVIRONMENTAL PERMITTING AND USACE COORDINATION

DC&A, in collaboration with Charles Jones, will be responsible for environmental permitting and regulatory aspects of the plan. The Moffatt & Nichol team has a strong working relationship with all the permitting agencies through previous local municipal contracts and State projects. We will work with these agencies through the review process, and we will be available to answer agency questions/concerns in order to acquire permit approval. *Moffatt & Nichol key staff has strong working relationships with USACE Wilmington District staff.*

DREDGING FEASIBILITY

Extensive experience in beneficial use of dredged material projects. The project location and the physical and chemical composition of the material will be critical in developing a least cost dredged material management plan. For these projects would have to consider potential reuse options or upland placement sites to minimize disposal costs. We will also consider site access, traffic, available easements and rights-of-way, aids to navigation, local contractor equipment and expected maintenance cycles.

WATER QUALITY MANAGEMENT AND MODELING

Moffatt & Nichol has a depth of regional expertise in water quality management and state-of-the-art numerical modeling of coastal systems. We have a full range of automated design tools incorporating digital terrain mapping techniques to expedite quantity take-offs and cost estimates. In addition, we have the capability to model one-, two- and three-dimensional circulation patterns in tidal estuaries, which can be used to predict the effect of channel dredging on water quality.



QUALIFICATIONS

MOFFATT & NICHOL



moffatt & nichol

Moffatt & Nichol offers clients a professional and experienced staff of coastal, dredging, navigation, civil, structural, mechanical, electrical, water resources and construction planners, engineers, scientists, and economists. *Since all key design disciplines are represented on our staff, Moffatt & Nichol is able to provide clients with thoroughly integrated projects completed under exacting quality control standards.* The Raleigh office of Moffatt & Nichol has been in business and provided coastal engineering services locally and regionally since 1981.

Moffatt & Nichol has an extensive and successful record of experience with coastal engineering, beach and dune nourishment, inlet maintenance and stabilization, dredging, and wetlands projects for the USACE Chief of Engineers Office, the Coastal Engineering Research Center, and multiple Districts as well as a variety of other clients including various port authorities and international governments. Typical projects that Moffatt & Nichol has undertaken include beach nourishment for ecosystem restoration and storm protection, inlet and sand management, modeling of beach and coastal processes, surface quality, dredging and dredged material disposal.

Raleigh staff have completed coastal engineering and planning investigations on behalf and number of municipalities and Counties within the State of North Carolina and Virginia including Towns of Oak Island and Caswell Beach, Town of Emerald Isle, Atlantic Beach, Pine Knoll Shores and Carteret County, the City of Norfolk and the City of Virginia Beach. Through these projects, Moffatt & Nichol has used analytical analyses, simple models (GENESIS and SBEACH), as well as multi-dimensional morphological models (DELFT3D) to replicate inlet and beach behaviors and evaluate possible management strategies. Moffatt & Nichol is also familiar with FEMA funding procedures for an engineered beach and recently assisted the Towns of Emerald Isle and Pine Knoll Shores in acquiring FEMA federal funds with the Post-Irene Renourishment Project. *In fact, Moffatt & Nichol is the only coastal engineering firm completing these types of project in the state.* All of our team members (Dial Cordy and Geodynamics) were also involved in this project.

In addition, Moffatt & Nichol has completed *planning and designs for placement of dredged sand on beaches in the nearshore*; the sand has been borrowed from offshore, inlets, and estuarine environments. Many of our beach/dredging projects have involved high-end numerical hydrodynamic and sediment fate modeling and included permitting, Long Term Management Strategies, Dredged Material Management Plans, and/or construction documents.

SUBCONSULTANTS

DIAL CORDY AND ASSOCIATES, INC. | ENVIRONMENTAL PERMITTING



DIAL CORDY
AND ASSOCIATES INC
Environmental Consultants

Dial Cordy and Associates (DC&A) is an independently owned environmental consulting firm specializing in the documentation of environmental impacts of large-scale beach restoration, navigation, and infrastructure projects and providing water resource planning, natural resource assessment, and regulatory compliance services to federal, state, and local governmental agencies. The firm's forte and principal role has been in the turn-key completion of NEPA Environmental Impact Statements and Environmental Assessments associated with coastal related projects throughout the southeastern United States and Caribbean. *Repeat long-term contracts with the USACE to provide planning and environmental support services is a clear recognition of DC&A's knowledge and capabilities in beach and inlet planning and assessment.* With reduced federal funding of shore protection projects throughout the United States, DC&A's role is changing to support coastal counties in implementing their own beach and inlet management programs.





Through the NEPA process, DC&A works closely with state, federal, and local stakeholders to identify ways to minimize environmental impacts to sensitive habitats such as hardbottom and sea turtle nesting grounds. DC&A has written over 500 NEPA documents in the last 15 years, including *of EISs and EAs for beach projects in North Carolina including Bogue Banks, Figure Eight Island, North Topsail Beach, Topsail Beach, Holden Beach, and the USACE's Brunswick Beaches 50-Year Project.*

CHARLES JONES | ENVIRONMENTAL PERMITTING

Mr. Jones began his state government career as a field consultant with the Division of Coastal Management and was employed with that agency until his retirement in 2007. During his tenure with the State, he was the recipient of a number of awards and honors including The Order of the Long Leaf Pine from Governor Mike Easley, the Eure-Garner Award from the Coastal Resources Commission and a Pelican Award from the NC Coastal Federation *in recognition of outstanding environmental service.*

GEODYNAMICS | COASTAL GEOLOGY & SURVEYING



Geodynamics offers the Town a professional and experienced staff of coastal geologists and hydrographers that are committed to the highest quality data acquisition and analysis. Geodynamics provides coastal mapping services to town and county governments, including the *Town of Ocean Isle, Carteret County, Village of Bald Head Island and Towns of Pine Knoll Shores and Emerald Isle.* Geodynamics is currently entrusted with monitoring the beaches of Carteret County under a five-year contract. These yearly and post storm data assist the County's Shore Protection Office and their engineer, Moffatt & Nichol, in obtaining FEMA reimbursement following significant erosion events caused by tropical storm systems, like Hurricane Irene in 2011.

Statewide, Geodynamics is a prime contractor for the *USACE Wilmington District* for their periodic beach profile surveys that are required for their authorized beach projects. Geodynamics performed a comprehensive survey of Ocean Isle, Holden Beach and Shallotte Inlet in 2006 and 2008 on behalf of the Wilmington District. The advent of Geodynamics' Shoreline and Nearshore Digital Mapping and Analysis Program (SaNDMAP) has revolutionized grid-based analysis allowing for datum derived shoreline generation, 3D volumetric change and repetitive surfaces analysis with much greater accuracy than traditional methodology.

In addition to local municipalities and the USACE Wilmington District, Geodynamics performs hydrographic surveys for clients including USACE Baltimore District, the US Navy NAVFAC Atlantic, the USACE Coastal Inlets Research Program, the NOAA Center for Coastal Fisheries and Habitat Research, and the North Carolina Division of Coastal Management. *Geodynamics is a woman-owned Historically Underutilized Businesses certified through the State of North Carolina Statewide Uniform Certification (SWUC) program.*

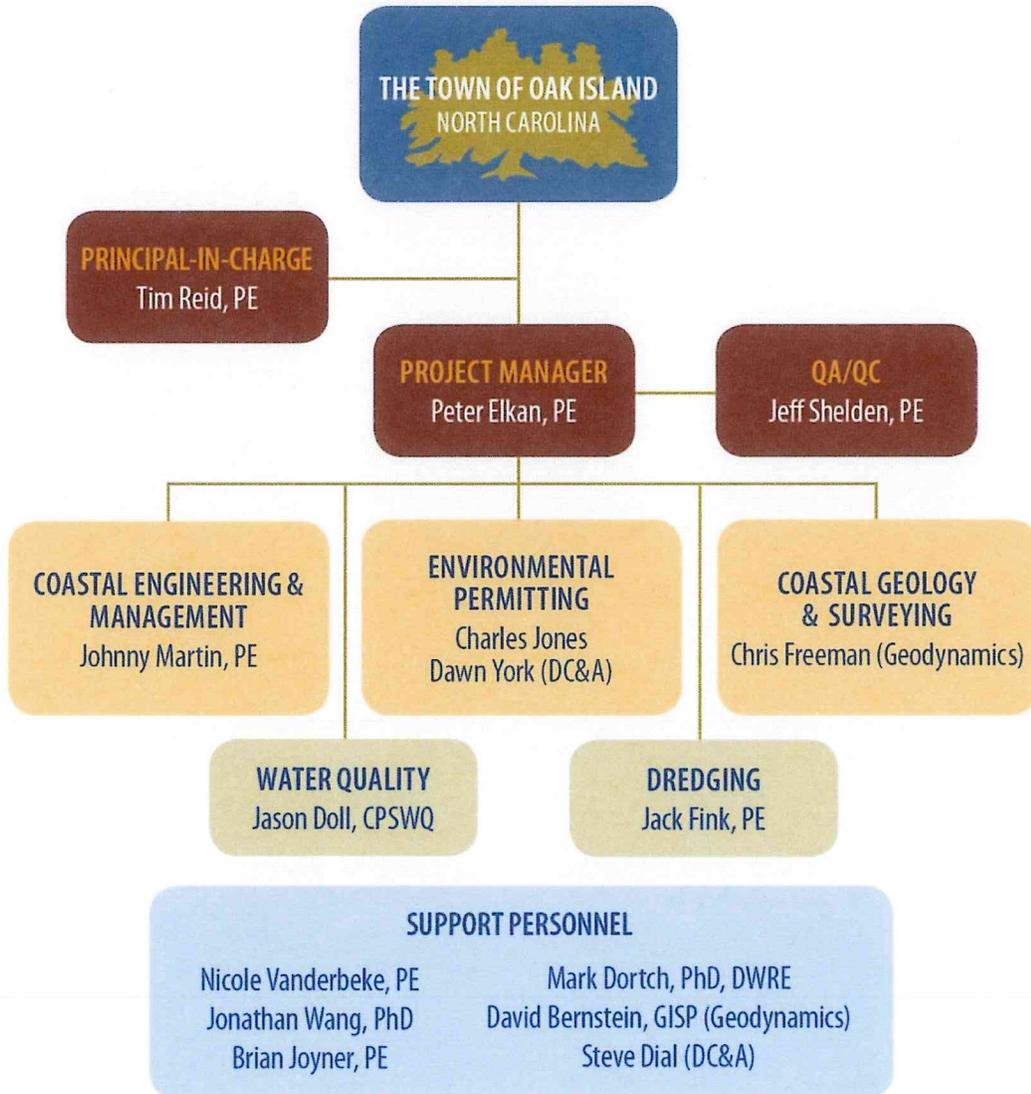




PROJECT ORGANIZATION AND STAFFING

The team’s organization and key personnel are shown in the project organizational chart below. Brief resumes also follow. *Moffatt & Nichol’s Project Manager Peter Elkan, PE will serve as the point of contact for the Town and will oversee communication and deliverables for the Moffatt & Nichol team.* Moffatt & Nichol engineering and planning staff will be responsible for conducting the coastal engineering, water quality, dredging, and planning. Geodynamics, led by Chris Freeman, will be responsible for field survey investigations and geological assessments. DC&A, in collaboration with Charles Jones, will be responsible for environmental permitting and regulatory aspects of the plan.

ORGANIZATIONAL CHART





KEY STAFF

Moffatt & Nichol is committed to serving the Town with the team members listed throughout the entire project. This project will be a multi-year effort and Moffatt & Nichol has a long-term commitment to NC and our clients here (since 1981). Our team is dedicated to delivering a product that will meet the needs, budget, and schedule of the Town through continual communication among the team, Town, Contractor, and regulatory agencies.

PETER ELKAN, PE | PROJECT MANAGER

- ★ 17 years of experience leading interdisciplinary coastal engineering and planning efforts
- ★ Lead for coastal stabilization projects throughout the southeastern U.S. including beach nourishment, groins, beach bulkheads, breakwaters, revetments, and jetties
- ★ NEPA preparation and permit acquisition from federal, state, and local agencies

TIM REID, PE | PRINCIPAL-IN-CHARGE

- ★ 28 years of project management, planning, evaluation, design & construction services
- ★ Principal for NC Terminal Groin Study, which led to development of guidelines
- ★ Principal on NC coastal engineering projects in Bodie Island, Nags Head, Emerald Isle, New Bern, Wilmington, Morehead City, and various counties

JEFF SHELDEN, PE | QA/QC

- ★ 29 years of experience in shoreline protection, waterfront and coastal structure design, and determining hydraulic and storm surge effects on coastal structures
- ★ PM for various NC-12 Vulnerability Studies as well as Bonner Bridge Studies
- ★ Numerical modeling of shoreline processes, tidal flows, and pollutant flushing rates

JOHNNY MARTIN, PE | COASTAL ENGINEERING & MANAGEMENT

- ★ More than 18 years coastal engineering services for NC clients
- ★ Coastal engineering lead on local projects including Bogue Banks Master Beach Nourishment Plan, NC Beach and Inlet Management Plan, NC Terminal Groin Study, and City of Norfolk Beach Nourishment and Breakwater/Groin Projects
- ★ Evaluation and feasibility of NC-12 Alternative Analysis, FIMP Plan, and Poplar Island Restoration

CHARLES JONES | ENVIRONMENTAL PERMITTING

- ★ 32 years of experience with NC Division of Coastal Management and former Director
- ★ Representative for Carteret County's NC Coastal Resources Advisory Council and one of its appointees to the Scenic By- Way Committee
- ★ Developer of coastal policies, rules formulation and CAMA permitting issues.

DAWN YORK | ENVIRONMENTAL PERMITTING

- ★ Environmental permitting for large-scale beach nourishment projects
- ★ Management of NEPA/SEPA environmental documentation and permit authorization
- ★ Sea level rise research under the USACE, Wilmington Harbor Deepening project

CHRIS FREEMAN | COASTAL GEOLOGY & SURVEYING

- ★ 14 years of geologic and oceanographic research through UNC-W, UNC-IMS, VIMS and Corps' FRF
- ★ Technical oversight for high-resolution swatch-bathymetry mapping
- ★ Pre-/Post-beach nourishment, development of advanced 3D shoreline mapping techniques





JASON DOLL, CPSWQ | WATER QUALITY

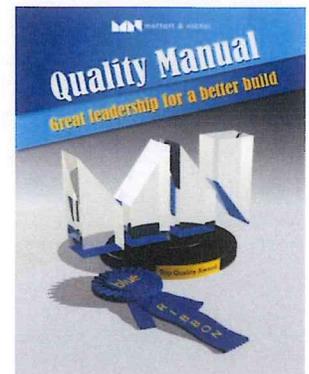
- ★ 17 years of water quality modeling and storm water management
- ★ Integration of ecological restoration with other non-point source management measures
- ★ Development and application of a watershed and water quality modeling tools including TMDLs

JACK FINK, PE | DREDGING

- ★ 23 years of marine construction and dredging projects
- ★ Long-term management strategies for the placement of dredged material
- ★ Former cost estimator and project manager for major marine construction and dredging contractor

QUALITY CONTROL

The Moffatt & Nichol team has an established formal quality assurance/quality control (QA/QC) framework that will be followed to promote the highest quality work possible. Moffatt & Nichol operates under a Quality Control Manual that sets the requirements and requires a QA/QC plan to be prepared at the outset of a project identifying the staff responsible for performing the review, the documentation to be reviewed, and the review dates. It requires part of the project budget to be allocated to review and allows for an internal review audit to occur on any project at any time.



The QA/QC process for this project will involve the following elements:

- ★ Independent overview of conclusions made previously by others
- ★ Verification of data at source or duplication of data, whenever possible
- ★ Comparison of data or report conclusions with other similar projects or situations, in particular the reference systems for each project alternative
- ★ In-house checking of all design input data, with particular reference to units and calibration parameters
- ★ Peer review of concepts, technical work elements and work products by specialists with experience in similar projects or conditions
- ★ Senior executive review of all primary conclusions and recommendations

All project managers must adhere to this requirement for every project. *This process has formally been in place at Moffatt & Nichol for nearly 20 years and works well to identify potential errors or faulty assumptions and methods.* Our designs have been successfully constructed and our work has withstood the highest level of scrutiny by *blue ribbon* panels due to this QA/QC procedure. Our subconsultants also have strong performance records.





EXPERIENCE

The following provides a brief selection of some of the Moffatt & Nichol team's specialized experience in beach renourishment, storm protection, environmental permitting, dredging, and water quality.

RECENT EXPERIENCE

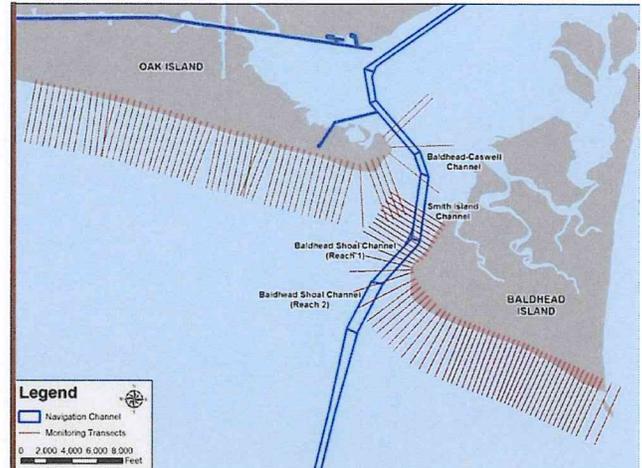
CAPE FEAR INLET SAND MANAGEMENT PLAN IMPLEMENTATION, TOWN OF OAK ISLAND AND TOWN OF CASWELL BEACH, NC

CLIENTS: TOWN OF OAK ISLAND AND TOWN OF CASWELL BEACH

Moffatt & Nichol has served as the coastal engineering technical advisor to the communities of Oak Island and Caswell Beach from 2008 to present with respect to the implementation of the Sand Management Plan at Cape Fear Inlet. The Cape Fear Inlet Management Plan was developed as part of the Wilmington Harbor deepening project (adopted in 2000), allowing for the beneficial use of beach compatible material dredged on beaches at Oak Island and Bald Head Island. Subsequent to the channel deepening and realignment in 2001, the USACE has been conducted maintenance dredging of the material with placement on the adjacent beaches and conducted monitoring of the physical processes at inlet and adjacent beaches (e.g. wave gage, on-shore and near-shore bathymetric surveys, current velocity).

Moffatt & Nichol has completed independent technical review of the ongoing monitoring performed by the USACE in support of the Cape Fear Inlet Management Plan. Additionally, Moffatt & Nichol has provided independent assessment of the *Draft Re-evaluation Report Sand Management Plan* (USACE, Draft 2011) and served as the technical representative for the communities of Oak Island and Caswell Beach in communication with the USACE and Town of Bald Head Island. Moffatt & Nichol performed independent calculations of shoreline change, volumetric change for the beaches and ebb shoal complex to assess the performance of beach fill and pathways of sediment transport in relation to shoaling within the Federal Navigation Chanel. Moffatt & Nichol has participated in stakeholder meetings, legal proceedings and provided technical guidance to Towns with respect to litigation brought by the Town of Bald Head Island against the USACE. Moffatt & Nichol has provided peer review of all technical and legal documents with respect to the litigation.

In addition to the SMP consultation, Moffatt & Nichol is currently advising the communities with respect to the proposed Cape Fear Inlet Area of Environmental Concern (AEC) in accordance with NC State Statutes.



Fees for Continuing Services (including Hydrographic Surveying in 2009):

\$150,000

Schedule: 2009-present

Change Orders: N/A

References:

Harry Simmons | (910)-200-7867

Dara Royal | (910)-470-9062

Principal:

Tim Reid, PE





NORTH CAROLINA BEACH AND INLET MANAGEMENT PLAN, NC

CLIENT: NCDENR

For the State of North Carolina, Moffatt & Nichol, and several subconsultants, developed a comprehensive beach and inlet management plan identifying potential strategies to maintain beach and inlet characteristics at levels determined from analysis of historic, current, and forecasted future positions and composition. Developed for coastal regions defined by physiography, vulnerability, and natural processes, management strategies were focused on the allocation and stewardship of available sediment resources in an attempt to maintain and prolong the character of North Carolina's shorelines. Specific aspects of the project included:

- ★ Data identification & acquisition
- ★ Beach & inlet management region definition
- ★ Draft management strategy development
- ★ Public review and input
- ★ Final report development

At the conclusion of the project, Moffatt & Nichol produced a report presenting study elements and process, proposed management strategies by region, identified potential funding sources, and provided background data supporting the study.



Original | Final Budget:

\$750,000 (fee) | \$781,700 (fee)

Schedule: 2007-2010

Change Orders: \$31,700 | Additional Economic Study

Reference:

Darren England | (919) 707-9013

Principal: Tim Reid, PE

SHALLOW DRAFT NAVIGATION MAINTENANCE STUDY, NC

CLIENT: NORTH CAROLINA GENERAL ASSEMBLY

Moffatt & Nichol performed a study to examine the costs, benefits, and management issues related to dredging North Carolina's shallow draft navigation channels. Over the last 30 years, more than 100 million cubic yards have been dredged from North Carolina's shallow draft waterways, at an average cost of \$15 million a year. The shallow draft waterways include 308 miles of the Atlantic Intracoastal Waterway (AIWW), as well as coastal rivers, small access harbors, and numerous inlets. Most of these waterways have been maintained by the USACE and funded through Congress. Future funding for this effort is uncertain, and the state is exploring revenue and maintenance alternatives. The study included:

- ★ Historical project inventory (frequency, method and volumes of dredging),
- ★ Dredged material management plan (current and future practices),
- ★ Economic impacts of shallow draft navigation waterways to state and local interests,
- ★ Safety concerns,



Original | Final Budget:

\$99,000 (fee) | \$99,000 (fee)

Schedule: 2005

Change Orders: None

Reference:

Darren England | (919) 707-9013

Principal: Tim Reid, PE





- ★ Equipment and operating costs (for potential dredges and ancillary equipment),
- ★ Financing options for dredging program,
- ★ Contracting alternatives, and
- ★ Regulatory costs for state dredging program.

The study determined that the channels significantly impact the state's economy, with revenue generated by recreational boating, tourism, commercial fishing, and marine trades, estimated to be in the hundreds of millions of dollars each year. In addition, the shallow draft waterways are considered to be an intrinsic part of North Carolina's heritage and way of life.

INDEFINITE QUANTITY CONTRACT: SHORELINE PROTECTION, NORFOLK, VA

CLIENT: CITY OF NORFOLK

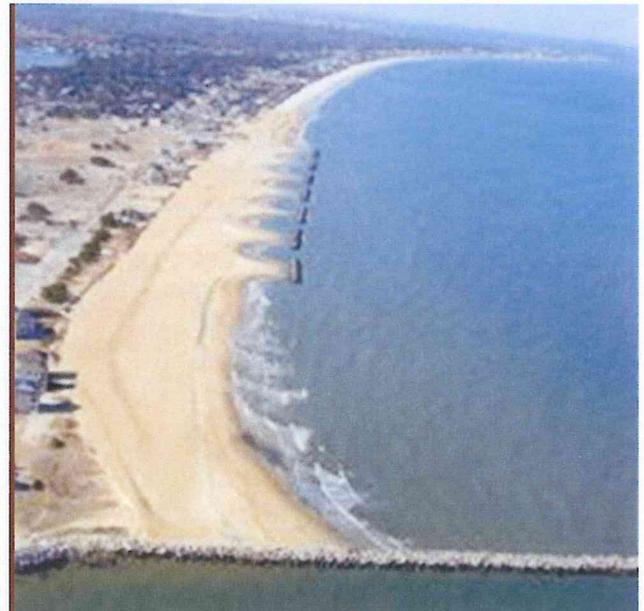
Under an on-call type contract held for the past eight years, **Moffatt & Nichol** has completed shoreline protection tasks including:

East Ocean View Beach Nourishment. Completed planning, preliminary/final design and construction documents for placement of 355,000 cy of sand along 5,300 lf of shoreline. Tasks included optimization of the beachfill template using SBEACH and GENESIS.

Central Ocean View Beach Re-Nourishment. Moffatt & Nichol completed planning, permitting, preliminary / final design and construction documents for placement of 428,000 cy of sand along 18,300 lf of shoreline. Tasks included a sand compatibility analysis and SBEACH numerical modeling of several representative beach profiles.

Beach Restoration, 800 Block, Ocean View Beach. For this study, Moffatt & Nichol performed a comprehensive study of historical and present conditions at the 800 Block area of Willoughby Spit to determine the cause of erosion and to develop a recommended alternative for future erosion control. The work included complex numeric modeling of the existing system to determine the causes of erosion. This study involved an intensive review of historical data and engineering activities at the 800 Block area followed by complex numerical modeling of the existing system, all of which aided in the determination of the probable cause of erosion at the study area. The calibrated model was used to evaluate alternatives to mitigate erosion in this area. The recommended alternative included removal of the groin spur and addition of a new breakwater located further offshore. Moffatt & Nichol worked with the City during a public outreach effort with the local civic leagues to explain the recommend alternative and the expectations of the project. With the public satisfied, Moffatt & Nichol prepared permits and project plans and specifications.

Bay Oaks Hot Spot Beach Restoration Design, Norfolk. Upon completion of a comprehensive study of the Bay Oaks erosional hotspot along the City's Ocean View Shoreline, Moffatt & Nichol developed a fully permitted final design for the breakwaters using offshore segmented breakwaters that were 125 feet long and set 140 feet



Original | Final Budget:
\$7.1 (construction) | Ongoing

Schedule: 2006-present

Change Orders: None

Reference:
Lee Rosenberg | (757) 664-4373

Principal: Michael Crist, PE



apart to allow sufficient wave energy to penetrate and move sand along the shore. This optimal configuration helped smooth the transition from existing breakwater field while increasing stable beach width along Bay Oaks.

POST-IRENE RENOURISHMENT PROJECT, CARTERET COUNTY, NC

CLIENT: TOWN OF EMERALD ISLE AND TOWN OF PINE KNOLL SHORES

Following the devastating passage of Hurricane Irene in August 2011, **Moffatt & Nichol** provided field investigations, coastal engineering design, and permitting support to nourish beaches impacted by the hurricane. In order to meet requirements to use an offshore dredged material disposal site as a borrow source, the field investigation consisted of a hydrographic multi-beam survey, a geophysical subsurface survey, collection of vibracores, and lab analysis and testing of vibracores for compatibility. Carteret County was already completing similar investigations as part of its Programmatic EIS; results were shared to expedite the process and decrease overall costs.

Based on the findings, **Moffatt & Nichol** determined which reaches of beach should receive nourishment and how large the fill template along each reach should be to offset the hurricane's effects. An estimate of the profile adjustment and immediate nourishment losses were provided, along with an estimate of the project design life for future project planning and public information.

Moffatt & Nichol assisted with the Environmental Assessment and permit documentation, provided agency coordination and attended agency meetings, and completed a sand compatibility analysis based on new geotechnical information. Once the permits were approved, **Moffatt & Nichol** prepared plans and specifications, including a digital elevation model to serve as a baseline for the construction drawings. **Moffatt & Nichol** also provided bidding assistance and construction management services, including construction monitoring and shop drawing review. Documentation was formatted to comply with FEMA requirements for reimbursement requests. *All the permit approvals for this project (including negotiation of the BOEM sand lease) was accomplished in one year.*



Original | Final Budget:
\$394,665 | Ongoing
Schedule: 2012-present
Change Orders: None
References:
Frank Rush | (252) 354-3424
Brian Kramer | (252) 247-4353
Principal: Tim Reid, PE



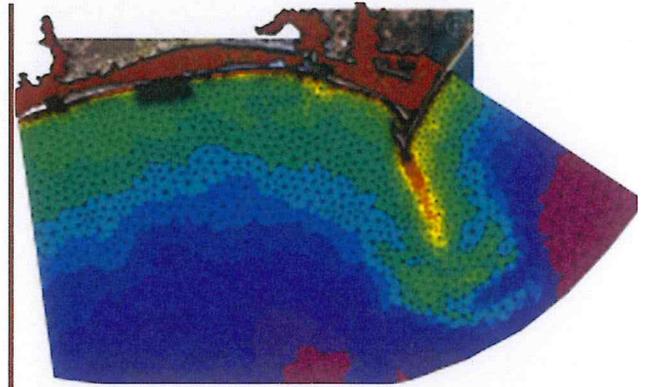
BOGUE BANKS MASTER BEACH NOURISHMENT PLAN, CARTERET COUNTY, NC

CLIENT: CARTERET COUNTY

Moffatt & Nichol, along with **Geodynamics** and **DC&A**, has been selected by Carteret County to complete a three-year project to develop a multi-decadal programmatic EIS. The project will incorporate all of Bogue Banks' beach nourishment and inlet management needs, and acquire permits that will cover these needs and the use of required sand sources for the next 30-50 years. The project will also be used to update and maintain static-line exceptions as well as FEMA engineered beach designation.

This report will include the response of shorelines and inlets to natural long-term and storm-induced erosion, as well as man-made (dredging and beach nourishment) forcing function. It will also provide the overall desired level of protection and the associated appropriate differing nourishment volumes, benchmarks, and triggers that should be used to meet a desired level of protection.

Geodynamics was contracted by Moffatt & Nichol through the Carteret County Shore Protection Office for the collection of topographic and hydrographic profile data for Bear Island (18 profiles), Bogue Banks (122 profiles), and Shackleford Banks (24 profiles). Tasks include acquiring profile elevation data in a timely manner, with spatial and data-density constraints, and RTK-GPS accuracy requirements. Geodynamics' willingness to develop a successful monitoring program has included post-storm survey work after Hurricane Irene within two days of passing, providing quick and thorough comparison of pre- and post-storm conditions such that the County has based their FEMA claims. Additional products include developing digital elevation models (DEMs), QA/QC assessments, and calculating volumetric changes alongshore.



Original | Final Budget:

\$1,905,434 (fee) | Ongoing

Schedule: 2010-present

Change Orders: \$600,000 | Required Geotechnical Investigations to meet Sediment Criteria Rule

Reference:

Greg "Rudi" Rudolph | (252) 393-2663

Principal: Tim Reid, PE

BOGUE BANKS STORM DAMAGE REDUCTION STUDY, CARTERET COUNTY, NC

CLIENT: CARTERET COUNTY

As part of the development of the USACE, Wilmington District storm damage reduction study for the Bogue Banks shoreline in Carteret County North Carolina, **Moffatt & Nichol**, as a subconsultant, has been tasked with developing a Beach-fx model of the entire study area.

The storm damage reduction study includes both coastal engineering and economic analysis. Beach-fx is a life-cycle simulation model that uses a Monte Carlo simulation technique to evaluate the physical performance and economic benefits and costs of shore protection projects. The prime, as one of the authors of Beach-fx, was primarily responsible for running the Beach-fx simulations while Moffatt & Nichol provided the coastal engineering analysis and developed the key input into the model, the



Original | Final Budget:

\$129,959 (fee) | \$186,874 (fee)

Schedule: 2008-2012

Change Orders: \$56,915 | Additional SBEACH Runs

Reference:

Greg Williams | (910) 251-4767

Principal: Tim Reid, PE





storm damage response database. The coastal response database was developed from over 500,000 SBEACH (Storm-induced BEACH CHANGE) model runs, which simulated beach profile response to storms for both existing conditions and future project conditions.

A set of 37 historical tropical storms and 23 extratropical storms were run for 13 beach profiles representing the various reaches of the beach based on 112 beach transects surveyed in 2009. The beach response to storms was then combined with economic damage functions and the Beach-fx model run for multiple 50-year simulation periods for existing conditions and various project cases. This data will form the USACE feasibility study.

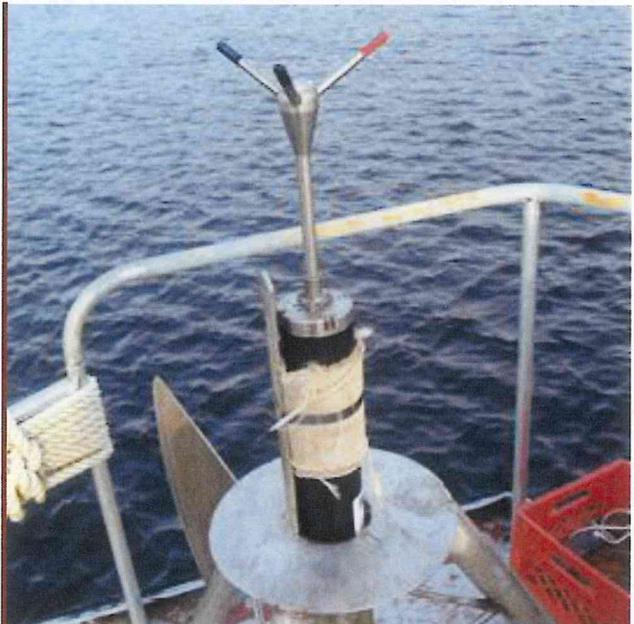
TIDAL HYDRAULIC MODELING FOR NEW BRIDGE OVER INTRACOASTAL WATERWAY, SUNSET BEACH, NC

CLIENT: NORTH CAROLINA DEPARTMENT OF TRANSPORTATION (NCDOT)

Sunset Beach is located on a barrier island near the border between North Carolina and South Carolina and was originally connected to the mainland via a wooden swing bridge over the Intracoastal Waterway. The bridge only supported one lane of vehicle traffic at a time, and traffic was stopped on the hour every hour to allow boats pass. NCDOT chose to replace the structure with a new 65-foot-high arc bridge that would allow a continuous flow of vehicle and vessel traffic, and they selected Moffatt & Nichol to provide the coastal engineering studies for the replacement.

Moffatt & Nichol conducted site investigations and field surveys to gather information about the proposed site of the new bridge. The firm used the data collected to perform hydrological and hydraulic studies, including numerical hydrodynamic modeling to determine water velocities along the proposed bridge alignment. The results of these studies were used as inputs for vessel impact studies, scour calculations, and determination of flushing characteristics for Big Narrows Channel.

The new Sunset Beach Bridge opened on November 11, 2010. The swing bridge it replaced was relocated to the mainland where it is protected by The Old Sunset Beach Bridge Preservation Society.



Original | Final Budget:
\$93,055 | \$93,055
Schedule: 2007-2008
Change Orders: None
Reference:
Scott Blevins | (919) 707-7132
Principal: Tim Reid, PE



LOCKWOODS FOLLY LOCAL WATERSHED PLAN, BRUNSWICK, NC

CLIENT: NORTH CAROLINA ECOSYSTEM ENHANCEMENT PROGRAM

Jason Doll of **Moffatt & Nichol** led the two-year effort to conduct a technical watershed assessment and develop Local Watershed Plan for the 150 mi² watershed of the Lockwoods Folly River for NCEEP. The study involved identification of key stressors, including nonpoint source pollutant loads, stream channelization, and wetland loss, that had the potential to degrade watershed functions. Detailed field surveys were integrated with functional assessment tools to identify opportunities for management efforts such as stream and wetland restoration and stormwater BMP retrofits to address areas where watershed functions were degraded. Assessment tools, including a watershed modeling analysis, were utilized to evaluate the degree of reduction in stressor impacts associated with each potential restoration or management opportunity and to target areas for management based on the greatest needs under existing and future land use conditions.



Original | Final Budget:

\$277,007 | \$311,609

Schedule: 2005-2007

Change Orders: One to add services

Reference:

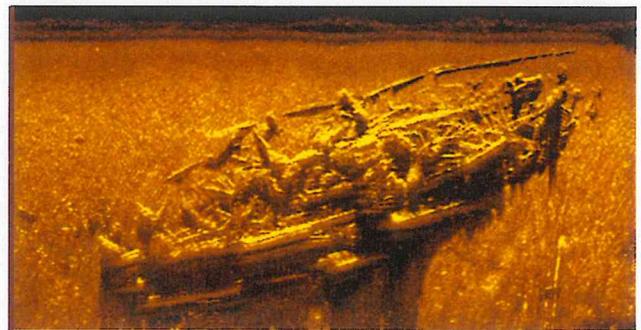
Michele Drostin | (919) 715-6817

Principal: N/A

ARCHAEOLOGICAL AND HARDBOTTOM SURVEYS OF OFFSHORE BORROW AREAS, BRUNSWICK COUNTY, NC

CLIENT: US ARMY CORPS OF ENGINEERS, WILMINGTON DISTRICT

The U.S. Army Corps of Engineers Wilmington District conducted preliminary investigations of two proposed offshore borrow areas, Jay Bird and Frying Pan Shoals, totaling 4,591 acres for a coastal storm damage reduction project along Brunswick Beaches, Brunswick County, North Carolina. As a part of these investigations, **DC&A** conducted marine magnetometer, side-scan sonar, and sub-bottom profile surveys of the proposed offshore borrow areas for the purpose of identifying any potential archaeological resources that might be impacted by offshore dredging activities during the sand mining process. In addition to archaeological resources, marine remote sensing and towed video surveys were performed to identify and confirm the presence or absence of hardbottom habitat within the two proposed offshore borrow areas.



Original | Final Budget:

\$300,320 | \$300,320

Schedule: 2009-2010

Change Orders: None

Reference:

Doug Piatkowski | (910) 251-4908

Principal: Steve Dial

DC&A did not identify any hardbottom habitat within either the proposed Jay Bird Shoal or Frying Pan Shoal borrow areas based on the remote surveys and towed video confirmations. Sediment samples confirm the presence of variable sediment types within the survey area of Jay Bird Shoal and homogeneous sand throughout the Frying Pan Shoal survey area.





HOLDEN BEACH EAST END SHORE PROTECTION PROJECT, HOLDEN BEACH, NC

CLIENT: TOWN OF HOLDEN BEACH

DC&A is contracted with Holden Beach as well as the US Army Corps of Engineers as an approved third party contractor to prepare an Environmental Impact Statement (EIS) and a Major CAMA permit application for the renourishment of approximately two (2) miles of Holden Beach and the construction of a terminal groin adjacent to Lockwood Folly Inlet. DC&A provided environmental expertise required to prepare the EIS and secured the necessary permits needed for Holden Beach to implement a beach nourishment/terminal groin project in the winter of 2014. DC&A coordinated closely with state and federal resource agencies for the development of an EIS, a Biological Assessment and an Essential Fish Habitat Assessment.

DC&A evaluated potential environmental, cultural, and anthropogenic effects associated with Holden Beach's East End Shore Protection Project. A terminal groin structure on the eastern end of Holden Beach is an alternative that is being considered as the preferred method to reduce the high erosion losses that have historically occurred at the east end of Holden Beach. A terminal groin alternative would include proactive sand management elements within Lockwoods Folly Inlet and the AIWW inlet crossing. DC&A's endeavor to complete NEPA documentation and obtain permits, will be to assist the Town's engineer in the development of a comprehensive inlet management plan.



Original | Final Budget:
\$419,496 | Ongoing

Schedule: 2012-present

Change Orders: None

Reference:
David Hewett | (910) 508-1950

Principal: Steve Dial

TOPOGRAPHIC AND HYDROGRAPHIC SURVEY OF OAK ISLAND AND CASWELL BEACH, NC

CLIENT: TOWN OF OAK ISLAND

Geodynamics was contracted by Moffat & Nichol to collect topographic and hydrographic survey data for Oak Island and Caswell Beach on 73 profiles. Hydrographic data acquisition was collected in accordance with the U.S. Army Corps of Engineers Hydrographic Surveying Manual, EM 1110-2-1003 (EM 1110-2-1003 January 2002). The project was collected using RTK-GPS techniques and collected under the data density and spatial constraints as described by the client. Many of the profiles in the Oak Island area have GPS-shadows or obstructions from beachfront houses. Geodynamics extended their effort and photo-documented all obstructions (i.e. houses / trees) or "gaps" in coverage to assist the clients in understanding the nature of any gaps in coverage and was included in the deliverable in addition to the XYZ ASCII text files and supplemental QA/QC information.



Original | Final Budget:
\$47,230 | \$47,230

Schedule: 2009

Change Orders: None

Reference:
Johnny Martin | (919) 538-6033

Principal: Chris Freeman



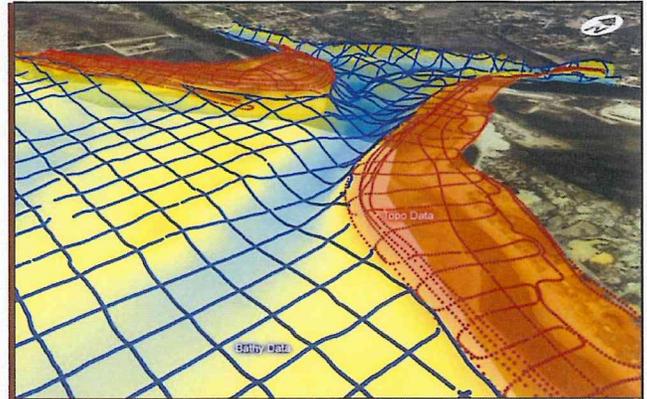


BEACH PROFILE AND INLET SURVEY FOR OCEAN ISLE, HOLDEN BEACH, AND SHALLOTTE INLET, NC

CLIENT: USACE - WILMINGTON

Geodynamics was contracted by the USACE – Wilmington District to perform detailed 2D and 3D topographic and bathymetric surveys for Ocean Isle Beach, Holden Beach and Shallotte Inlet in Brunswick County, NC. The combination of equipment and specialized acquisition / processing methodology allowed Geodynamics to achieve seamless 2D and 3D topo/bathy profiling and subsequent digital elevation modeling for Ocean Isle Beach, Holden Beach and Shallotte Inlet with the highest allowable accuracy.

Bathymetric data was acquired with an Odom CV100 ultra-shallow water digital singlebeam sonar system that is integrated with a POS inertial navigation system on the research vessel Shoals; a 20' shallow water platform which permits the acquisition of spatially dense bathymetric data across all portions of the survey area and to achieve maximum overlap with topographic data in the surfzone. The second topographic and hydrographic survey at Brunswick County utilized the NC Geodetic Survey Shallotte Virtual Reference Station (VRS) to provide the surveyors with continuously fixed RTK solutions for navigation, tides, motion aiding and topographic elevations. RTK-GPS was used to supplement these corrections in areas with poor cellular coverage.



Original | Final Budget:

\$77,355 | \$77,355

Schedule: 2008

Change Orders: None

Reference:

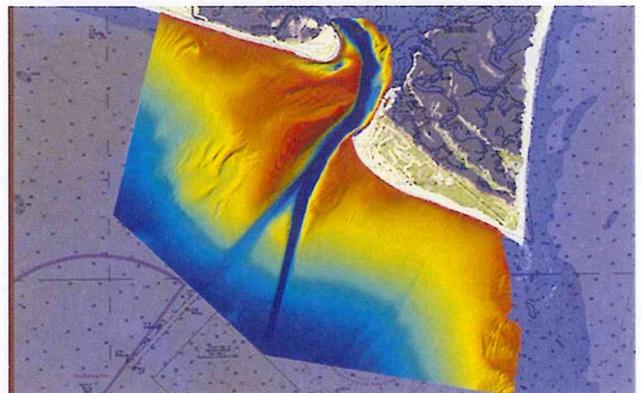
Jim Jacaruso | (910) 251-4064

Principal: Chris Freeman

HIGH-DENSITY MULTIBEAM SONAR, GEOPHYSICAL & GROUND TRUTH MAPPING: CAPE FEAR INLET, NC

CLIENT: OLSEN ASSOCIATES

Geodynamics was contracted by the Town of Bald Head Island and Olsen Associates to perform a high-resolution multibeam sonar survey of the entrance to the Cape Fear River, NC. Data was used for regional sediment management and transport modeling. Follow on work included sub-bottom surveys of potential borrow areas along Jay Bird Shoal and ground trothing of the multibeam backscatter using standard surficial grab sample techniques.



Original | Final Budget:

\$106,647 | \$106,647

Schedule: 2006

Change Orders: None

Reference:

Erik Olsen | (904) 387-6114

Principal: Chris Freeman



LITIGATION EXPERIENCE

Moffatt & Nichol, on rare occasion, has become involved in litigation matters which are often due to misunderstanding of our role and responsibility as the project engineer. Most of these matters are closed without any payment by our insurance carrier or a compromise is reached to avoid substantial legal fees. Our firm has an excellent claims history, and the few claims that the firm has been involved with over the years have been settled well within insurance policy limits with no exposure to the firm or its clients.

Our subconsultants, DC&A and Geodynamics, have not been involved in any such proceedings occurring during the last 10 years.

PROJECT STATISTICS

MINIMIZATION OF CHANGE ORDERS

The Moffatt & Nichol team has a successful history of completing projects on time and within the original budget. As can be seen in the previous project descriptions, Moffatt & Nichol only requests change orders when significant changes to the original scope occur or when additional scope items are added at the client’s request. Moffatt & Nichol believes that once a scope of work and contract are agreed upon, no change orders are warranted unless the scope is significantly altered by the client.

LARGEST DOLLAR AMOUNT PROJECT

Moffatt& Nichol Raleigh Coastal Practice | Bogue Banks Master Beach Nourishment Plan – \$2,505,434

DC&A | Bogue Banks Programmatic EIS - \$619,006

Geodynamics | Bogue Banks Topographic and Hydrographic Study - \$385,000 through 2012; signed a new 5 year contract

NUM BER OF PROJECTS AT THIS TIME

The Moffatt & Nichol Raleigh coastal and water resources group is engaged in over 15 active projects both in support of other offices as well as locally led work. The following is a list of representative clients which the Raleigh coastal and water resource group is currently contracted directly.

Contract	Role	Client
Little Lagoon Pass	Prime	Alabama DOT
Bogue Banks Master Beach Nourishment	Prime	Carteret County
City of Belhaven Main Street Flooding Mitigation *	Prime	City of Belhaven
Inland Green Drainage Improvements*	Prime	City of Wilmington
Roanoke River Basin Model for NCDWR	Subcontractor	Hydrologics
NCDOT Bridge Replacement Group R	Subcontractor	KCI Technologies, Inc.
Kilpatrick Stockton Expert Witness Services for Town of Caswell Beach and Oak Island	Subcontractor	Kilpatrick Stockton
Stormwater Ocean Outfall	Prime	NCDENR
Post-Irene Renourishment Project, Emerald Isle*	Prime	Town of Emerald Isle

* Projects to be completed within three (3) months

- ★ DC&A is engaged in 34 active projects supporting three offices in the southeast.
- ★ Geodynamics is engaged in 3 active projects.



CAPABILITIES AND APPROACH

FAMILIARITY WITH NC SHORELINE PROJECTS

Moffatt & Nichol has extensive experience working in North Carolina on coastal engineering and management issues since the Raleigh office inception in the early 1980's. In the past ten years, the Moffatt & Nichol team has completed a number of coastal storm protection projects on behalf of local municipalities, the State, and USACE Wilmington District.

BACKGROUND & UNDERSTANDING

Historically, the Town has relied on the USACE to maintain its beaches and manage both the Cape Fear Inlet and Lockwoods Folly Inlet navigation channels.

The Town, in collaboration with Brunswick County and the communities of Caswell Beach and Holden Beach, had been focused on a path with the USACE for a new joint GRR for a Federally authorized "50 Year Coastal Storm Damage Reduction Project". While this effort to secure federal funding will continue, the funding for continuance by Congress is currently in jeopardy. Given the uncertainty of the federal project, the Town has an immediate need to develop an independent path to protect its shoreline and mitigate erosion.

The USACE historically has dredged Lockwoods Folly Inlet to a maintained depth of eight feet until FY 2010 when funding for the dredging was withdrawn. Dredging efforts were able to continue after that date with matching funding from the NC State Division of Water Resources. The local matching share was borne by the Town of Holden Beach, Brunswick County, and the Town of Oak Island. The Corps continued to use the side cast vessel "Merritt" to keep the channel open under a memorandum of agreement between the four entities. A permanent "Memorandum of Agreement" to continue the current financial arrangement for a five-year period is now under review. While the current agreement continues to keep the Inlet open, there is the possibility that the Corps may retire its dredge, with no replacement. The Town, in collaboration with the State and other parties, would like to develop an inlet management plan and strategy to implement that plan to maintain Lockwoods Folly Inlet for commercial and recreational navigation and provide for the placement of beach quality material on adjacent beaches.

In addition to Storm Protection and Lockwoods Folly Inlet Management, the Town has identified a need to dredge Davis Canal in order to improve navigation and water quality for the estuarine system.

PROJECT APPROACH

BEACH AND SHORELINE MANAGEMENT

As identified above, the overall goal of the Beach and Shoreline Management component of the project is to formulate and implement a long-term shore protection program for the Town's beaches. Under the current effort, the following tasks are proposed by the project team:

- ★ **Review Existing Data** – review and document prior investigations and existing/historical data
- ★ **Conduct Vulnerability Analysis & Identify Conceptual Design Alternatives** – document historical shoreline conditions and characterize vulnerability of existing infrastructure along the Town's coast
- ★ **Complete Coastal Engineering/Geology and Planning Evaluation** - establish performance criteria & specific objectives/constraints, identify nourishment requirements, assess availability of sand sources, develop capital and maintenance cost estimates and identify potential funding strategies for a Town sponsored program



- ★ **Provide Additional Coastal Engineering Services** – support the Town in the development of strategies and implementation of coastal protection and management in collaboration with USACE, NCDENR, Brunswick County, Holden Beach, and the Town of Caswell Beach

REVIEW OF EXISTING INFORMATION & IDENTIFICATION OF FIELD DATA COLLECTION PROGRAM

Moffatt & Nichol will review in detail all engineering and planning data collected by USACE as reported in the *Draft Integrated General Reevaluation Report and Environmental Impact Statement Coastal Storm Damage Reduction, Brunswick County Beaches* (USACE, October 2012). Moffatt & Nichol will also obtain periodic surveys of the Lockwoods Folly Inlet, beach surveys of the turtle nourishment project and field data collected under investigations for the Town to evaluate potential borrow sources. Based on our prior work with the Town as well as the Town of Caswell Beach we maintain and have reviewed or analyzed much of the data collected by the USACE for the Cape Fear Inlet SMP.

Moffatt & Nichol will identify any data gaps necessary to complete engineering and planning investigations in support of the protection plan and develop a monitoring program necessary to collect additional field data including physical surveys (nearshore and beach profiles, borrow areas) and geotechnical investigations.

If required, the Moffatt & Nichol project team will perform additional field investigations necessary to characterize existing conditions along the beach and in the nearshore in support of the engineering design and planning. The team anticipates at a minimum conducting beach profile surveys and collection and analysis of beach samples in support of a compatibility assessment.

VULNERABILITY ANALYSIS & IDENTIFICATION OF CONCEPTUAL DESIGN ALTERNATIVES

Moffatt & Nichol will update the vulnerability analysis performed by the USACE using the most recent shoreline and survey data. Empirical and analytical comparison of historical data such as shoreline positions, beach profile surveys, and erosion rates will aid in providing an initial estimate of long-term nourishment needs and the spatial distribution of those needs along the beach.

With the implementation of the Cape Fear Inlet SMP, there have been a number of beach nourishment projects completed on Oak Island (Figure 1). With initial dredge of the channel in 2001 approximately 510,000 cy of material was placed within the Town of Oak Island from the deepening project with an additional 336,000 cy in 2009 from maintenance dredging; the sea turtle nourishment project resulted in 2.65 Mcy of material being placed on the beach. Given the net sediment transport in the region from east to west, in addition to the material placed within the Town limits, the Town’s beaches have also indirectly benefited from placement of a portion of the material that has been placed on Caswell Beach.

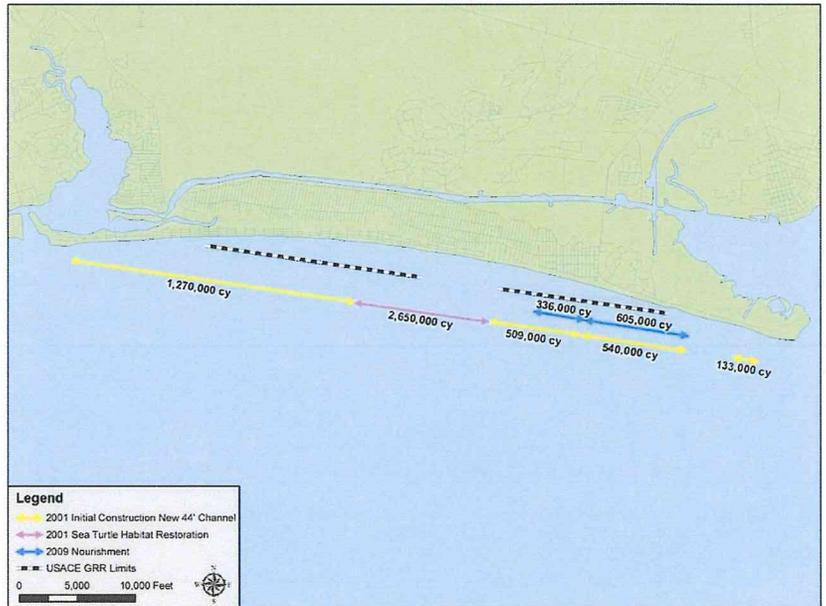


Figure 1: Limits of Beach Nourishment on Oak Island (2001 to 2010) and NED Preferred Plan.



The Moffatt & Nichol Team will work with the Town staff to identify specific objectives and alternative conceptual strategies for the proposed nourishment to be evaluated, including an update to the NED Plan (USACE, 2012).

Following the USACE NED Plan, two designated areas were identified for beach nourishment (Figure 1). A total of 3.0 Mcy of material was planned for the Oak Island reach (19,800 lf) design under initial construction and 1.8 Mcy every six years thereafter; this equates to approximately 151 cy/lf (assuming placement of material uniformly) for the initial project and 90 cy/lf every six years thereafter. Within the Oak Island/Caswell Beach segment (15,500 lf) a total of 2.0 Mcy of material was planned for initial construction and 1.8 Mcy every eight years thereafter; approximately 129 cy/lf for the initial project and 116 cy/lf every eight years thereafter. Along the two reaches the USACE called for a 25-foot wide dune crest at a top elevation of 13 feet above National Geodetic Vertical Datum (NGVD) fronted by a 75-ft-wide berm width at 7 ft NGVD (Figure 2). It would require a total of approximately 525,000 cy/year to maintain the beach segments identified; approximately 430,000 cy/year of that would be needed for the portion within the Town of Oak Island.

Alternatives to the NED plan will be identified that seek to meet storm protection criteria, static line exception and FEMA engineered beach requirements and minimize cost of protection while fully incorporating the USACE's Sand Management Plan for Wilmington Harbor as well

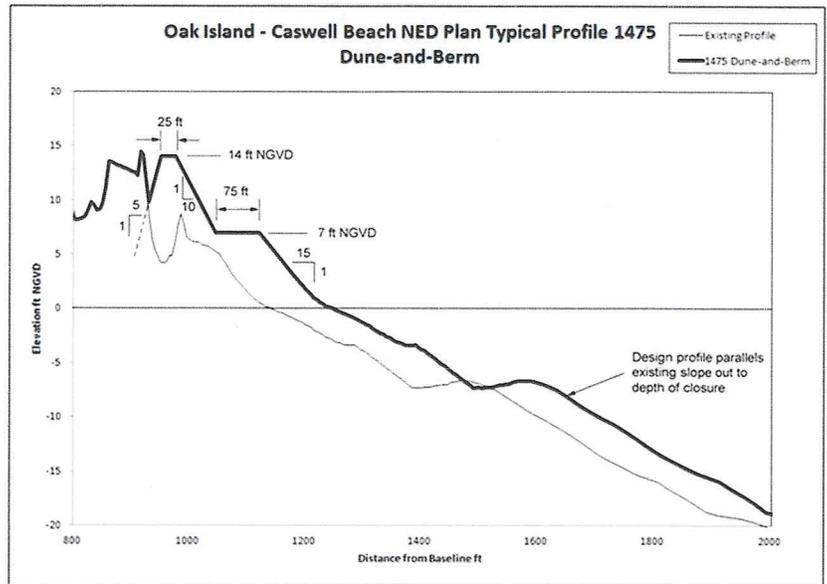


Figure 2: Typical Cross-Section NED Plan.

SAND SOURCES

Several potential sand sources were investigated by the USACE in support of the Federal Project including upland, inlet and offshore locations (Figure 3). For the GRR, the USACE selected Frying Pan Shoals as the preferred alternative based on sediment compatibility, dredging feasibility, costs and environmental acceptability. The Moffatt & Nichol team will reassess the potential use of the multiple sand sources and programming of those various sources including the upland disposal, nearshore borrow area as well as ebb shoals at the inlets. If one were to assume an initial

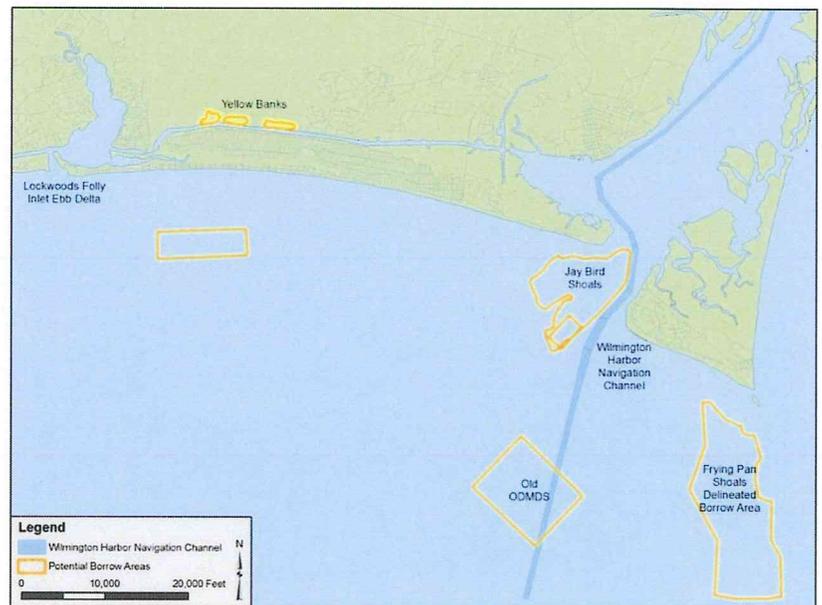


Figure 3: Potential Sand Sources.





requirement of 3.0 Mcy and additional 430,000 cy/yr in looking at the Town's needs for an initial project and maintenance over a 15 year period that would be a cumulative 9.45 Mcy of material that is required. It may be more cost effective for the Town to use a combination of sand sources in the short term, including beneficial use of material from Lockwoods Folly Inlet.

COASTAL ENGINEERING/GEOLOGY AND PLANNING EVALUATION

Moffatt & Nichol will collaborate with Town staff to refine specific project objectives and review numerical models most appropriate to achieve those specific objectives. The most efficient tools and methods will be employed to achieve the Town's goals. Consideration will be made to the approach that can be supported based on the available data (within budget and schedule), building on the work by the USACE. Based on our current project understanding, we would anticipate a combination of wave transformation and sediment transport models to be developed and applied as described below.

Analysis of Wave Refraction and Sediment Transport Potential

Numerical modeling will be performed to characterize the local wave climate and alongshore sediment transport gradient with the study area. A wave transformation model such as STWAVE (Steady State Irregular WAVE Model) or comparable will be applied to transform representative offshore wave spectra from deep water to the shoreline. STWAVE is a finite-difference spectral wave model that considers depth and current-induced wave refraction and shoaling. As waves generally travel from deeper water off-shore they will "feel" the bottom, or shoal with change in depth as the waves approach shore. Additionally, as waves travel at an angle across non-uniform depth contours the waves will turn, or refract; simplistically this results from the wave speed differential along the crest (wave travels faster in deeper water compared to shallow water).

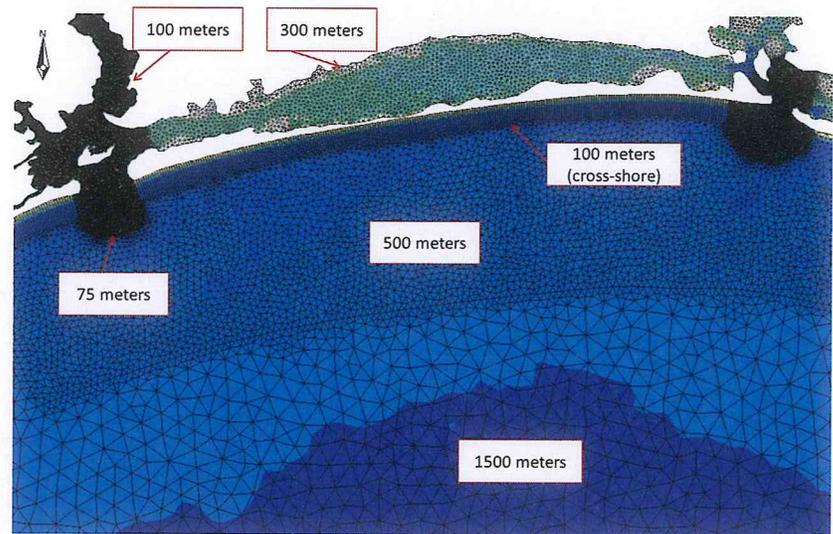


Figure 4: Regional Wave Model

Wave data sources from the Wave Information Studies (WIS) program will be reviewed and determination made of representative wave cases. Wave cases will be run using the bathymetric data to be collected by USACE FRF. Model results may be used to compute the alongshore sediment transport potential using the CERC formula by relating breaking wave height and angle with respect to the shoreline. The model will also be used to establish the boundary conditions of the one dimensional alongshore sediment transport model (if undertaken) as described below.

Sediment Transport Modeling

The sediment transport modeling approach will include the modeling of existing coastal conditions, and short-term and long-term modeling of beach/shoreline responses to proposed alternatives. Although sediment transport processes in the nearshore are three-dimensional, given the complexity of modeling three-dimensionally processes, it is customary in beach nourishment design to consider the cross-shore and plan form evolution separately. This is partially justified as for many projects the cross-shore evolution is believed to occur on a shorter time scale than the plan form evolution.



1-Dimensional (long-shore) and 1-Dimensional (cross-shore) Modeling. It is anticipated that the analysis of the beach behavior and expected design life of proposed projects may use two widely accepted shoreline and profile change models developed by the USACE: (a) GENESIS (Generalized model for Simulating Shoreline change), a one-dimensional shoreline change model which simulates longshore sand transport and the movement of the shoreline plan primarily driven by wave action and (b) SBEACH, a one-dimensional model which simulates the cross-shore beach change induced primarily by storm wave action. These two models allow for investigation of both the long-term behavior of the shoreline due to erosion and nourishment and the storm induced changes to the beach profile or design nourishment templates.

Optional - Geomorphologic Modeling

If desired, a detailed 2D/3D hydrodynamic and sediment transport/geomorphologic modeling would be performed. DELFT3D or MIKE FM, could be applied to provide physics based mathematical representation of the nearshore processes. The models would be used to investigate hydrodynamic circulation/sediment transport patterns (including long-shore transport distributed across the profile) and morphological changes for representative wave and tide conditions. A DELFT3D model has been developed by Olsen Associates (2012) and based on the collaboration has been made available to the Town of Oak Island and Caswell Beach. That model with further refinement could be used as the basis for beach nourishment design and evaluations.

Evaluation of Town Sponsored Protection Alternatives

The numerical models will be used to evaluate the proposed protection strategies. Effectiveness and anticipated life span of the proposed alternatives may be evaluated using the sediment transport models as well as empirical and analytical methods. A borrow area use plan will be identified in association with planned nourishment programming.

For the beach nourishment alternatives, the total sand source requirements for a 15-year (or longer) planning horizon will be identified. *FEMA requirements for an engineered beach will also be studied and estimated given that post storm renourishments could provide the County with significant federal dollars in the recovery efforts after presidentially-declared disaster events.* Each alternative will include the estimated initial cost of construction, ongoing maintenance requirements and regulatory and administrative steps and timeline for implementation.

Conceptual drawings will be revised based on the evaluation with sufficient detail to provide project profiles and fill volumes along generalized transects throughout the recommended area.

Based on the alternatives analysis, short-term and long-term shoreline management strategies will be recommended. Potential funding mechanisms for implementation of the strategies will be identified in coordination with Town staff.

ADDITIONAL COASTAL SERVICES

As part of the shore protection efforts outlined above, Moffatt & Nichol will ensure that the following Town goals are incorporated and met:

- **Qualify for and maintain static-line exceptions (per NCCAMA regulations).** As part of the static line projects, proof must be given that the Town has a multi-decadal plan for storm protection needs and the sand resources and funding stream to meet that need. Therefore, the static-line requirements much be considered while the plan is being developed and must be integral to the final plan. It is critical to preserve the Town’s tax base and redevelopment opportunities for current and future funding of these projects.
- **Qualify for and maintain FEMA engineered beach designation.** Getting FEMA approval and certification is a somewhat nebulous process and no firm guidelines are given in writing. It is





important that FEMA has confidence in the engineering analysis that is completed to determine the nourishment triggers and local funding needs to convince them that the overall project is viable and WILL be maintained by local interests. Our experience with Carteret County and their FEMA program will be critical to provide success here.

- **Integration of the Town's Comprehensive Plan with the USACE Sand Management Plan.** Any federal resources that can be used to meet the Town's long term protection needs must be optimized to the extent possible.

The Cape Fear Inlet Sand Management Plan was developed as part of the Wilmington Harbor deepening project (adopted in 2000), allowing for the beneficial use of beach compatible material dredged on beaches at Oak Island and Bald Head Island. Based on the original SMP the apportionment of the material is at a ratio of 2:1 to Baldhead Island and Oak Island respectively; with planned dredging and placement on a two year cycle, placement on the beaches of Oak Island would recur every 6 years.

In accordance with the Draft Re-evaluation Report Sand Management Plan (USACE, Draft 2011), backpassing of material is proposed based on shoaling rates within the federal navigation channel. It is inferred that sand being deposited in BHI channel Reaches 1&2 is eroded from BHI and material in Smith Island Reach originates from west of the channel and the shoaled material should be returned to the respective BHI and Oak Island shorelines. Based on the USACE analysis it is proposed under the Draft SMP that the USACE continue to dredge and distribute the material at a ratio of 2:1 to Baldhead Island and Oak Island respectively.

The continued placement of this material on the beaches of Oak Island will be critical in the Storm Protection Plan for the Town of Oak Island.

Moffatt & Nichol will act as an advocate to be sure that dredged material from the project is used to the extent possible. It may be advantageous to discuss options of the Town providing "delta" funds to place sand further west if future needs dictate.

- **Assist the Town in Coordination for the Completion of the USACE Coastal Storm Damage Reduction Project.** Again, any federal resources that can be marshaled will only increase the sustainability of the overall Town plan. M&N will attend meetings with the Town as needed to help guide alternatives analyses and be sure that Town interests are represented.

LOCKWOODS FOLLY INLET AREA MANAGEMENT PLAN

In parallel with the Shore Protection project, Moffatt & Nichol will review in detail all engineering and planning data collected by USACE including periodic surveys of the Lockwoods Folly Inlet and prior investigations documenting sediment budget at Lockwoods Folly Inlet. Moffatt & Nichol will seek to build on *Brunswick Data Compilation Analysis and Sediment Budget* (OCTI, 2009) prepared for the USACE and the Inlet Management Plan being prepared by the Town of Holden Beach by Dial Cordy and Associates in support of permitting the Terminal groin. Moffatt & Nichol will review operations data compiled and verify the timing and placement of dredging and beach nourishment activity by the USACE.



HISTORIC ENGINEERING ACTIVITY AND SEDIMENT BUDGET

At Lockwoods Folly Inlet, the USACE has maintained the channel in two distinct reaches: the outer bar and the AIWW inlet crossing (Figure 5). Historically, the USACE has typically used cutterhead dredge with pipeline and beach fill placement for material in the AIWW. Sidecaster dredges (e.g. Merritt, Fry) predominantly have been used to maintain the outer bar navigation channel; a special purpose split hull hopper dredge (i.e. Currituck) has also periodically employed with nearshore disposal.

There is no defined dredge template for Lockwoods Folly Inlet outer bar. Dredging activities are restricted to follow “deep water”.

This restricts USACE from performing advanced dredging within Lockwoods Folly Inlet, resulting in frequent dredging (2-3 times a year). Based on sediment budget developed by for the USACE (OCTI, 2008) an estimated 125,000 cy/year material shoals in the channel. Historically, approximately 135,000 cy/year is sidecast (with an estimated 50% efficiency) and an additional 55,000 cy/year dredged and placed in the nearshore.

Typically, Lockwoods Folly Inlet AIWW crossing is dredged annually and beach fill is placed in an upland disposal area or on the beach. The primary purpose of this project is for AIWW maintenance with the project footprint limited to the AIWW and a bend widener. During the period from 2002 to 2011, on average 48,000 cy/year has been dredged and placed on Holden Beach.

Moffatt & Nichol will use the most recent survey data, dredge records and sediment transport analysis conducted for the Beach and Shoreline Management to update the sediment budget for the Inlet which will serve as a basis for identifying management strategies.

IDENTIFY AND EVALUATE STRATEGIES FOR IMPLEMENTATION

In collaboration with USACE, NCDENR, Brunswick County, and Holden Beach and the Town of Caswell Beach, Moffatt & Nichol will assist the Town to identify and assess strategies for continuing to maintain the inlet. The strategies identified will be designed to:

- ★ Improve water quality in the entire area, including the Eastern Channel, and the AIWW
- ★ Maintain the complex's navigation channels
- ★ Provide placement of beach quality material on the adjacent beaches
- ★ Minimize cost



Figure 5: Lockwoods Folly Inlet Navigation Channel and AIWW.

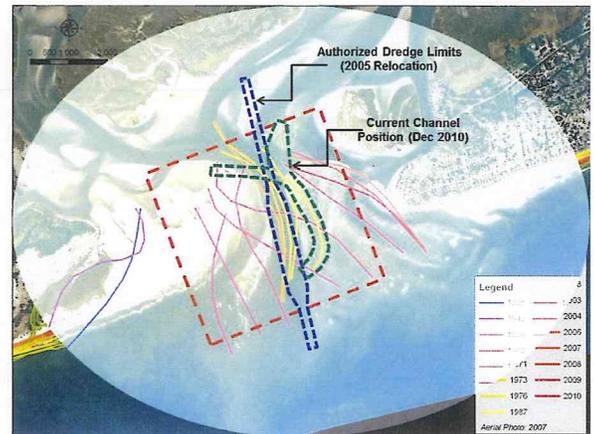


Figure 6: Inlet “Safe Box”





First efforts in this process will be to work with the USACE to see if changes to the current inlet management protocols can be realized. For instance, perhaps the special purpose dredge could be utilized more often and dredge to slightly deeper depths to provide the above goals.

However, if this effort proves unfruitful, our team stands ready to investigate the management of Lockwoods Inlet in a more optimal manner. It is expected that a 2D/3D modeling effort will be required to determine a more optimal channel arrangement. The focus of these efforts will be to determine a preferred channel location and dimension (length, width, depth) that offers increased inlet and adjacent shoreline stability while also providing improved water quality and more dependable navigation access. M&N will also study to determine a “safe box” to allow normal inlet fluctuations within, but once the inlet channel moves to a location outside of the “safe box”, an inlet relocation will be completed back to the originally permitted location.

Should the USACE dredging be terminated an alternate permitting process will be pursued as discussed below.

DAVIS CREEK AREA MANAGEMENT PLAN

Moffatt & Nichol will review existing physical surveys, water quality and environmental data and prior investigations of the Davis Canal and adjoining AIWW. Additional data collection requirements will be identified for purpose of designing and permitting the dredging of the channel.

A scoping meeting will be held with the Town and State and Federal Regulatory agencies to review the concept and identify path for permitting and regulatory review.

Specific design and performance objectives with respect to water quality and hydraulic flushing will be identified in collaboration with the project partners. Alternative dredging concept designs will be based on knowledge and understanding of the system.

In support of design and permitting it is anticipated that a numerical model will be developed and applied to evaluate existing conditions and proposed changes in hydraulics and water quality resulting from the dredging alternatives. Selection of the numerical model(s) will be based on the key performance measures and design criteria; it is anticipated that a couple hydrodynamic and water quality model will be employed (e.g. MIKE-21, RMA-2). The most cost-effective approach will be undertaken enabling the Town to meet its objectives and provide a basis of design and permitting. It is expected that this model will also be the one used for the inlet management study. M&N completed a similar analysis for Sunset Beach when developing the 2D model used for the bridge replacement.

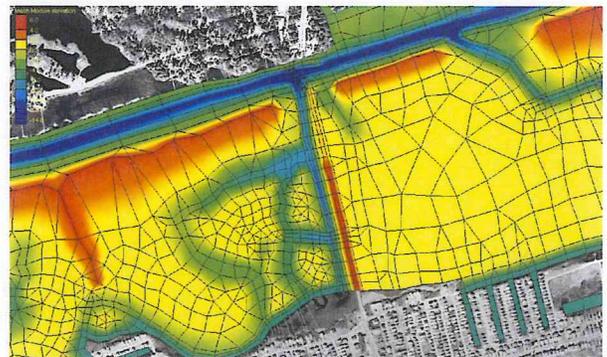


Figure 7: Sunset Beach 2D Model.

A plan for upland disposal will developed in conjunction with the development of dredging alternatives. An opinion of capital costs will be developed and benefits for each of the alternatives. A preferred alternative will be selected based on the Town’s criteria for navigation and water quality improvement.

NEPA/SEPA DOCUMENTS AND ENVIRONMENTAL PERMITTING

Dial Cordy and Associates Inc. (DC&A) experience in the preparation of NEPA documents for beach restoration and inlet management projects is quite extensive and includes not only successful completion of EA/EIS’s here in NC, but throughout the southeast and Gulf. They bring to the table a seasoned team of local coastal and marine scientists and regulatory experts who have prepared NEPA documents for coastal governments here in NC, including Holden Beach, as well as the first





Programmatic EIS and Master Beach Nourishment Plan in NC that incorporates inlet and shoreline management. As a result of their performance on these past and ongoing studies, they bring with significant and recent knowledge of critical issues associated with the permitting and management of shorelines, inlets and estuarine complexes.

As demonstrated in this submittal, their staff has extensive planning and technical experience supporting the USACE civil works programs in North Carolina and throughout the southern and mid-Atlantic regions, including the Wilmington, Jacksonville, Savannah, Charleston, Mobile, Nashville, Norfolk, and Huntington Districts. Their repeat contracts with the Corps, the largest single federal agency charged with implementing shore protection and navigation programs, by providing planning and environmental support is clear recognition of their knowledge and capabilities in beach and inlet NEPA planning and assessment. With reduced federal funding of shore protection projects throughout the United States, their role has evolving to support coastal communities in implementing their own beach and inlet management programs. DC&A has successfully conducted numerous environmental and EIS studies for a variety of other federal, state, and local clients along the eastern and gulf states. Work assignments have been successfully performed in twelve states over the past ten years.

They bring to the Town of Oak Island over 17 years of strong and successful performance on similar projects and personal commitment to work diligently with the Town to become the first community in NC with an approved comprehensive coastal shoreline management program. Through our previous and current work with North Carolina's coastal beach and inlet resources and processes, we will be able to hit the ground running. DC&A's reputation within the state for high quality of work and objectivity will give the Town of Oak Island the transparency needed for municipality endorsement.

ENVIRONMENTAL PERMITTING APPROACH

BEACH MANAGEMENT AND SHORELINE EROSION

The proposed beach management and shoreline erosion program is one component of the Town of Oak Island's currently proposed comprehensive beach management program, further described in the below elements. Based on the October 2012 Alternative Formulation Briefing for the Coastal Storm Damage Reduction Brunswick County Beaches report prepared by USACE, the NEPA permitting process could be initiated with the USACE thru a pre-scoping meeting and request to develop an Environmental Assessment, rather than Environmental Impact Statement.

OVERALL NEPA/SEPA APPROACH

Based on DC&A's comprehensive understanding of the DCM Major permitting process and past experience permitting beach nourishment efforts in North Carolina as well as throughout the southeast, the Moffatt & Nichol team anticipates the environmental documentation, review, and agency coordination could be completed within a two-year timeframe providing no extenuating circumstances. As part of the pre-feasibility study, DC&A will corroborate environmental and regulatory requirements and develop a schedule and expected cost range for project tasks, review, permitting, and monitoring.

As outlined below, DC&A believes the planning and analyses required for the EA consists of two major tasks: 1) the completion of an engineering study/analysis determining the sediment needs (volume, placement area, and interval), sand source location, and design of an effective nourishment placement area and 2) the coordination and preparation of a NEPA/SEPA document with permits allowing the design and construction of a beach nourishment and shoreline restoration program. While two separate tasks, the project will be integrated throughout its development. DC&A expects substantial coordination with the regulatory agencies (NCDCEM, USACE, etc.) finalizing the work plan and developing the project approach for the analyses required to complete the NEPA/SEPA document. It is very important that the project team and the USACE are "walking hand in hand" during all phases of the project so that there are no surprises along the way and the USACE is comfortable in utilizing and





accepting the documentation provided by the project team within the draft EA. Therefore, DC&A envisions meeting at least quarterly informing the agencies of progress and providing an avenue for feedback.

Depending upon requirements of the Town and regulatory agencies relative to the number of sediment sources targeted and the preferred design of the placement area for permitting and the modeling/studies/investigations required; it is expected the NEPA/SEPA documentation will take a maximum of two years. It is also expected that while some upfront work on the NEPA/SEPA document can be started at the beginning of the project, the main body of environmental work and study will be completed after the engineering analysis has determined the alternatives for sediment needs and sand sources required to meet design parameters.

Below are the general approaches for the environmental tasks:

SCOPING

Agency coordination and communication is key to the success of any NEPA/SEPA process. DC&A guides clients through the permitting process based on a thorough understanding of current regulations and environmental resource concerns as well as relationships with the regulatory agencies built on years of professional respect. Based on DC&A's extensive experience in preparing NEPA/SEPA compliance documents, they have developed a streamlined NEPA scoping process working closely with the agency representatives. This streamlined process will help avoid additional steps and/or analyses that could delay the production of pertinent documents. DC&A will facilitate project coordination cooperatively with the Town of Oak Island and the USACE, the lead agency for federal actions under NEPA. The NCDCM will lead the State's SEPA permit process in coordination with the USACE and DC&A, in order to limit duplication of effort and conflict.



These agencies, along with NCDMF, NCWRC, NMFS, USFWS and NCDWQ, will form the core Project Review Team as well as private and/or non-profit interest groups such as the NC Coastal Federation, Audubon, and Environmental Defense. DC&A's highly trained environmental project managers, in coordination with the Town of Oak Island, USACE, and NCDCM, will manage all phases of the NEPA scoping process by organizing an official NEPA public scoping meeting, during which issues and concerns associated with the project will be described and prioritized. The Moffatt & Nichol team will then coordinate meetings at significant benchmarks to review the formulation of the Lockwood's Folly Inlet Management Plan and offer specific recommendations on issues that must be considered to avoid or minimize potential environmental consequences. While the PRT process is often perceived as a time consuming step in the NEPA process, DC&A has successfully been able to minimize the introduction of new concerns or issues at the Draft and Final phases of the project.





REVIEW OF PREVIOUS NEPA DOCUMENTATION

The availability of relevant biological data collected in support of previously permitted beach nourishment projects along Oak Island (as well as Holden Beach) simplifies the effort to acquire, research, and evaluate existing environmental and physical conditions as well as assess the potential impacts of similar projects in the same or similar vicinity. DC&A is currently developing the EIS for the Holden Beach East End Shore Protection Project and therefore is in a unique position to provide available data that currently exists in the Lockwoods Folly Inlet area and Oak Island. Physical and biological reporting and monitoring data from all recent beach nourishment events, ranging from the USACE 2001 Wilmington Harbor Deepening nourishment project (Section 933 project) as well as the Town's 2001 Ecosystem Restoration Report, EA, and FONSI (Section 1135 Sea Turtle Habitat Restoration Project) will be used to develop baseline conditions and resource assessments. The USACE's 50-year project as well as other sources includes information regarding nesting and foraging habitat for shorebirds and sea turtles, locations of the listed plant species seabeach amaranth, and studies of project effects which include the presence/absence and use patterns by species and habitats of concern (i.e. piping plover, shorebirds, and colonial waterbirds; nesting sea turtles; benthic macroinvertebrates; salt marsh habitat; submerged aquatic vegetation; and shellfish). DC&A will utilize this dataset in the evaluation of possible project alternatives and the development and implementation of the Oak Island Shoreline Management Project.



Based on DC&A's extensive long-term biological monitoring experience associated with over 25 beach nourishment projects, DC&A has a very clear understanding of the nature of the potential environmental impacts, both temporary and longer term. Not only do they have a thorough understanding of the environmental issues associated with beach nourishment, but together with Moffatt and Nichol's engineers they are able to design environmentally conscientious projects.

NEPA/SEPA DOCUMENTATION

PRELIMINARY DRAFT EA: Upon Notice to Proceed, DC&A will immediately initiate preparation of a Preliminary Draft EA document consistent with federal regulations described in the CFR, Title 40, and Part 1502. As described in state regulations Chapter 25 of North Carolina Administrative Code [1 (NCAC) 25] and USACE regulations contained in Title 33, Chapter II, Part 325, and Appendix B which describe NEPA implementation procedures for the USACE's regulatory program the following tasks will be developed for the NEPA/SEPA documentation: Project Purpose and Need, Project Alternatives, Affected Environment, and Environmental Consequences. Additional technical and scientific references will be included providing a framework in which existing and relevant information will be used describing the affected environment and environmental consequences of the proposed Project.

DC&A will reproduce and distribute the Preliminary Draft EA to the USACE, NMFS, EPA, and USFWS, and other appropriate agencies, as identified by the USACE in its role as lead agency. Interagency Preliminary Draft EA review meetings will assist in the solicitation of comments on the content, format, organization, and analyzes as presented in the Preliminary Draft EA document. Based on agency review, DC&A will identify the data and/or analysis gaps raised by the agencies. Upon revision and approval, the Draft EA will be published by the USACE in the Federal Register.





PUBLIC HEARING & COMMENTS: In accordance with applicable federal regulations and USACE guidance, DC&A will prepare and provide to the USACE a draft notice for publication in the Federal Register to announce the availability of the Draft EA for a 45 day public review period and the public hearing on the document.

FINAL EA: To advance and complete the Final EA, DC&A will solicit input from the agencies as to appropriate revisions to the Draft EA document. Based on the review of the document and comments from the USACE and other agencies, DC&A will make appropriate revisions and prepare the Final EA. The USACE will provide for reproduction and distribution to agencies and the public in accordance with federal regulations.

PERMITS: For a typical shoreline protection project, a NCDCM major authorization and a NCDWQ 401 certification demonstrating the project would not degrade waters of the state or violate water quality standards will be required. Following the NC 401 certification, the USACE's Section 10/404 permit would be issued in compliance with the Clean Water Act. The Moffatt & Nichol team will ensure efficient and effective coordination through the USACE's initiation as will be required with the US Fish and Wildlife Service (USFWS) under Section 7 of the Endangered Species Act for impacts to any threatened or endangered species or their habitats within the proposed project area; the National Marine Fisheries Service (NMFS) for impacts to Essential Fish Habitat (EFH); and with the NC State Historic Preservation Office (SHPO) for Section 106 clearance for cultural and/or historical resources within the footprint, placement, and borrow locations. Coordination would potentially be required for sand placement easements along the beach and possibly across the island depending on source locations and sand transport corridors. The EA and associated environmental documentation such as the EFH, BA, and Cumulative Effects Assessment will be used to support an Individual Permit request from the Department of the Army (USACE) and a Major CAMA permit from the State of North Carolina. As indicated by the USACE per previous discussions, a 30-year Individual Permit via EA process would be authorized including a list of special conditions.

LOCKWOOD FOLLY INLET AREA MANAGEMENT

Shallow draft inlet and AIWW crossing stakeholders will need authorizations (permits) allowing local maintenance dredging within the Lockwood Folly AIWW crossing and inlet in the event of federal or state funding/operational short falls. An approach would be locally held permits for the same SAW AIWW crossings and inlet maintenance dredging efforts. AIWW crossing locations, widths, depths and shoreline disposal locations would mirror SAW's current authorizations. Inlet maintenance dredging would follow deep water at current SAW authorized widths, depths, lengths including current beneficial use shoreline placement locations.

As indicated in the RFP, many of NC's shallow draft inlets have not been in a Presidential budget since 2005 (e.g., Bogue, New Topsail, Carolina Beach and Lockwoods Folly). USACE Headquarters is also internally assessing the viability of the side-cast dredge plant "Merritt"; SAW's primary dredge plant for shallow draft inlet maintenance in NC. If NC's shallow draft inlet maintenance dredging continues receiving limited or no support within Presidential budgets and USACE Headquarters fails to garner future fiscal support and potentially determines the "Merritt" as non-viable, local stakeholders, such as the Town of Oak Island and Holden Beach must have alternatives. Local stakeholders cannot wait for the ultimate worst case scenario and DC&A is positioned with the regulatory representatives to maintain these local coastal infrastructure features. Our exceptional experience in working with the Corps of Engineers and local/State taxing districts (e.g. FIND) includes performing resource surveys, delineating wetlands for expanding disposal areas, assessing long term maintenance requirements, developing mitigation options for unavoidable wetland losses, preparing NEPA documents (and BAs and EFH assessments) for use, and acquiring Section 404/10 permits from the Corps of Engineers. We have worked with the Corps of Engineers in assessing disposal options and mitigation options for the entire



AIWW in Georgia and assisted the Jacksonville District with assessments for over 25 projects in Florida. In addition, DC&A has co-authored several Inlet Management plans and assisted in acquiring 25-year permits for maintenance events.

There are potentially two different pathways a maintenance dredging permit could take including:

Pathway 1 (least desirable)

- ★ Coordinate with agencies.
- ★ Gather existing resource data and SAW templates.
- ★ Prepare an EFH.
- ★ Prepare a BA.
- ★ Prepare a NCDCM Major Application.
 - USACE
 - NC 401 Certification
- ★ Coordinate with agencies.
- ★ With final permit decisions made by state and federal resource agencies.

Typically, each project is authorized as a “one time event” and all future events require submittal of a permit modification request.

Pathway 2 (most desirable and efficient)

If agreement could be reached on:

- ★ The maintenance dredging operations are, for the most part, the same as previous operations.
- ★ The local maintenance dredging templates would exactly mirror those currently followed by SAW.
- ★ The current potential for threatened and endangered species’ effects is basically the same as was determined for previous operations and adjacent shore protection projects (Holden Beach East End Shore Protection Project).
- ★ The current potential for essential fish habitat effects is reasonably the same as determined for previous operations.
- ★ Sufficient cultural resource data is currently available for each site.
- ★ Currently, SAW employed reasonable and prudent measures are sufficiently minimizing potential resource effects.

Then:

- ★ Agency pre-coordination occurs with the acceptance of the use of the General Permit 199602878.
- ★ SAW design templates are attained with the understanding that the approach must be coordinated with the Corps Navigation Branch early in the process.
- ★ Most recent site specific BAs and EFHs are attained.
- ★ A single BA and single EFH are compiled from each site’s most recent consultations (formal or informal).
- ★ A single NCDCM Major Application is prepared and circulated.





- ★ Agency coordination continues.
- ★ Final permit decisions are made by state and federal agencies.

Based on discussions with the NC Division of Water Resources, the State will continue to seek federal shallow draft inlet maintenance dredging funds as well as continue annual SAW MOA efforts. If the above falls short, the Town of Oak Island will have an alternative that would allow local maintenance of these infrastructure features to continue.

DAVIS CREEK COMPLEX MANAGEMENT

Permitting a navigation channel through Davis Creek could be done under an existing Department of the Army General Permit (198000291) which is a joint State and Federal Government permit application process. By focusing on navigation requirements, alternatives to the proposed project would be minimal which should greatly shorten the permitting time. While the permit application would be for a navigation channel, there is general agreement that the new channel has the potential to improve flow velocities and circulation in Davis Creek which could in turn provide more favorable water quality conditions for shellfish growth and production. The measure of success of the new channel in providing a secondary benefit of improved water quality and shellfish habitat could be determined from existing water quality and shellfish monitoring stations maintained by State resource agencies. DC&A staff has extensive water quality experience based on a 10-year study conducted on the Cape Fear River and tributaries in partnership with UNCW and the USACE Wilmington District. This local knowledge will come into play when designing and permitting the navigation channel through Davis Creek.

Sufficient environmental data detailing the current condition and location of sensitive marine resources is necessary for both the Federal and State regulatory approval process. DC&A understands volunteers for the Town of Oak Island have begun testing waters to learn more about sources of pollution. It is our team's intent to work closely with the Town of Oak Island, including the group of volunteers, the Stormwater Advisory Board, and stormwater coordinator, John Michaux. It is not anticipated additional field activities associated with the implementation of a biological resource characterization or monitoring program will be required for Davis Creek Management program as there is already a 8-month baseline dataset. The Moffatt & Nichol team are working under the assumption that the appropriate State and Federal agencies will provide all pertinent information they may have in their records to assist in the historic data acquisition phase for determining the presence or absence of natural resources within and adjacent to the study area. The State and the Stormwater Advisory Committee seem to have a good handle on background levels although there are no firm conclusions yet. Early tests seem to show that water quality starts out good toward the western end of the island, which experiences the best flushing and influx of sea water. As sampling moved east, both coliform and brightener numbers seemed to increase, in some cases far exceeding the single-sample limit for swimming of 400 colonies per 100 milliliters of water. Some of the higher numbers of contaminants were in the area of SE 40th Street, the eastern edge of the navigable part of Davis Creek.

DC&A will review all existing water quality monitoring data collected by various State agencies and based on agency feedback may devise a post-construction program to evaluate the impacts of the new channel on water quality and its impacts on shellfish production and growth. DC&A assumes that the existing water quality monitoring stations and data regarding shellfish production and growth are sufficient to characterize existing water quality and shellfish conditions in the immediate vicinity of the proposed new channel. Therefore, additional water quality monitoring stations or shellfish sampling stations would not be recommended at this time. Based on State and Federal agency feedback and permit conditions, a post-construction water quality monitoring program may need to be designed.



REFERENCES

- USACE, October 2012. *Draft Integrated General Reevaluation Report and Environmental Impact Statement Coastal Storm Damage Reduction, Brunswick County Beaches.*
- ATM, November 2012. *Work Plan for the Proposed Terminal Groin on the East End of Holden Beach, Lockwoods Folly Inlet, NC.* Prepared for the Town of Holden Beach.
- Offshore and Coastal Technologies, May 2008. *Brunswick Data Compilation Analysis and Sediment Budget,* Prepared for the USACE Wilmington District.
- Cleary, Bill, 1999. *An Assessment of the Availability of Sand for Beachfill Offshore of Oak Island.*
- Olsen Associates, 2012. *Calibration of a Delft3D model for Bald Head Island and the Cape Fear River Entrance,* Prepared for the Village of Baldhead Island.

CONTRACTUAL RELATIONSHIPS WITH LOCAL FIRMS

Moffatt & Nichol is committed to using local resources for this project, with 95% of the work for this project being completed by North Carolina staff and residents.

PROXIMITY OF THE FIRM’S OFFICE TO TOWN OF OAK ISLAND

Core project team members from Moffatt & Nichol, DC&A, and Geodynamics are located in Raleigh, NC, Wilmington, NC and Newport, NC.

CAPACITY

The following key members of the Moffatt & Nichol Team proposed for this contract will be available for immediate assignment to perform any work required by the City on an accelerated project schedule.

Key Staff	Role	% Availability
Peter Elkan, PE	Project Manager	50%
Tim Reid, PE	Principal-in-Charge	10%
Jeff Shelden, PE	QA/QC Review	30%
Johnny Martin, PE	Coastal Engineering Management	40%
Charles Jones	Environmental Permitting	50%
Dawn York	Environmental Permitting	40%
Chris Freeman	Coastal Geology and Surveying	50%
Jason Doll, CPSWQ	Water Quality	40%
Jack Fink, PE	Dredging	30%

With the extensive support staff in North Carolina comprising of 12 coastal and water resources engineers and scientists in Moffat & Nichol, 12 environmental scientists at DC&A and 6 staff members at Geodynamics, *our team has an unparalleled depth of resources to complete the Town’s objectives.*



HOURLY RATE

MOFFATT & NICHOL

Classification	Hourly Rate
Principal Engineer	\$200
Supervisory Engineer	\$175
Senior Engineer	\$150
Engineer III	\$130
Engineer II	\$110
Engineer I	\$ 95
Staff Engineer	\$ 85
Senior Technician	\$125
Designer	\$100
CADD II	\$ 85
CADD I	\$ 75
Word Processor	\$ 60
General Clerical	\$ 50

DIAL CORDY AND ASSOCIATES

Classification	Hourly Rate
Principal	\$200
Project Manager/Technical Director	\$150
Senior Scientist III	\$120
Senior Scientist II	\$102
Staff Scientist I	\$ 90
Scientist/Operations Specialist	\$ 82
GIS Specialists	\$ 90
Administrative Assistant	\$ 68
Report Production Manager	\$ 75

GEODYNAMICS

Classification	Unit	1 st year	2 nd year	3 rd year	4 th year	5 th year
Project Manager	Hr.	\$123.00	\$127.92	\$133.04	\$138.36	\$143.89
Supervisory PLS (Office)	Hr.	\$87.50	\$91.00	\$94.64	\$98.43	\$102.36
Professional Engineer	Hr.	\$116.00	\$120.64	\$125.47	\$130.48	\$135.70
Engineering Technician	Hr.	\$72.50	\$75.40	\$78.42	\$81.55	\$84.81
Surveying Technician	Hr.	\$66.42	\$69.08	\$71.84	\$74.71	\$77.70
CADD Technician	Hr.	\$59.05	\$61.41	\$63.87	\$66.42	\$69.08
GIS Specialist Senior	Hr.	\$97.72	\$101.63	\$105.69	\$109.92	\$114.32
GIS Specialist	Hr.	\$79.00	\$82.16	\$85.45	\$88.86	\$92.42
GIS Technician	Hr.	\$57.44	\$59.74	\$62.13	\$64.61	\$67.20
Word Processor	Hr.	\$50.00	\$52.00	\$54.08	\$56.24	\$58.49
Supervisory Survey Tech (Party Chief)	Hr.	\$68.90	\$71.66	\$74.52	\$77.50	\$80.60
Survey Tech (Instrument Person)	Hr.	\$54.01	\$56.17	\$58.42	\$60.75	\$63.18
Survey Aid (Rod Person)	Hr.	\$36.81	\$38.28	\$39.81	\$41.41	\$43.06
Survey Party, Class II (Items 11 & 12)	Hr.	\$122.92	\$127.84	\$132.95	\$138.27	\$143.80





Classification	Unit	1 st year	2 nd year	3 rd year	4 th year	5 th year
Survey Party, Class III (Items 11, 12, & 13)	Hr.	\$159.73	\$166.12	\$172.76	\$179.67	\$186.86
Survey Party, Class IV (items 11, 12, 13,13)	Hr.	\$196.53	\$204.39	\$212.57	\$221.07	\$229.91
GPS Survey Party, Class I	Hr.	\$84.30	\$87.67	\$91.18	\$94.83	\$98.62
GPS Survey Party, Class II	Hr.	\$138.32	\$143.85	\$149.61	\$155.59	\$161.81
GPS Survey Party, Class III	Hr.	\$175.13	\$182.14	\$189.42	\$197.00	\$204.88
ATV, 1-Person Crew, RTK GPS	Hr.	\$82.51	\$85.81	\$89.24	\$92.81	\$96.52
ATV, 2-Person Crew, RTK GPS Profiles	Hr.	\$126.05	\$131.09	\$136.34	\$141.79	\$147.46
Certified Hydrographic Surveyor	Hr.	\$104.10	\$108.27	\$112.60	\$117.10	\$121.78
Hydrographic Survey Technician	Hr.	\$76.65	\$79.71	\$82.90	\$86.22	\$89.67
Boat, 16 to 19 feet	Day	\$45.00	\$46.80	\$48.67	\$50.62	\$52.64
Hydro Crew/Vessel 18'-20': Includes Vessel, 2-Person Crew, RTK GPS Capability and all Hydro equipment necessary (software and hardware) to meet USACE Hydrographic Survey Specifications	Hr.	\$296.05	\$307.89	\$320.21	\$333.02	\$346.34
Hydro Crew/Vessel 20-23' Includes Vessel,2- Person Crew, RTK GPS Capability and all Hydro equipment necessary (SW and HW) to meet USACE Hydrographic Survey Specifications	Hr.	\$299.44	\$311.42	\$323.87	\$336.83	\$350.30
Hydro Crew/Vessel 24' and Greater Includes Vessel,2-Person Crew, RTK GPS Capability and all Hydro equipment necessary (SW and HW) to meet USACE Hydrographic Survey Specifications	Hr.	\$326.89	\$339.96	\$353.56	\$367.70	\$382.41
Hydro Crew/Vessel -Small Beach/Surf Includes Vessel,2Person Crew, RTK GPS Capability and all Hydro equipment necessary (SW and HW) to meet USACE Hydrographic Survey Specifications	Hr.	\$296.05	\$307.89	\$320.21	\$333.02	\$346.34
Multi-beam Sounding System	Hr.	\$212.00	\$220.48	\$229.30	\$238.47	\$248.01
Sidescan Sonar System	Hr.	\$117.71	\$122.42	\$127.31	\$132.41	\$137.70
Marker, Concrete Type 1a	Each	\$110.00	\$114.40	\$118.98	\$123.74	\$128.68
Marker, Concrete Type 1b	Each	\$136.00	\$141.44	\$147.10	\$152.98	\$159.10
Marker, Type 2	Each	\$68.00	\$70.72	\$73.55	\$76.49	\$79.55
Marker, Type 3	Each	\$38.00	\$39.52	\$41.10	\$42.74	\$44.45
Aluminum Monument -Magnetic/Standard Size 30"	Each	\$40.00	\$41.60	\$43.26	\$44.99	\$46.79
Mileage (Sedan)	Mile	GSA	GSA	GSA	GSA	GSA
Mileage (Truck)	Mile	GSA	GSA	GSA	GSA	GSA
Mileage (Truck towing boat)	Mile	1.75* GSA	1.75* GSA	1.75* GSA	1.75* GSA	1.75* GSA
Travel IAW JTR (per person per day)	Day	GSA	GSA	GSA	GSA	GSA
Overhead (Included in Rates)	%	159.76%	159.76%	159.76%	159.76%	159.76%

EVIDENCE OF LICENSURE IN THE STATE

As noted on the representative resumes, Moffatt & Nichol's project manager, principal and lead staff all maintain professional licenses to practice engineering in North Carolina.





MINORITY BUSINESS

Geodynamics is a woman-owned Historically Underutilized Businesses certified through the State of North Carolina Statewide Uniform Certification (SWUC) program.



APPENDIX A - RESUMES

PETER ELKAN, PE

PROJECT MANAGER (MOFFATT & NICHOL)

Mr. Elkan possesses more than 17 years of engineering experience acquired on a variety of coastal and hydraulic engineer and water resources projects involving field investigations, planning, permitting, analysis, design, construction document preparation, and post-construction-award services. He provides substantial experience in the analysis of coastal, riverine, and estuarine processes; coastal hydrodynamics; watershed and stormwater management; hydrology and hydraulics; tidal flows; salinity intrusion; and sediment and pollutant transport. He is skilled at developing numerical models for rivers, estuaries, bays, and harbors using the HEC suite, MIKE suite, QUAL2E, SED-2D, and RMA. In addition, Mr. Elkan has extensive experience with coastal stabilization projects involving bulkheads, breakwaters, revetments, and jetties.

RELEVANT EXPERIENCE

North Carolina Beach and Inlet Management Plan, NC. Project engineer for statewide study developing a beach and inlet management plan for North Carolina’s ocean coastline of over 320 miles and 19 active inlets. He gathered, compiled, and analyzed relevant coastal datasets including beach nourishment, dredging and shoreline erosion. He also developed management regions and strategies. Additionally, he conducted the stakeholder process including facilitating 10 public meetings. The final comprehensive plan covered the beach and inlet management strategies, regional approaches, economic valuation, vulnerability assessment and funding methodologies.

Sand Management Cape Fear Inlet, Oak Island, NC. Provided coastal engineering services for the communities of Caswell Beach and Oak Island. He served as a technical representative for the Town in the ongoing litigation between the case between the Town of Bald Head Island and the USACE. He also conducted an independent review of USACE Physical Monitoring and Sand Management Plan Revaluation with respect to sand management at the Cape Fear Inlet.

IQC: Shoreline Protection Engineering Services, Norfolk, VA. Task leader/coastal engineer for two tasks completed as part of this open-end contract – East Ocean View Beach Nourishment and Central Ocean View Beach Nourishment (total of 600,000 cubic yards of sand). He worked with team members in development and application of a longshore sediment transport model for beach nourishment design. For East Ocean View, he provided design of a series of four nearshore breakwaters to stabilize the beach. For Central Ocean View, he provided construction support by responding to contractor RFIs and proposed design modifications for the beach nourishment project.

North Carolina Terminal Groin Study, NC. Coastal engineer for this terminal groin study to evaluate its applicability and feasibility as an erosion control device in the State of North Carolina. This study led to aiding the North Carolina General Assembly to develop terminal groin guidelines.

REGISTRATION:

North Carolina (#24720)

EDUCATION:

MS, Coastal & Hydraulic Engineering: University of California, Berkeley

MS, Environmental Policy and Management, UNC

BS, Civil Engineering: Union College

AFFILIATIONS:

American Society of Civil Engineers

Chi Epsilon

Coasts, Oceans, Ports and Rivers Institute

American Shore & Beach Preservation Association





TIM REID, PE

PRINCIPAL-IN-CHARGE (MOFFATT & NICHOL)

Mr. Reid is currently the Moffatt & Nichol branch manager of the Raleigh office overseeing its day-to-day operations and having responsibility for assigning office resources to furnish timely and accurate project completion. In addition, he routinely provides quality control/assurance, team coordination, and project oversight. In addition to being a vice president, Tim is a senior civil engineer with 22 years of project management, planning, evaluation, design, construction document preparation, and post-construction award services experience acquired on a wide variety of civil engineering assignments. In addition, his civil engineering experience also includes planning, design, and construction document preparation for a variety of projects such as stormwater management facilities, drainage systems, military and industrial pavements, traffic staging/control, highways, utilities (water, sewer and fuel), and erosion control plans.

REGISTRATION:

North Carolina (#15869)

EDUCATION:

BS, Civil Engineering,
North Carolina State
University

AFFILIATIONS:

American Society of
Highway Engineers

RELEVANT EXPERIENCE

Post-Irene Renourishment Project, Emerald Isle, NC. Principal-in-charge for the field investigations, coastal engineering design, and permitting support to nourish beaches impacted by Hurricane Irene. The findings helped to determine which reaches of beach should receive nourishment and how large the fill template along each reach should be to offset the hurricane's effects.

Oregon Inlet Economic Study, Manteo, NC. Principal in charge for a study that examined the costs, benefits, and management issues related to maintaining all of North Carolina's shallow draft navigation channels (including Oregon Inlet). The study included: historical project inventory, dredged material management plan, economic impacts of shallow draft navigation waterways to state and local interests, safety concerns, Equipment and operating costs, financing options, contracting alternatives, and regulatory costs for state dredging program.

Bonner Bridge Replacement Environmental Impact Statement, Oregon Inlet, NC. Principal in charge for the assessment of existing coastal conditions and processes causing changes to the Oregon Inlet channel position and cross-section. Analysis included historic shoreline changes on Pea Island and Bodie Island and the evaluation of existing site sediment budgets, and analyzed the effects of water level changes due to tides, winds, storms, and local wave climate on the channel. Based on historic conditions and trends, channel movement within the inlet was forecasted along with shoreline changes and maximum channel depths.

North Carolina Terminal Groin Study. Project principal for the terminal groin study to evaluate its applicability and feasibility as an erosion control device in the State of North Carolina. This study led to aiding the North Carolina General Assembly to develop terminal groin guidelines.

NC-12 Interim Highway Improvements, Ocracoke Island, NC. Principal in charge for the vulnerability analysis of a 5.5-mile-long section of NC-12 located within the Cape Hatteras National Seashore Recreation Area. Examined erosion hot spots which are subjected to frequent roadway overwashing and damage from high surges and waves experienced during hurricanes and northeasters.

Fire Island to Montauk Point Breach Contingency Plan, Long Island, NY. Civil engineer for evaluation of barrier island breach potential and development of alternative corrective actions should a breach occur. Provided reach delineation for a 50-mile-long segment of shoreline. Developed borrow area locations from which to obtain emergency fill material including evaluation of different breach closure methods, including dredging, trucking from upland, and stockpiling material near "hot" spots. Determined detailed quantities as input to cost estimate.





JEFF SHELDEN, PE

QA/QC (MOFFATT & NICHOL)

Mr. Shelden is a senior coastal engineer with more than 28 years' experience in permit acquisition, dredging, shoreline protection, waterfront and coastal structure design, determining hydraulic and storm surge effects on coastal structures, numerical modeling of shoreline processes, tidal flows, and pollutant flushing rates for bays, estuaries and marina basins including shoreline evolution modeling using the USACE' numerical model GENESIS. He has analyzed winds, waves and currents in dozens of locations throughout the world.

RELEVANT EXPERIENCE

North Carolina Terminal Groin Study, NC. Senior coastal engineer who participated in the terminal groin study to evaluate its applicability and feasibility as an erosion control device in the State of North Carolina. This study led to aiding the North Carolina General Assembly to develop terminal groin guidelines.

North Carolina Beach & Inlet Management Plan, NC. Senior coastal engineer for the development of a comprehensive beach and inlet management plan (BIMP) identifying potential strategies to maintain beach and inlet characteristics at levels determined from analysis of historic, current, and forecasted future positions and composition. He provided oversight and QA/QC for the studies five main tasks – formation of a centralized database of available beach and inlet data, definition of management regions, development of draft management strategies, prioritization for state funding of beach and inlet management projects, and the project final report.

Coastal Processes Modeling, Replacement of Herbert C. Bonner Bridge, Oregon Inlet, NC. Provided evaluation of coastal processes at Oregon Inlet, including inlet migration, shoreline changes, dredging and terminal groin effects, as part of determining the alignment of a new bridge. Analyses included use of GENESIS, a shoreline evolution model, to project future shoreline conditions in response to a new terminal groin and future conditions considering the possibility of major jetty construction at the inlet.

Environmental Impact Statement, Replacement of Herbert C. Bonner Bridge, Oregon Inlet, NC. Assistant project manager who conducted a planning study of potential changes at Oregon Inlet likely to result from removal of the terminal groin at the north end of Hatteras Island. Performed shoreline change analysis using available historic data to estimate potential changes. Provided a report documenting background of inlet and summarizing analysis methods, findings, and conclusions.

Fire Island to Montauk Point Reformulation Study, Long Island, New York. Coastal engineer who provided technical input during numerical modeling of storm damage to various shoreline profile configurations considered during plan formulation and development of the “with-project” beach design profiles.

Rudee Inlet North Jetty Stabilization, Virginia Beach, VA. Senior coastal engineer who reviewed study to assess the wave and current fields around a scour hole that developed intermittently and provide solutions to stabilize the north jetty tip. The field investigations and numerical modeling revealed that there are increased currents at the tip of the jetty, which causes the scour hole. Three alternative solutions were identified to manage the creation of the scour hole and damage to the jetty.

REGISTRATION:

North Carolina (#15470)

EDUCATION:

MS, Civil Engineering,
North Carolina State
University

BS, Civil Engineering with
Highest Distinction,
University of Virginia

AFFILIATIONS:

American Shore and Beach
Preservation Association

American Society of Civil
Engineers

Chi Epsilon, the National
Civil Engineering Honor
Society

Tau Beta Pi, the National
Engineering Honor Society





JOHNNY MARTIN, PE

COASTAL ENGINEERING & MANAGEMENT (MOFFATT & NICHOL)

Mr. Martin provides 18 years of experience with coastal engineering and water resources planning, analysis, and design including detailed experience with numerical modeling for a variety of coastal and hydraulic engineering projects. He has extensive knowledge of state of the-art numerical models including the MIKE series, SBEACH and GENESIS, as well as specialized models developed by the USACE such as RMA-2 and -4 and the current set of Hydrologic Engineering Center models. He has served as the lead coastal engineer and/or assistant project manager for all past City of Norfolk projects.

RELEVANT EXPERIENCE

North Carolina Beach and Inlet Management Plan, NC. Project manager for this statewide study developing a beach and inlet management plan for North Carolina's ocean coastline of over 320 miles and 19 active inlets. He gathered, compiled, and analyzed relevant coastal datasets including beach nourishment, dredging and shoreline erosion. He also developed management regions and strategies. He conducted stakeholder process including facilitating 10 public meetings. The final comprehensive plan covered beach and inlet management strategies, regional approaches, economic valuation, vulnerability assessment and funding methodologies.

Post-Irene Renourishment Project, Emerald Isle, NC. Project manager for the field investigations, coastal engineering design, and permitting support to nourish beaches impacted by Hurricane Irene. The findings helped to determine which reaches of beach should receive nourishment and how large the fill template along each reach should be to offset the hurricane's effects.

Oregon Inlet Economic Study, Manteo, NC. Project manager for a study that examined the costs, benefits, and management issues related to maintaining all of North Carolina's shallow draft navigation channels (including Oregon Inlet). The study included: historical project inventory, dredged material management plan, economic impacts of shallow draft navigation waterways to state and local interests, safety concerns, Equipment and operating costs, financing options, contracting alternatives, and regulatory costs for state dredging program.

Bogue Banks Beach and Nearshore Mapping, NC. Project manager for the Bogue Banks Beach and Nearshore Mapping Program. Surveys are performed each spring along all three stretches of shoreline to document changes in the beach morphology and serve as a baseline before each storm season. In addition, after large storm events, surveying is performed along Bogue Banks to assess damages and to serve as documentation for FEMA reimbursement for sand lost. The survey data is used to compute shoreline change at Mean High Water (MHW) and volume change above MHW, -5 ft NAVD88 (wading depth), -12 ft NAVD88 (outer bar), and -20 ft NAVD88 (closure).

North Carolina Terminal Groin Study. Project manager who participated in the terminal groin study to evaluate its applicability and feasibility as an erosion control device in the State of North Carolina. This study led to aiding the North Carolina General Assembly to develop terminal groin guidelines.

NC-12 Interim Highway Improvements, Ocracoke Island, NC. Project engineer for vulnerability analysis of a 5.5-mile-long section of NC-12 located within the Cape Hatteras National Seashore Recreation Area. Examined erosion hot spots which are subjected to frequent roadway overwashing and damage from high surges and waves experienced during hurricanes and northeasters.

REGISTRATION:

North Carolina (#23487)

EDUCATION:

MS, Civil Engineering
(Water Resources), North
Carolina State University

BS, Civil Engineering,
North Carolina State
University

AFFILIATIONS:

American Shore and Beach
Preservation Association

American Water Resources
Association

National Council of
Examiners for Engineering
and Surveying, Water
Resources Board

North Carolina American
Public Works Association,





CHARLES JONES

ENVIRONMENTAL PERMITTING (JONES COASTAL CONSULTING)

Mr. Jones began his state government career as a field consultant with the Division of Coastal Management and was employed with that agency until his retirement in 2007. During his tenure with the State, he was the recipient of a number of awards and honors including The Order of the Long Leaf Pine from Governor Mike Easley, the Eure-Garner Award from the Coastal Resources Commission and a Pelican Award from the NC Coastal Federation in recognition of outstanding environmental service.

EDUCATION:

BA, Geography, East Carolina University

AFFILIATIONS:

Core Sound Museum and Heritage, Board of Directors

NC Coastal Resources Advisory Council, Carteret County Representative

Scenic By-Way Committee

PROFESSIONAL HISTORY

President, Jones Coastal Consulting, Inc. Consulting firm focusing and specializing in project planning, permitting and regulatory liaison for development projects located in Areas of Environmental Concerns under the NC Coastal Area Management Act. Projects and expertise include oceanfront developments, marina facilities with associated dredging, residential and commercial developments. Presently providing technical assistance to Moffatt & Nichol and DC&A for the Bogue Banks Beach 50-Year Nourishment Master Plan, including the development of a Programmatic EIS.

Director, NC Division of Coastal Management. Directed a 68 member staff with a 5.5 million dollar budget and served as Executive Secretary to the 15 member Coastal Resources Commission. Responsible for all staff support and operations for the Commission and coastal program including regulating development, local land use planning, administering grant programs for planning and public access, Coastal Reserve Program and long range planning and policy development for coastal issues. Served as the Governor's voting representative on the Coastal States Organization and worked closely with elected officials and state and federal agencies.

Assistant Director for Permits and Enforcement, NC Division of Coastal Management. Responsible for all aspects of the Division's permitting and enforcement activities in the twenty coastal counties including the management and supervision of four district offices. Responsibilities included technical and administrative support of regulatory staff, implementing and enforcing requirements of the Coastal Area Management Act and the Dredge and Fill laws and managing consistency provisions of the federal Coastal Zone Management Act. Delegated the authority by the Director to approve CAMA and Dredge and Fill Permits and provided recommendations to the Director for the denials of projects and consistency determinations. Worked closely with the USACE Regulatory, Planning and Navigation Branches and federal and state agencies.

District Manager, NC Division of Coastal Management. Responsible for the day-to-day operations of the Morehead City District Office. This included the supervision and management of the daily activities and decisions made by the district regulatory staff, assisting staff in the resolution of sensitive or unusual problems arising from enforcement actions and development applications. Provided technical information for the rule making process and drafted proposed rules for Coastal Resources Commission adoption.

Chief of Field Services, NC Division of Coastal Management. Responsible for the supervision of Division of Coastal Management field consultants and the minor permit program for the twenty coastal counties. Primary responsibilities included ensuring the consistency in project review and recommendations made in each office, assisting in project evaluations for large and controversial project, providing testimony for contested cases and providing assistance to local governments in their implementation of the Coastal Area Management Act.

Coastal Management Consultant, NC Division of Coastal Management. Duties included the review of development permit applications as required under the Coastal Area Management Act and the Dredge and Fill Act. Provided consultation assistance to individuals proposing development in Areas of Environmental Concern and assistance to local governments in land use preparation and other planning issues.





DAWN YORK

ENVIRONMENTAL PERMITTING (DC&A)

Mrs. York, a coastal scientist and project manager, has been involved in the design, preparation, coordination, and adaptive management of large-scale, multi-disciplinary coastal monitoring, environmental assessment, and comprehensive natural resource management programs for 12 years. Her experience is associated with environmental permitting requirements for large-scale beach nourishment programs including the management and direction of environmental documentation and permit authorizations in accordance with the State Environmental Policy Act (SEPA) and the National Environmental Policy Act (NEPA). Dawn conducted three years of sea level rise research under the direction of Dr. Courtney Hackney for the USACE Wilmington Harbor Deepening Project.

EDUCATION:

MSc, Marine Science

BSc, Biology and Environmental Studies

AFFILIATIONS:

National Association of Environmental Professionals

North Carolina Association of Environmental Professionals

North Carolina Beach, Inlet, and Waterway Association

RELEVANT EXPERIENCE

NC Terminal Groin Study, NC Division of Coastal Management. Lead technical writer for the NC Terminal Groin Study. Coordinated directly with the Coastal Resources Commission and Science Panel on documenting environmental impacts of terminal groins.

Bogue Banks Programmatic Environmental Impact Statement, Carteret County, NC. Project manager and lead agency coordinator for the first Programmatic Environmental Impact Statement in North Carolina.

Holden Beach East End Shore Protection Project, USACE 3rd Party Contractor, Holden Beach, NC. Project manager and lead agency coordinator for the one of the four Environmental Impact Statements associated with a terminal groin in North Carolina.

Post-Irene Beach Renourishment Project, Carteret County, NC. Lead technical writer for the Environmental Assessment required by the Bureau of Ocean and Energy Management. Permits acquired in fall 2012.

Environmental Monitoring for the Bogue Inlet Channel Erosion Response Project, Emerald Isle, NC. Field manager for the pre- and post-construction environmental monitoring associated with the Bogue Inlet Channel Erosion Response Project.

Environmental Impact Statement and Natural Resources Technical Memorandum for Bonner Bridge Replacement Project in the vicinity of Oregon Inlet, NC (NCDOT). Assisted in the preparation of an Environmental Impact Statement for the proposed replacement of Bonner Bridge over Oregon Inlet, NC.

Environmental Impact Statement for the North Topsail Beach Shoreline Protection Project, North Topsail Beach, NC. Environmental project manager and environmental technical lead for the preparation of an Environmental Impact Statement for the construction of a five phased beach nourishment and inlet realignment project on North Topsail Beach.

Environmental Impact Statement for the Topsail Beach Interim (Emergency) Beach Fill Project, Topsail Beach, NC. Environmental project manager for the preparation of a Supplemental Environmental Impact Statement in accordance with National Environmental Policy Act and the State of North Carolina Environmental Policy Act to the US Army Corps of Engineers - Wilmington District for Topsail Beach. Section 404 and 401 permits acquired in May 2009.





CHRIS FREEMAN

COASTAL GEOLOGY & SURVEYING (GEODYNAMICS)

Mr. Freeman has 15 years of experience in high-accuracy coastal mapping projects. Chris has provided survey design, field investigations, analysis, document preparation and consulting services for clients such as the City of Norfolk, U.S. Navy, the USACE-Norfolk, Wilmington, Baltimore, and Charleston, NASA, and Moffatt & Nichol. Coastal monitoring projects have included pre/post beach nourishment, development of advanced 3D shoreline mapping techniques and datum derived shorelines.

RELEVANT EXPERIENCE

Emergency Rapid Response Hydrographic Survey of Pea Island, NC. Contracted by the NCDOT Location & Surveys Unit to complete a rapid response hydrographic survey of the breach formed during Hurricane Irene along the Pea Island NWR. Specific role included emergency communication and mobilization, project estimation and management, survey design, final reports and survey technical oversight.

High Resolution Hydrographic Survey of Oregon Inlet, NC. Contracted by the USACE Wilmington District to perform a comprehensive hydrographic survey and Digital Elevation Model of Oregon Inlet. Survey included multibeam, singlebeam, and topographic data acquisition aboard multiple vessels. Specific role: project management, survey design, technical oversight.

Geophysical and Hydrographic Survey offshore Carteret County, NC. Conducted hydrographic survey of proposed sand resource areas offshore of Bogue Banks for the Carteret County Shore Protection Office. Multibeam backscatter was used to identify areas of possible hardbottom/rock outcrops, areas of possible archaeological concern, bedforms, and likely surface sediment type. Role included project estimation and management, obtaining and maintaining permits, survey design, final reports and survey technical oversight.

Morehead City Port Berth Construction Hydro Surveys, Morehead City, NC. Contracted by Weeks Marine to perform topographic stationing, singlebeam and multibeam hydrographic surveys during construction to stabilize berth walls. 13 separate surveys were performed to establish baseline conditions, provided interim progress surveys, and supply a final construction completion survey. Specific role included project estimation and management, final reports and survey technical oversight.

High Resolution Multibeam Bathymetry: Pre- and Post-Dredge Sediment Volume Change, Ocean City, MD. High density bathymetry surveys for elevation and physical modeling using multibeam sonar in 3mi² inlet region. Surveys are part of USACE Baltimore's Regional Sediment Management Effort to accurately understand sediment transport, wave transformation, and to make more accurate pre- and post-dredge volume calculations. Specific role included project estimation and management, survey design, final reports and presentations to client. Project management responsive to client's changing data needs and timeline.

Topo-Bathy Beach Profiles of Carteret County, NC. Completed comprehensive annual shoreline surveys of Bogue Banks, Bear Island, and Shackelford Banks since 2008 with Moffatt & Nichol to support regional sediment management, beach nourishment, and coastal engineering needs. Post-storm surveys are initiated following a natural disaster declaration to measure volumetric change for FEMA reimbursement.

Topo-Bathy Beach Profiles and Feature Mapping Surveys, Norfolk, VA. Contracted by Moffatt & Nichol to perform seamless beach and hydrographic surveys of the Ocean View Beach area for the city of Norfolk as part of a long-term monitoring/shoreline management project.

EDUCATION:

MS, Marine Geology: Univ. of North Carolina
Wilmington

BA, Environmental
Science/Earth Science
minor, UNC Wilmington

AFFILIATIONS:

Hydrographic Society of
America

American Congress of
Surveying & Mapping

American Shore & Beach
Preservation Association

Geological Society of
America





JASON DOLL, CPSWQ

WATER QUALITY (MOFFATT & NICHOL)

Mr. Doll has more than 18 years as an environmental scientist and project manager specializing in watershed planning, water quality modeling, and stormwater management for both public and private sector projects completed throughout North America. In particular, he has completed numerous watershed planning projects utilizing multi-disciplinary approaches to integrate ecological restoration with point and non-point source management measures to develop comprehensive strategies to improve and protect watershed functions. Jason provides extensive experience in the development and application of a wide array of watershed and water quality modeling tools for a variety of assessment scenarios including numerous TMDL's. In addition to being a registered CPSWQ, Mr. Doll is certified in Low Impact Development by North Carolina State University.

RELEVANT EXPERIENCE

Lockwood Folly River Local Watershed Management Plan, Brunswick County, NC. Project manager who developed a local watershed management plan for the NC Ecosystem Enhancement Program. Project integrated detailed field surveys with functional assessment tools to identify opportunities for management efforts such as stream and wetland restoration and/or stormwater BMP retrofits to improve areas where watershed functions were degraded. Assessment tools, which included watershed modeling analyses, were utilized to evaluate the degree of reduction in stressor impacts associated with each restoration or management opportunity. The cost effectiveness of each option was then evaluated in order to optimize limited implementation resources. The project team worked with NCEEP and stakeholders to identify the most feasible/desirable restoration, preservation, and management alternatives.

Water Quality Modeling Study, Second Bridge to Oak Island, Oak Island, NC. As project manager/water quality modeler, he completed watershed modeling to satisfy Clean Water Act Section 401 water quality certification requirements for the second bridge to Oak Island through development of Generalized Watershed Loading Function (GWLf) and Simple Method watershed models to examine the indirect/cumulative impacts associated with the planned bridge and roadway. The analysis simulated potential increases in nonpoint source loads of nitrogen, phosphorous, sediment, and fecal coliform resulting from growth induced by the planned infrastructure improvements, and included a risk analysis to examine the potential for stream erosion.

Archers Creek Stormwater Study, Emerald Isle, NC. Project manager for the development of a conceptual plan for addressing the water quality violations, including culvert replacement, to maximize tidal flushing and to connect tidal creek habitat to Bogue Sound, brackish marsh restorations, freshwater stream buffer restorations, structural and non-structural stormwater BMPs and retrofits.

Clear Run and New McCumbers Preliminary Watershed Study, Wilmington, NC. Project manager and lead scientist for preliminary assessments of two urbanized watersheds in Wilmington with flooding problems. The project included development of hydrologic and hydraulic modeling framework using SWMM to evaluate the flooding problems and identify feasible alternatives. The project team worked with the City to identify preferred alternatives for each watershed and then presented them, along with opinions of probable cost, in the corresponding Feasibility Reports. Opportunities to improve water quality with stormwater BMP retrofits, where appropriate, were also identified. The project also highlighted the opportunity to perform restoration of the open channel portions of Clear Run Branch using natural channel design principles.

REGISTRATION:

Certified Professional in
Storm Water Quality
(#0217)

EDUCATION:

BS Fisheries & Wildlife
Science, North Carolina
State University

AFFILIATIONS:

American Water Resources
Association

Georgia Association of
Water Professionals

North Carolina Association
of Environmental
Professionals

North Carolina Water
Resources Association
(Past President)





JACK FINK

DREDGING (MOFFATT & NICHOL)

Mr. Fink provides more than 26 years of diverse civil engineering experience with particular emphasis on marine construction & dredging including several LTMS for dredged material placement. As a former PM/cost estimator for major marine construction, dredging, & heavy civil construction contractor, he possesses a comprehensive background in hard dollar cost estimating as well as constructability analysis, construction management, QC/QA, and project engineering. Primary responsibilities on heavy civil construction & dredging projects have included project coordination with owners, engineers, & public agencies, change orders preparation/negotiation, subcontract administration, construction schedules/procedures review, project submittals, testing requirements, & daily/ monthly reports preparation.

REGISTRATION:

California (#60931)

EDUCATION:

BS, Civil Engineering, Texas
A&M University

RELEVANT EXPERIENCE

Hamilton Wetlands Restoration Project (HWRP), U.S. Army Corps of Engineers, Novato, CA. Project engineer who coordinated and performed engineering related functions associated with the dredged material pipeline alternatives. The HWRP involved analyzing the various alternatives for the location, alignment, and outboard marsh crossing for the dredged material off-loader and pipeline. This project involved close coordination with equipment owners and manufacturer's to determine operating parameters and capacities. Once a preferred alternative was determined, a feasibility analysis was performed to determine project costs associated with the placement of dredged material at the wetlands restoration site.

Laguna Madre Placement Alternatives for the Gulf Intracoastal Waterway, Corps of Engineers-Galveston District, TX. Project engineer and cost estimator for cost analysis of maintenance dredging including material placement for 17 different locations along the length of the Gulf Intracoastal Waterway (GIWW) within Laguna Madre. Laguna Madre is 99 miles long and consists of two shallow tidal bays, transected/connected by GIWW. Cost analysis results were used, along with other studies, to prepare a 50-yr-long dredged material management plan for the GIWW in Laguna Madre. Dredging estimates incorporated in-bay, upland, and offshore placement alternatives and the accompanying site design necessary to contain 50 years of dredged material.

Alameda Point Channel Maintenance Dredging, Alameda Reuse and Redevelopment Authority, Alameda, CA. As technical lead for the maintenance dredging of over 350,000-cy of dredged material with placement at the SF-11 (Alcatraz) Disposal Site, he managed the preparation and completion of contract documents and was the Engineer of Record for the final Bid Documents. Prepared the final dredging cost estimate which was used by the Owner to budget the project. During construction of the project, he assisted with field inspections, construction management services and project closeout upon completion of the contract. The project was completed on time and below the Owner's approved budget.

Suisun City Marina Maintenance Dredging, City of Suisun City, Suisun City, CA. Project manager for the maintenance dredging of 120,000 cubic yards of shoaled material in portions of the marina, yacht club, Marina Village subdivision, and associated access channels. Dredging was accomplished with a hydraulic cutterhead dredge with disposal at Pierce Island Upland Disposal Site. In addition to managing the preparation of final contract documents, he was intimately involved with the acquisition of all required project permits from the Dredged Material Management Office member agencies as well as consultation with the NOAA Fisheries and U.S. Fish & Wildlife Service regarding endangered species issues. Additional toxicity testing and water quality modeling were performed to obtain the Water Quality certification for the project. Obtained all required agency approvals for the project in a short time frame, including an extension beyond the regulatory dredging window, to allow the marina to continue operations in an uninterrupted fashion.

