DEVELOPING A MANAGEMENT STRATEGY FOR NORTH CAROLINA'S COASTAL OCEAN: DRAFT REPORT

Submitted to the North Carolina Division of Coastal Management by
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THE NORTH CAROLINA COASTAL RESOURCES LAW, PLANNING AND POLICY CENTER

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OCEAN POLICY STEERING COMMITTEE

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GLOSSARY OF ACRONYMS

AEC – Area of Environmental Concern
AMAC – NH Atlantic Marine Aquaculture Center
BIMP – Beach and Inlet Management Plan
CAA – Clean Air Act
CAMA – Coastal Area Management Act
Center – North Carolina Coastal Resources Law, Planning and Policy Center
CHPP – Coastal Habitat Protection Plan
CMP – Coastal management Plan
Corps – Army Corps of Engineers
CRC – NC Coastal Resources Commission
CRMC – RI Coastal Resources Management Council
CWA – Clean Water Act
CZMA – Coastal Zone Management Act
DCM – NC Division of Coastal Management
DENR – NC Department of the Environment and Natural Resources
DOA – NC Department of Administration
DOI – US Department of the Interior
DWQ – Division of Water Quality
DWR – Division of Water Resources
EEZ – Exclusive Economic Zone
EIS – Environmental Impact Statement
EMC – Environmental Management Commission
EMEC – European Marine Energy Centre
EPA – Environmental Protection Agency
EPRI – Electric Power Research Institute
ESA – Endangered Species Act
FAO – UN Food and Agriculture Organization
FERC – Federal Energy Regulatory Commission
FONSI – Finding of No Significant Impact
FPA – Federal Power Act
IPCC – Intergovernmental Panel on Climate Change
MMPA – Marine Mammal Protection Act
MMS – US Minerals Management Service
NCAC – North Carolina Administrative Code
NCGS – North Carolina Geological Survey
NEPA – National Environmental Policy Act
NHPA – National Historic Preservation Act
NOAA – National Oceanographic and Atmospheric Association
NPDES – National Pollution Discharge Elimination System
OCRM – Office of Coastal Resource Management
OCS – Outer Continental Shelf
OCSLA – Outer Continental Shelf Lands Act
OPSC – Ocean Policy Steering Committee
POTW – Publicly Owned Treatment Works

POWER – People of Oregon for Wave Energy Research
RHA – Rivers and Harbors Act
RITE – Roosevelt Island Tidal Energy
RSM – Regional Sediment Management
SAMP – Special Area Management Plan
SEFLOE – Southeast Florida Outfall Experiment
TISEC – Tidal In-Stream Energy Conversion Device
USGS – US Geological Survey

EXECUTIVE SUMMARY

In 2004, reports from the US Commission on Ocean Policy and the Pew Oceans Commission were released, encouraging all levels of government to take a fresh look at ocean resource issues. In response to this challenge, North Carolina saw the opportunity and a need to update its existing policies on ocean uses. In 1994, Walter Clark, formerly of North Carolina Sea Grant, and the North Carolina Division of Coastal Management (DCM), released a study on ocean policy and management entitled "North Carolina's Ocean Stewardship Area: A Management Study." The 1994 study, a follow-up to a 1984 study entitled "North Carolina and the Sea: An Ocean Policy Analysis," focused on issues such as ocean jurisdiction, extraction of solid minerals, oil and gas activities and marine pollution. This 2009 report is an update to the 1994 study and focuses on North Carolina's emerging policy issues related to ocean and coastal resources. In furtherance of this effort, DCM partnered with North Carolina Sea Grant and the North Carolina Coastal Resources Law, Planning and Policy Center (Center) to complete a rigorous study on the state's emerging ocean policy issues. The goal of this effort is to identify emerging challenges to the use of and access to ocean and coastal resources and to recommend appropriate policies and strategies to address these challenges. The Center's co-directors led this effort.

To assist the Center, a steering committee was convened to provide technical expertise and to work with the Center to formulate policy recommendations. The Ocean Policy Steering Committee is comprised of fourteen members from federal and state agencies, local government, academia and the private sector. Together, the Center and steering committee identified five emerging ocean resources issues for North Carolina:

- Sand resource management
- Ocean-based alternative energy development
- Ocean outfalls
- Marine aquaculture
- Comprehensive ocean management

The Center and steering committee worked throughout 2008 to fully research these emerging issues and develop recommendations on how the State could address them. This draft report has been prepared to allow the public to have input before a final report is submitted to the Coastal Resources Commission in May 2009. Below is a summary of the steering committee's recommendations on how North Carolina may address its emerging ocean policy issues. It should be noted that not all of the recommendations presented in this document were fully endorsed by all steering committee members, and instead were agreed upon by a majority. Recommendations with majority support, as opposed to unanimous support, by the steering committee will be indicated as receiving only majority support.

Sand Resource Management

- Development of a State comprehensive plan to protect beaches and inlets
- Identification of available sand sources
- Establishment of a system of legal rights to State-owned sand resources
- Development of a coastal vulnerability index
- Incorporation of a sea level rise component to CAMA land use plans
- Disclosure of natural hazards for coastal real estate purchases[1]
- Management of inlet tidal delta sand sources
- Preventing loss to the barrier island system of sand in inlet channels
- Amendment to rules regarding dredging around hard-bottom areas
- Development of a "worst-case scenario" State-level planning document

Ocean-Based Alternative Energy

- Enactment of a comprehensive statute and promulgation of rules to address the granting of easements and leases of State-owned submerged lands and the associated water column and air space for alternative energy projects
- Review and amendment of existing CRC rules affecting alternative energy facilities sited in State and federal waters
- Clarification of CRC, EMC and Utilities Commission roles in the development of rules for the siting of ocean-based alternative energy projects
- Examination of CRC's policies on non-water dependent structures and their pertinence to alternative energy facilities

Ocean Outfalls

- No new or expanded ocean outfalls for stormwater or wastewater in NC
- Decommission existing stormwater outfalls by using a phase-out process, including source reduction to existing outfalls, use of best management practices to clean discharge as needed and retrofitting existing outfalls in the interim
- Examine the potential for alternative water treatment methods, such as water reclamation and reuse facilities

Marine Aquaculture

- Technical assessment to research the feasibility of marine-based aquaculture in North Carolina's coastal-ocean waters
- DCM should monitor the progress of the National Offshore Aquaculture Act of 2007 or similar future bill

Comprehensive Ocean Management

- Update North Carolina's coastal ocean resources maps

[1] This recommendation received majority, but not unanimous, support of the steering committee.

INTRODUCTION

Beginning in the 1980s, maritime states around the US began to see a reduction in the role of federal financing in the management of state ocean and coastal resources, and as a result embarked on an effort to analyze "their individual and collective policy relationships to ocean and coastal issues."[2] In 1984, North Carolina followed suit and published "North Carolina and the Sea: An Ocean Policy Analysis." Later, in 1994, North Carolina published "North Carolina's Ocean Stewardship Area: A Management Study." These reports represent the State's earliest forays into examining a comprehensive ocean management plan, with the 1994 report building off recommendations and policy shifts that had been proposed but not necessarily carried out under the 1984 report. Each of the reports were based on a study of the State's ocean management regime at the time and had an end goal of identifying deficiencies prevalent with ocean and coastal management policy.

Within the last ten years, many of the issues facing North Carolina's coastal ocean have changed, and new issues have come to the forefront of policy development. For example, there is greater interest in offshore sand resources as beach nourishment has become more critical to addressing shoreline erosion. There is greater focus on marine protected areas, or as they might be referred to in state waters, Critical Habitat Protection areas. There is a new and evolving interest in wind energy development in North Carolina's coastal waters and in federal waters, and in large-scale marine aquaculture production. Coastal ocean observing systems are rapidly developing and becoming an increasingly important part of North Carolina's emerging management information system. The moratorium on oil and gas exploration in the ocean waters off North Carolina's coast has been lifted. These changing needs, along with heightened awareness and new challenges given to ocean issues by the US Commission on Ocean Policy report, signal a crucial time for North Carolina to review its ocean policy structure and to devise policy options that ensure the US is prepared to meet the challenges of tomorrow.

On June 24, 2004, Governor Mike Easley, in his comments on the report from the US Commission on Ocean Policy, recognized the importance of properly managing ocean resources. Governor Easley stated that protecting coastal and ocean resources means protecting an integral part of North Carolina's economy and culture.

In December 2005, DCM identified protecting ocean resources as a high priority in its current five-year strategy, to be supported by Coastal Zone Management Act Section 309 Enhancement Grant funds from the US Department of Commerce. DCM expressed interest in using part of this funding to work with North Carolina Sea Grant and the Center to review and update the State's policy regarding ocean resources and ocean use. The Center is an inter-institutional partnership between the North Carolina Sea Grant College Program, the University of North Carolina School of Law and the University of North Carolina Department of City and Regional Planning. Joseph Kalo,

[2] Clark, Walter F., "North Carolina's Ocean Stewardship Area: A Management Study," North Carolina Sea Grant College Program and North Carolina Health, Environment and Natural Resources Division of Coastal Management, 1994, p. 1.

University of North Carolina School of Law, and Lisa Schiavinato, North Carolina Sea Grant College Program, co-direct the Center. The Center serves as a research, advisory and educational entity that provides informational support to state agencies, state advisory groups, local governments, the legal community and community organizations in their efforts to address ocean, coastal and development issues.

Preliminary work on the ocean resources policy study began during the summer of 2007. During this time the Center identified potential emerging issues and produced memoranda on the state of the law regarding these issues. During this phase, the need became clear that a steering committee needed to be convened to assist in identifying emerging issues and to guide the Center's research. In the fall of 2007, DCM appointed members to the Ocean Policy Steering Committee. The steering committee, chaired by Kalo and Schiavinato, identified North Carolina's emerging ocean policy issues[3] and provided relevant historical, scientific and policy background, while also working with the Center to develop the policy recommendations included in this report. The steering committee held six meetings throughout 2008 and the spring of 2009, during which technical issues were refined and recommendations for management strategies to address North Carolina's emerging issues were developed. This report identifies North Carolina's most pressing emerging ocean resource issues, provides background on these issues and puts forth policy recommendations to address them. Once complete, the final report will be presented to the Coastal Resources Commission (CRC), which will decide on any action it will take.

This report is divided into five chapters, each devoted to an emerging ocean policy issue regarding the use of ocean resources. Each chapter provides background and technical information, along with an explanation as to why the issue was identified. At the end of each chapter are policy recommendations, along with a rationale behind each recommendation. At the end of the report are several appendices that provide additional technical information.

[3] This report does not include oil and gas development as an emerging issue. The reason it is not included is that the steering committee identified the emerging issues in the early spring of 2008, before the sharp rise in gas prices in 2008 and before Congress lifted the moratorium. Due to time and funding constraints, the steering committee was unable to add oil and gas as an emerging issue for this study. However, in November 2008 the General Assembly called for a panel to specifically study the feasibility of drilling for oil and gas off North Carolina's coast. Members of the study panel were named in January 2009 and include university researchers, industry and environmental representatives and citizens. The panel will review research on offshore oil and gas drilling and examine its economic benefits and costs, as well as hold public hearings on the issue.

CHAPTER 1

SAND RESOURCE MANAGEMENT

Climate change, sea level rise and storms all have the potential to cause erosion or increase erosion that already has occurred along North Carolina's shorelines. As a consequence, structures may be damaged or destroyed during storms, creating the potential for structures to be abandoned in the surf zone or surrounded by sand bags. This potential hazard inevitably will require the State and coastal communities to confront serious and difficult policy issues about what coastal areas and coastal resources to protect and how to adapt to the changes resulting from sea level rise and receding shorelines. According to Dr. Stanley Riggs and colleagues at East Carolina University, coastal communities are currently seeking beach nourishment projects totaling approximately 122 miles of the 325-mile long North Carolina ocean shoreline. This ten-fold increase is in contrast to the 12 to 15 miles of public ocean shorelines in North Carolina that were routinely nourished prior to the increased storm frequency that began in 1996.[4] Their evidence suggests that this rate is presently increasing and will continue to increase in response to ongoing processes of global change. The US Geological Survey funds Dr. Riggs' ongoing coastal research program.

A study being conducted by Dr. Len Pietrafesa and colleagues at North Carolina State University will provide additional information on shoreline erosion by predicting future sea level rise along the coasts of North Carolina and Virginia for the next 50 years. In this study, maps of future scenarios for inundation and erosion will be based on running past coastal storms on future scenarios of sea level rise. The study is being funded by the National Oceanic and Atmospheric Administration's National Environmental Satellite, Data and Information Service.

According to 15A NCAC 07M.0202(b) and (c), North Carolina allows developed shorelines to be protected through beach nourishment projects or through retreat (i.e., the movement of erosion threatened structures out of harm's way). The preferred response to shoreline erosion utilizes the administrative rules of the CRC, land use planning, building setback lines, building relocation and vegetation management. In addition, the State has found that beach nourishment can provide a viable alternative to allowing the landward migration of the ocean shoreline, resulting in the loss or massive relocation of oceanfront development. Figure 1 shows the different strategies used to address receding shorelines.

[4] Riggs, S.R., S.J. Culver, D.V. Ames, D.J. Mallinson, D.R. Corbett and J.P. 2008. North Carolina's Coasts in Crisis: A Vision for the Future. White Paper, North Carolina Coastal Geology Cooperative Research Program, US Geological Survey and East Carolina University, Greenville, NC, 26 p.

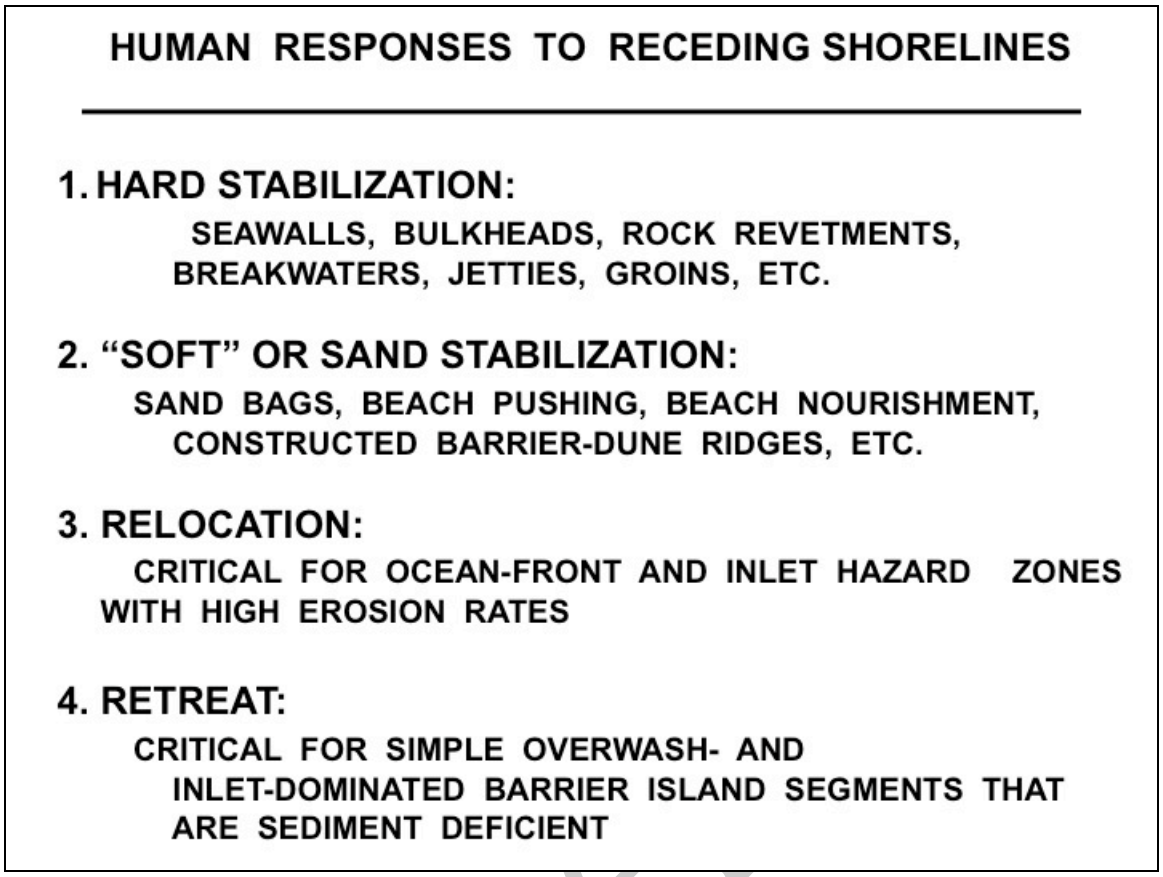

Figure 1: Human Responses to Receding Shorelines

Since beach-quality sand sources are limited and likely will be insufficient to meet all the demands for beach nourishment projects in the future, there is the potential for conflicts between beach communities over the right to the same, yet limited, beach-quality sand sources. This potential conflict is further underscored by the current State and federal regulatory system in which beach-quality sand is available on a "first come, first served" basis. The legal means for acquiring a continuing priority, and legal right, to sand sources located in State waters does not exist; and, neither the State nor federal system prioritizes access to sand resources based on an assessment of whether the proposed sand use is the wisest use of this public resource.

Furthermore, a fundamental question North Carolina will need to address is whether it will be economically and practically feasible to provide adequate protection to all shoreline areas, or whether some portions of the North Carolina shoreline must be left to the effects of climate change, sea level rise and coastal storms. In order to plan for the future, the State needs to define the geomorphic and physical components of all island segments and determine which coastal areas are most vulnerable. To reduce unsafe development in vulnerable areas, existing and future owners of coastal property should be fully informed of the risks. Finally, the State must take steps to assure that other activities, such as inlet management (including navigation channel maintenance), do not

result in the natural loss of beach-quality sand to the barrier island system or result in other adverse impacts to barrier island resources.

PLANNING FOR SHORELINE MAINTENANCE THROUGH BEACH NOURISHMENT

Sand Sources

Barrier islands are essentially large sand bars that are formed by storms at the land-sea-air interface. In general the best beach sand is already on the barrier islands. Some islands are sand-rich (complex islands), while many others are sand-poor (simple inlet and overwash dominated islands), as illustrated in Figure 2. In the northern portion of North Carolina, much of the seafloor sand on the inner shelf tends to be deep and fairly fine-grained. In the southern part of North Carolina's coast, these islands generally sit on a hard rocky bottom with limited amounts of surficial and ephemeral sand deposits on the nearshore continental shelf. These thin sand veneers generally have insufficient volumes to provide the sand for beach nourishment projects.[5]

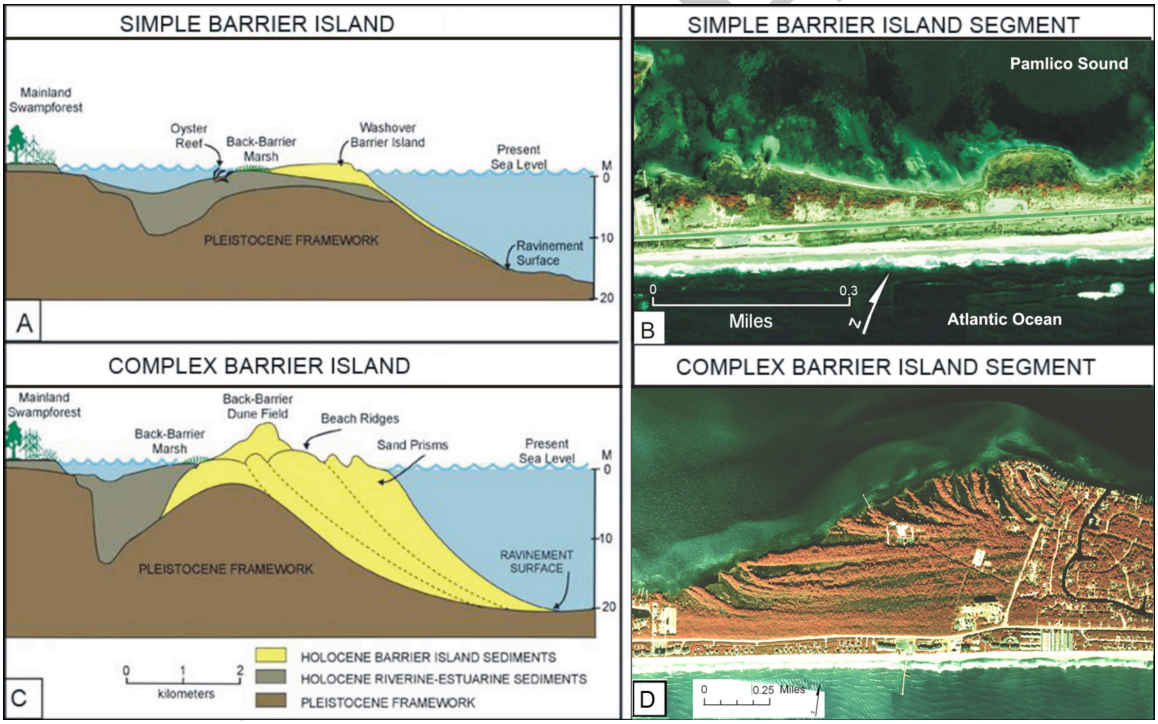

Figure 2. Panel A shows a schematic cross-sectional diagram of a sand-poor, simple inlet and overwash-dominated barrier island. Panel B is a 1998 infrared aerial photograph example of a sand-poor, simple barrier island segment just north of Buxton, NC. Panel C shows a schematic cross-sectional diagram of a sand-rich, complex barrier island. Panel D is a 1982 infrared aerial photograph example of a sand-rich, complex barrier island segment on Bogue Banks, NC that is composed of multiple beach ridges. Figure 2 was modified from Riggs, et al. (2008).

[5] Riggs, S.R., S.J. Culver, D.V. Ames, D.J. Mallinson, D.R. Corbett and J.P. Walsh. "Coasts in Crisis: A North Carolina Case Study" (in review), US Geological Survey, Scientific Investigations Report, 90 p.

According to Dr. Stanley Riggs of East Carolina University and his colleagues, other than the barrier islands themselves and their associated inlet deposits, there are generally four types of deposits that lie within State coastal-ocean waters and potentially contain beach-quality sand deposits. The four sources and their potential for supplying adequate volumes and qualities of nourishment sand are as follows.

- Paleo-river channels and delta deposits: very local, poor to high quality, and moderate to large volume.
- Shore-oblique sand shoals: very local, moderate to high quality, and small to moderate volume.
- Inner shelf stratigraphic units: very local, low to moderate quality, small to moderate volume.
- Cape shoal structures: distant, very high quality, and very large volume. They include Diamond Shoals off Cape Hatteras, Cape Lookout Shoals off Cape Lookout and Frying Pan Shoals off Cape Fear.[6]

Based on Dr. Riggs' characterization of these sources, the cape shoal structures appear to have vast volumes of high quality sand, but they are substantially removed from beaches that need sand for nourishment. Mining the shoal areas for beach-quality sand and transporting it to those beaches in need of nourishment, will be costly and present substantial environmental, physical and economic challenges. In addition, these shoals do play an important, but not fully understood role in the function and maintenance of the barrier island system. This role will need to be studied in greater detail before large quantities of sand are removed from the system. Recent research on North Carolina's shoal systems indicates that there may be 4 billion m^3 of sand that has been lost from the transgressing barrier islands to the cape-associated shoals (Cape Fear, Cape Hatteras and Cape Lookout) over the last 4,000 years.[7] The other three potential sources of beach-quality sand are much more limited in their location and size and will require substantial exploration costs. In addition, the first three potential sources may present user conflict issues, depending on the location of the sand mining. For instance, many of these potential sand mining areas occur adjacent to hard-bottom habitats; are designated as Essential Fish Habitat; or there is the potential that wind turbines may be placed in or near these areas in the future.

Today, the most commonly utilized sources of beach nourishment sand in North Carolina are ebb-tide deltas and channel sand in adjacent inlets. Simple barrier islands need inlets to build island width and inlets need to breath (migrate and expand-contract) in response to water flow during different kinds of storm events (Riggs et al., 2008). In order to do this, an inlet needs space on the adjacent barrier islands (areas defined as the Inlet Hazard Zone) and well-developed ebb-tide (ocean side of inlet) and flood-tide deltas (estuarine side of inlet). Mining the ebb-tide delta for beach nourishment sand robs the sand that allows inlets to: 1) feed sediment into the various complex components of the barrier island system; and 2) breath in response to the changing wave, current, and

[6] *See id.*

[7] McNinch, J.E., Wells, J.T., and Snyder, S.W., "The Long-Term Contribution of Pre-Holocene Sands to Transgressing Barrier Islands," Coastal Sediments Conference, 1999.

tide conditions during each storm event.[8] Thus, for a healthy barrier island system, substantial portions of the inlet's ebb-tide delta should not be mined and the inlet channel should not be overly widened. Both of the latter situations could ultimately destabilize the inlet, causing increased inlet migration and associated shoreline recession. This ultimately leads to the desire to lock the inlet in place with hardened structures.

If a situation were to arise in which multiple beach communities would be vying for the same sand sources, there is no established procedure for the acquisition of the exclusive right to mine a fixed amount of sand from any particular sand source, nor is there any process for allocating available sand based on a determination of which communities have a greater need, and where the placement of sand would provide the greatest benefit to the State. Consensus among coastal managers and scholars in North Carolina is that a coherent, comprehensive strategy is needed to facilitate prioritization.

The Current Regulatory System

The primary federal laws concerning beach nourishment projects are Section 404 of the Clean Water Act[9] (CWA) and the National Environmental Policy Act (NEPA).[10] The designated federal agency to oversee these projects is the US Army Corps of Engineers (Corps). Prior to beginning a shore protection project that involves the placement of dredged or fill material in US waters or below the mean high tide line in coastal areas, a CWA Section 404 permit must be acquired from the Corps.[11] When deciding whether to issue a Section 404 permit, the Corps reviews the proposed project to evaluate multiple factors, including shore erosion, effects on conservation and water quality to determine the project's impacts on the environment, navigation and adjacent property. To assure that the necessary federal regulations are followed, the Corps has developed a six-step planning process. This six-step process was developed under the Water Resources Planning Act in order to integrate NEPA with the Section 404 permit process for beach nourishment projects.[12]

The Corps also considers the potential use of material dredged from navigation works for State nourishment projects. Before a dredging project can proceed, the Corps and DCM require testing the quality of the dredged material for eligibility for nourishment projects, unless the sand is from an existing navigation channel, and the channel will be dredged only to its original depth. A CWA Section 404 permit is required for the dredging, transport and disposal operations of these materials. Moreover, under Section 111 of the Rivers and Harbors Act (RHA), the Corps can participate in

[8] Riggs, S.R., S.J. Culver, D.V. Ames, D.J. Mallinson, D.R. Corbett and Walsh, J.P. "Coasts in Crisis: A North Carolina Case Study" (in review), US Geological Survey, Scientific Investigations Report, 90 p.
[9] 33 U.S.C. §1344.
[10] 42 U.S.C. §4321 et seq.
[11] The Corps is authorized to issue permits for work done in navigable waterways under Section 10 of the Rivers and Harbors Act. *See* 33 U.S.C. §403. Section 10 provides the Corps with jurisdiction over obstructions to navigable waterways, as well as excavating from, or introducing fill material to, navigable waterways.
[12] *See* 42 U.S.C. §1962a-2. *See also* ER 1105-2-100, "Planning Guidance Notebook" (USACE 2000).

shoreline erosion mitigation projects for damage resulting from federal navigation works.[13]

The location of suitable sand sources also requires compliance with federal regulations, if the sand source is located in federal waters. Under the Outer Continental Shelf Lands Act (OCSLA), the Minerals Management Service (MMS) administers the removal of minerals and materials from lands lying underneath federal waters on the Outer Continental Shelf (OCS). When federal agencies, state agencies and municipalities acquire sand from the OCS, they negotiate directly with MMS by formally requesting mineral rights and then negotiating either a non-competitive agreement or a negotiated agreement.[14]

Under North Carolina's Coastal Area Management Act (CAMA), ocean and inlet beaches and ocean waters are designated as Areas of Environmental Concern (AECs).[15] Because beach nourishment projects impact these AECs, a CAMA major development permit is required.[16] Before the necessary permit is issued, the proposed project is thoroughly reviewed by DCM and other state and federal agencies to assure the proposed project will comply with all existing applicable CAMA regulations, as well as any other applicable state laws and regulations. The primary purpose of the CAMA review is to assure that all environmental impacts associated with a project have been identified and either minimized, avoided or mitigated. However, DCM cannot require mitigation. Formal mitigation of adverse effects of the project occurs via a permit from the Corps, since mitigation generally is part of the NEPA analysis. However, DCM may establish permit conditions such as monitoring.[17] Furthermore, neither DCM nor the Coastal Resources Commission (CRC) has the authority under North Carolina law to grant leases or licenses to remove sand from ocean or sound waters.

Acquiring the Right to Remove Sand from North Carolina Public Trust Waters

Sands lying underneath coastal and sound waters are State property. N.C. Gen. Stat. §146-64(6) states that:

> "State lands" means all land and interests therein, title to which is vested in the State of North Carolina… and specifically includes all…submerged lands…"[18]
>
> "Submerged lands" means State lands which lie beneath… the Atlantic Ocean to a distance of three geographical miles seaward from the coastline of this State.[19]

[13] 33 U.S.C. §426i.
[14] However, a federal entity would not request a competitive lease sale, since it automatically would be considered a federally authorized project. A state agency or municipality would only request a competitive lease sale if no federal funds were involved, or the sand was not used for a shore protection or beach restoration project. *See* Email from Geoffrey Wikel, Environmental Division, Minerals Management Service (December 16, 2008, 11:30 am EST) (on file with authors).
[15] 15A NCAC 07H .0201 and 07H .0300.
[16] N.C. Gen. Stat. §113A-118(a).
[17] ER 1105-2-100, "Planning Guidance Notebook" (USACE 2000).
[18] N.C. Gen. Stat. §146-64(6).

Therefore, sand lying in coastal waters, within inlets or the sounds, is a State-owned resource.

Obtaining an enforceable legal right to remove sand from State-owned submerged lands requires an easement from the State. Since "sand" is classified as a "mineral,"[20] under N.C. Gen. Stat. §146-8 the State, acting at the request of the Department of Environment and Natural Resources (DENR), is authorized "to sell, lease or otherwise dispose of any and all mineral deposits belonging to the State which may be found in the bottoms of [the] waters of the State." "Waters of the State" would include the waters of the Atlantic Ocean within three miles of the North Carolina coastline. In addition, any DENR grant of rights to remove sand must be approved by the Department of Administration (DOA) and by the Governor and Council of State.[21]

At the present time, DENR has not developed a system to grant legal rights to remove sand for beach nourishment projects. Under existing CAMA rules, when a beach nourishment project is proposed, the applicant must identify a "beach-compatible" sand source[22] sufficient to meet the needs of the proposed project. The project is then evaluated with that source as the borrow site. Assuming all other regulatory requirements are met, a CAMA permit can be issued. While DOA comments on all proposed beach nourishment activities through the CAMA major permitting process, no easement or license for the removal of the sand has been deemed necessary, as the issuance of the necessary CAMA permit has been regarded as sufficient authorization. Additionally, the CAMA permit sets a maximum quantity of sand the applicant may remove from the source identified for the applicant's project. According to DCM, another applicant for another project may remove sand from the same source, so long as that sand source is sufficient to meet the needs of both projects.

At the present time, sand sources in both North Carolina waters and adjacent federal waters have been sufficient to meet local demands for sand for beach nourishment projects. However, in the future, sand sources may become insufficient to meet the needs of communities because of the likely increase in the number of beach nourishment projects due to coastal storms, erosion and sea level rise. Under the existing system, DCM issues a permit to the first local government that identifies a sufficient source of sand and has submitted a completed CAMA major development permit application. Similarly, MMS grants a lease to the first local government to submit its request. If more than one municipality seeks to utilize a sand resource that is insufficient to meet the needs of both municipalities, MMS currently does not evaluate or weigh the relative benefits of awarding the lease to one municipality, as opposed to the other. The sequence of the lease applications would determine which local government would receive the lease.[23] This "first-come, first-served" policy presumes a limitless resource. Since this is

[19] N.C. Gen. Stat. §146-64(7).
[20] N.C. Gen. Stat. §74-49(6).
[21] N.C. Gen. Stat. §146.8.
[22] 15A NCAC 07H .0312.
[23] Minerals Management Service, Marine Minerals Program, "Guidelines for Obtaining Sand, Gravel and Other Non-Energy Mineral Resources from the Continental Shelf," *at* http://www.mms.gov/sandandgravel/ObtainingMarineMinerals.htm.

not the case, the State should consider establishing a process for sand allocation that includes the needs of the natural dynamics of the barrier island system as well as the needs of beach communities.

Potential Loss of Sand to the Barrier Island System

Another prevalent issue concerns sand that may be lost to the barrier island system due to sand mining, whether it is for beach nourishment projects or to maintain North Carolina's navigation channels. In performing its task of maintaining navigation channels within inlets, the Corps removes large quantities of sand each year from channels in North Carolina's waters. Sometimes, this sand is disposed of at unfavorable locations either in federal waters or State waters, which ultimately results in its loss to the beach system in the area from where it is taken.

This practice by the Corps conflicts with current North Carolina law. N.C. Gen. Stat. §113-229 (h1) and §113-229 (h2) state:

> §113-229 (h1): "Except as provided in subsection (h2) of this section, all construction and maintenance dredgings of beach-quality sand may be placed on the affected downdrift ocean beaches or, if placed elsewhere, an equivalent quality and quantity of sand from another location shall be placed on the downdrift ocean beaches."
>
> §113-229 (h2): "Clean, beach-quality material dredged from navigational channels within the active nearshore, beach or inlet shoal systems shall not be removed permanently from the active nearshore, beach or inlet shoal system. This dredged material shall be disposed of on the ocean beach or shallow active nearshore area where it is environmentally acceptable and compatible with other uses of the beach."

Despite this State mandate, the Corps is not required to be consistent with current policies as under the CZMA, federal entities are only required to be consistent with the federally approved components of a State's coastal zone management plan (CMP) to the maximum extent practicable. The NOAA Office of Coastal Resource Management (OCRM), has not approved this language for incorporation into North Carolina's CMP as an enforceable policy since it does not include the "maximum extent practicable" caveat.

The reason the Corps has the ability to dispose of dredged material at an offshore site rather than on North Carolina beaches stems from the Corps' "least-cost mandate." Also known as the Federal Standard, this least-cost mandate was established by the Corps for the dredging activities it undertakes. Under 33 C.F.R. §335.4, the Corps is required to consider all practicable and reasonable alternatives when undertaking operations and maintenance activities. The least-cost mandate specifically includes, "the discharge of dredged or fill material into waters of the US or ocean waters in the least costly manner, at the least costly and most practicable location, and consistent with

engineering and environmental requirements."[24] This mandate often precludes the Corps from disposing dredged or fill material onto North Carolina beaches, since the practice usually is more expensive than the alternative of disposing of it at an offshore site.

Agreements have been reached in the past where the federal government has, when practicable, deposited dredged material on neighboring beaches under a Corps Section 933 project. Section 933 of Public Law 99-662, which was incorporated into the Water Resources Development Act, states that:

> It is Corps policy to participate in the additional costs for placing clean sand or other suitable material, dredged by the Corps during construction or maintenance of federal navigation projects, onto adjacent beaches or near shore waters if the following requirements are met:
>
> (1) The added cost of such placement must be justified by the benefits associated with protection of such beach or beaches. Recreation benefits produced as a consequence of the basic project may exceed 50 percent of total project benefits, but economic justification must be demonstrated on the basis of recreation benefits limited to 50 percent of total benefits.
> (2) The beaches involved must be open to the public.

If the requirements are met, a Section 933 project is considered to be in the interest of the federal government, and a cost share for the complete recommended plan is required. The federal share is 50%, and the non-federal share is 50%. State and local governments can be non-federal sponsors for Section 933 projects.[25]

Even if N.C. Gen. Stat. §113-229 was included as part of the State's federally approved CMP, it is not clear that the Corps would have to act consistently with it. Under the CZMA consistency provision, the directive that federal entities act consistently with a coastal state's enforceable policies to the maximum extent practicable does not require the federal entity to be consistent when Congress, in other federal legislation, has directed that the federal entity specifically perform a particular task in a manner that conflicts with a state's requirements.[26] The Corps asserts that it must use the least cost method of disposing of sand and other materials dredged from navigation channels, and the least cost methods of disposal are the ones it is currently using. The Corps' interpretation of its mandate was the subject of litigation between it and the Carteret County Beach Commission. However, in December 2008, the parties reached a settlement, in which the Corps agreed to re-examine how it disposes of dredged sand as part of its Morehead City Harbor Project. Included in this re-examination, the Corps will

[24] 33 C.F.R. §335.4.
[25] *See* National Oceanic and Atmospheric Administration, Beach Nourishment: A Guide for Local Government Officials, *at* http://www.csc.noaa.gov/beachnourishment/html/human/law/history.htm. *See also, e.g.,* Carteret County Shore Protection Office, Section 933 Project, *at* http://www.protectthebeach.com/933/Phase%20II/section933.htm.
[26] 16 U.S.C. §1456.

prepare a new dredged material management plan for the Morehead City Harbor Project and an associated NEPA analysis.[27] The deadline for completion of these documents is October 31, 2011, and the beach commission has the right to challenge the documents agreed upon in the settlement if the commission does not believe they conform to either North Carolina law or federal law.[28] In the event the Corps is unable to meet this deadline, the beach commission has the right to re-file its lawsuit against the Corps.[29]

Concerns for the Future

In the past, there has been no need to establish any defined legal right to beach-quality sand in State waters. Sand supplies have been adequate for existing projects, and the entities undertaking the projects are generally public. However, if the predictions regarding future sea level rise and beach erosion are accurate, several potential policy issues are presented by the existing regulatory system – issues the OPSC believes should be addressed.

First, demand for beach-quality sand will increase, but the number of sand sources will remain limited. Under the present system, the decision to allow access to the limited supply of sand does not involve any evaluation or determination of whether the use of the sand for a particular beach project is in the best interest of the State and the long-term health of the barrier island system, or is the most cost-effective use of a limited State-owned resource. The evidence presented to the steering committee strongly suggests that, in the future, there simply will be insufficient sand to meet the needs of all communities desiring a beach nourishment project, even if funding is otherwise available. Funds available for beach nourishment projects are not unlimited, and the State will need to prioritize the use of those limited funds. The State will be faced with the difficult choice of deciding what areas to protect and what areas will be left to the effects of natural forces. Mining the cape shoals for sand is a future possibility, but whether these shoals represent ecologically, geologically, hydrologically and economically viable sand sources remains to be determined. These large and complex shoal systems need to be studied extensively prior to any serious evaluation for their use as a sand source for beach nourishment.

Acquiring Legal Rights to Sand Located in Federal Waters

Sand resources located beyond the three-mile limit off North Carolina's coast are in federal waters, including material located in offshore ocean dredged material disposal sites. The OCSLA established a system for granting to public and private entities the legal right to remove sand from federal waters. Under OCSLA, the Secretary of the Department of the Interior has the authority to manage minerals on the OCS located in

[27] Shannon Kemp, "Corps, Beach Panel Resolve Dispute," Carteret County News-Times *at* http://www.carolinacoastonline.com/articles/2008/12/24/news-times/news/doc49511a7ce6320555176888.txt (December 27, 2008).
[28] *Id.*
[29] *Id.*

submerged lands lying underneath federal waters.[30] The administration of these resources has been delegated to MMS, which is a bureau in the department. MMS issues leases for sand, gravel and other non-energy minerals on a case-by-case basis.

The process for leasing sand from the OCS begins with a written request to MMS. Negotiated non-competitive agreements are reserved for federal, state or local government agencies, or their representatives, whereas any person or company with commercial interests may request access to sand on the OCS on a competitive basis. Public Law 103-426[31] allows MMS to negotiate, on a non-competitive basis, rights to OCS sand, gravel or shell resources for shore protection, beach or wetlands restoration projects or for construction projects that are funded in whole or in part by or authorized by the federal government. According to MMS, it has executed twenty-three non-competitive negotiated agreements to date for use of OCS sand in beach nourishment or coastal restoration projects, but none of these have been in North Carolina. MMS is currently working with the Corps on the feasibility and environmental review of the West Onslow Beach and New River Inlet (Topsail) and Surf City / North Topsail Shore Protection projects.

Lease agreements are subject to NEPA and other environmental requirements and are determined on a case-by-case basis. The main difference between the two types of lease agreements is that if all environmental requirements are satisfied, and the applicant is successful in obtaining exclusive leasing rights to specific areas of federally owned submerged lands, a 1999 amendment to OCSLA prohibits MMS from charging federal, state and local government agencies a fee for using OCS sand.[32] In the case of a competitive lease agreement, MMS will circulate the proposed mining operation to other parties who may be interested in bidding on the proposed lease area. Under the competitive lease agreement, affected state governments have the ability to comment on the size, timing or location of a proposed lease sale or with respect to a proposed development and production plan.[33]

Under either leasing format, and prior to conducting any mining activities, a prospecting permit is required by MMS for entities proposing to conduct any prospecting activities on the OCS for marine mineral resources, with the exception of other federal agencies that are encouraged to submit notice to MMS.[34] Environmental review is required to obtain a prospecting permit. Following any prospecting activities, all NEPA and environmental requirements, such as cultural resource surveys and biological consultations, must be satisfied prior to the lease agreement being negotiated between MMS and the applicant. Pursuant to the CZMA consistency provision, affected states review all proposed activities to ensure consistency with their enforceable program policies.

[30] 43 U.S.C. §1334(a).
[31] Codified at 43 U.S.C. §1337(k)(2).
[32] 43 U.S.C. §1337(k)(2)(B).
[33] 43 U.S.C. §1345(a).
[34] *See* 43 U.S.C. §1340(d). *See also* 30 C.F.R. §280.10-280.12.

MMS does not issue long-term leases for the removal of OCS sand for beach nourishment or coastal restoration projects, as contract terms are generated specific to initial construction or subsequent maintenance projects. MMS has not had multiple interests competing for the same resources at the same time. However, the same borrow area has been used by various interests. In those instances, there were adequate quantities of OCS sand available, and requests for these resources are generally staggered, e.g., Sandbridge Shoal offshore from Virginia and Cape Canaveral Shoals offshore from Florida. The current MMS policy is to negotiate on a "first-come, first-serve" basis, balancing need and availability to the maximum extent possible.

MMS strongly encourages that states take the lead on prioritizing sand between various competing communities. MMS would prefer that states take the lead in establishing guidelines and rules for prioritizing and advise MMS, so it can develop leasing policies consistent with states' goals and policies. If a state such as North Carolina develops such goals and policies, then under the CZMA consistency provision, a federal agency such as MMS would need to be consistent to the maximum extent practicable in its own policies relating to the management of similar resources located in federal waters.

RECOMMENDATIONS

Development of a State Comprehensive Plan to Protect Beaches and Inlets

DCM and the NC Division of Water Resources (DWR) are partnering to develop a comprehensive Beach and Inlet Management Plan (BIMP). The BIMP is the State's first attempt at developing a systematic management strategy for its 325 miles of oceanfront barrier islands and up to 22 to 24 active tidal inlet complexes. Creation of the BIMP was a recommendation of the Coastal Habitat Protection Plan (CHPP), which was adopted in 2004, as well as a directive of the General Assembly's 2000 Appropriations Bill.[35] In September 2007, DENR hired an engineering firm to assist with the following tasks over an 18-month period: (1) data identification and acquisition of existing datasets; (2) delineation of beach and inlet management regions; (3) scheduling and facilitation of stakeholder meetings; (4) development of draft beach and inlet management strategies; and (5) preparation of a final report.[36]

Two groups have been established to guide BIMP development: a BIMP advisory committee and a DENR technical work group. The advisory committee includes representatives from federal and state agencies, local governments, academic institutions and non-profit organizations. The technical work group includes DENR agency and federal representatives. The two groups meet periodically to review progress and provide suggestions. Public meetings will be held in each coastal region to share information on the data compiled by this effort and gather input on the delineation of the beach regions and draft management strategies for those regions.

Over the past few years, DCM has discussed the integration of the Corps' regional sediment management (RSM) philosophy into the BIMP. By definition, RSM is a "system-based approach" that seeks to solve sediment-related problems by designing solutions that fit within the context of a regional strategy. RSM is a Corps-wide approach that is being implemented through coordinated activities using several Corps authorities. The State and the Corps recognize the importance of a cooperative relationship for successful implementation of both the BIMP and RSM. The re-authorization of the Water Resources Development Act in 2007[37] gave the Corps authority to implement RSM within its programs and operating framework. Basing the BIMP on an RSM philosophy will adapt traditional, stand-alone project management techniques to a systems-wide, holistic approach dictated by coastal processes and sediment resource distribution. Ultimately, the placement of sediment management projects into a regional framework will allow for a more efficient and cost-effective method of resource conservation and management.

[35] *See* H.B. 1840 §13.9c (2000).
[36] N.C. Division of Coastal Management, N.C. Beach and Inlet Management Plan, *at* http://dcm2.enr.state.nc.us/bimp.htm.
[37] Water Resources Development Act, Pub. L. 110-114, 121 Stat. 1041 (2007).

The steering committee supports the work of DCM and DWR in its goal to develop a BIMP and integration of the Corps' RSM philosophy. The RSM effort of the BIMP and the Corps will be key to inventorying the State's sand resources, particularly mapping sources on the cape shoals as these areas are not adequately mapped, and that the physical processes by which they were established and are maintained are not fully understood.

Identification of Available Sand Sources

The steering committee recommends that the State conduct additional studies to determine where acceptable sand sources are located and the amount of sand available from each potential source. In particular, further evaluations (ecologic, geologic, hydrologic and economic) should be conducted of the sand sources of the cape shoal structures of North Carolina, which are potentially significant sources of sand available to meet the long-term needs of North Carolina's coastal communities. Since the NC Mining Commission does not require permits for the mining of beach sand and defers permitting authority to DCM, the steering committee recommends that the cape shoals system be managed under the CRC's submerged lands mining regulations at 15A NCAC 07H.0208(12).

Establishment of a System of Legal Rights to State-Owned Sand Resources

In light of the possibility of adjoining municipalities competing for sand resources, the steering committee recommends the development of a process for granting public entities easements to State-owned sand deposits. Establishing such a process would assure both the permitting authority and communities that the sand necessary for a long-term beach nourishment projects would be available. This process should be developed in conjunction with priorities for sand resources.

Easements for offshore sand resources should be limited to public entities for use in connection with beach nourishment projects in which the entity is an identified sponsor.[38] The steering committee is concerned that private entities may attempt to acquire legal rights to sand sources in state waters for the purpose of selling the sand, at a profit, to communities engaged in beach nourishment projects. It is the steering committee's view that sand resources are held in public trust and should be utilized as a public resource for the protection and preservation of North Carolina's public beaches.

The terms of the easement should allow for modification of its terms and potential identification of alternative sand sources available to account for storms and other events creating emergency needs for a particular beach community; and to allow the State to

[38] One potential option, however, is to make an exception in cases similar to that of Figure Eight Island, which is a private beach community. In this situation, the homeowners association (HOA) would be the applicant for a beach nourishment project. Although a private entity rather than a public or government entity, the HOA's application would be for the benefit of the entire island community. It is in situations such as this when an easement could be granted to a non-public entity because the sand would benefit a community and not be used to make a profit.

determine that it is in the public's best interest of the state to allow a community immediate access to the sand source.

Development of a Coastal Vulnerability Index

The natural course for many areas along the sediment-poor island segments of the North Carolina coast is that, without nourishment, some barrier island segments will be inundated in the future if sea level continues to rise. This problem can be exacerbated by storm surge associated with hurricanes and nor'easters. The steering committee recommends that the State develop a coastal vulnerability index (CVI) to provide an understanding of the hazards associated with current and future coastal conditions. A CVI could support the State in establishing beach nourishment priority areas and would be a prudent tool to inform property owners of the potential dangers of oceanfront living. While the US Geological Survey (USGS), North Carolina Geological Survey (NCGS) and scientists within academic communities (e.g., Pilkey, et al., 1980; 1998; Riggs and Ames, 2003; in press) have all created CVIs that cover the North Carolina coast and are based on studies of barrier island geomorphology,[39] the steering committee recommends developing a State-level index that is of high resolution and includes economic data for coastal area development in an effort to provide a clearer picture of the particular areas of vulnerability along the coast. A State-level index is needed because USGS and NCGS indices utilize a larger scale (one kilometer cells) thereby generating a coarser resolution of state resources and environments.

A CVI can be used as a tool to help differentiate areas according to their level of vulnerability and provide a suite of potential options, from beach nourishment to relocation. By utilizing a State-level CVI, coastal management policies and priorities can be developed to better assess the risks from coastal hazards, and to evaluate options and alternatives for community response to sea level rise. An important question is whether emphasis would be placed on investing money for beach nourishment in the most vulnerable areas, or whether sand allocation would be advocated for areas with the lowest vulnerability to create an incentive for development in those areas and perhaps a disincentive for development in highly vulnerable areas. The application of a CVI as a tool for coastal communities to use as they make decisions on options for managing shoreline erosion could be further developed as part of the BIMP. In addition, a CVI could be a tool to address other concerns, such as managing multiple uses in North Carolina's coastal waters, such as commercial and recreational fishing, dredging for sand for beach nourishment and wind energy projects in coastal waters.

The steering committee recommends that the BIMP should incorporate priorities for sand resource allocation, with input from stakeholders. A determination should be made which barrier islands, or portions of barrier islands, are most vulnerable to damage from storm events; which are most likely to be adversely impacted by sea level rise; and which are most likely to need nourishment projects during the next 50-100 years. The priorities for allocating limited State-owned sand resources for beach nourishment

[39] North Carolina Geological Survey, "A Pilot Study to Assess Relative Risk to Oceanside Overwash Along the North Carolina Coastal Barrier Island System," December 2006.

projects should take into consideration economic costs and benefits, and the feasibility of long-term protection for affected areas. The plan also should take into consideration that, under the CZMA consistency provision, the priorities established also would apply to the leasing of sand located on the OCS by MMS.[40] Allocations should not be permanent, but should be long-term, and leases should be dependent on beach nourishment cycles to allow for flexibility in any sand allocation plan. Furthermore, leases should include flexibility in the event of an emergency situation, such as a hurricane or nor'easter.

Incorporation of a Sea Level Rise Component to CAMA Land Use Plans

According to the Intergovernmental Panel on Climate Change (IPCC), the impacts of climate change will be felt across the entire globe and North Carolina's coast will experience some of these impacts. Although the numbers vary, relative sea level rise could have a dramatic impact on the North Carolina coast. Sea level has been rising at a rate between 16 and 18 inches per 100 years. This present rate has substantially increased from an average rate of three inches per 100 years for several thousand years prior to 1800 AD.[41] However, North Carolina's coast is not only vulnerable to sea level rise, but also to coastal storms that severely exacerbate shoreline erosion and put life and property in danger. North Carolina's sandy beaches play an important role when tropical systems impact the coast, as they absorb wave energy, even as strong waves erode the shoreline. Moreover, in North Carolina's highly dynamic coastal system, shoreline erosion is a natural process in response to rising sea level and is a basic component of "short- and long-term coastal evolution."[42]

Given the complexities regarding coastal erosion and the possible effects of rising sea levels, the steering committee recommends that the CRC add a sea level rise component to its CAMA land use plan guidelines. Specifically, this component should include a characterization of how local governments will address the relocation of oceanfront structures should sea level rise continue at its present rate or at an increased rate. Such a component would allow for relocation buyout programs, and other adaptations to sea level rise to be discussed by local governments as part of their land use plans.[43] Even an understanding that there is nowhere within a municipality to relocate structures would highlight unavoidable tax base losses that would result from relocation.

Disclosure of Natural Hazards for Coastal Real Estate Purchases

A major concern for North Carolina's coastal communities is the threat from natural hazards. It is critical to ensure that potential property owners are knowledgeable

[40] Provided these standards are approved as enforceable policies by the NOAA Office of Ocean and Coastal Resource Management.
[41] Riggs, S.R., et al., 2008.
[42] Riggs, Stanley R. and Dorothea Ames, *Drowning the North Carolina Coast: Sea Level Rise and Estuarine Dynamics*, 2003, pg. 15.
[43] Similar issues are addressed peripherally in the hazards requirement for land use plans (*see* 15A NCAC 07B .0702), but the committee recommends that sea level rise should be a stand-alone section in CAMA land use plans. Relevant issues that the land use plans could address are where to go if there is a need to retreat, such as transition from barrier island to the mainland.

and aware of the risks they assume when purchasing coastal real estate. Disclosure of natural hazards for real property is not required in North Carolina, despite several legislative attempts to incorporate this requirement. The most recent attempt was in 2007 with H.B. 1628 that called for "reasonable notice" of coastal hazards to prospective purchasers of coastal property prior to acquisition. The bill would have required the CRC to file with the clerk of court in each county a notice with a description of coastal hazards in that county, which would have included areas designated as AECs. The bill also would have required sellers of coastal real estate[44] to prepare a coastal hazards disclosure statement (a form that would have been provided by the CRC at no cost to the seller) to each prospective purchaser of the real property. A majority of the steering committee recommends that the General Assembly reconsider a similar bill. However, it is important to note that the steering committee did not unanimously agree to this recommendation.

Comprehensive Management of Inlet Tidal Delta Sand Sources

Inlet tidal deltas (ebb-tide and flood-tide; ocean and estuarine side, respectively) are an important component to the health of the barrier island system. While large quantities of beach compatible sand located in inlet deltas are attractive, lower cost sand sources for beach nourishment projects, allowing excessive mining of inlet tidal deltas destabilizes the associated inlet, diminishes the quantity of sand available to the backside of barrier islands and interrupts the natural deposition-erosion dynamics on adjacent barrier islands. Destabilization of inlet deltas can result in the increased erosion and narrowing of adjacent barrier islands. It is the steering committee's recommendation that additional studies of inlet tidal deltas should be conducted to assist the CRC in developing policies and rule language concerning where excavation may occur within these areas, and what are the appropriate limits on the total volume of sand removed.

Preventing Loss to the Barrier Island System of Sand in Inlet Channels

Due to the scarcity of beach-quality sand, the steering committee supports efforts of the State to assure that none of this valuable resource is lost from the barrier island system. The steering committee also notes that dredged sand re-deposited in federal waters, is no longer owned by the State. Rather, ownership and control of the sand passes to the federal government. The steering committee supports the BIMP in its efforts to address this issue and recommends that the State continue to work with NOAA's Office of Ocean and Coastal Resource Management and the Corps to incorporate N.C. Gen. Stat. §113-229 (h1) and (h2), preventing dredged materials from being removed from the near shore beach system, as a component of the State's federally approved CMP.

[44] The bill would apply to all properties adjacent to an ocean shoreline, as defined in N.C. Gen. Stat. §113A-115.1(a)(1) and all properties located along shorelines in areas designated inlet hazard areas.

Amendment to Rules Regarding Dredging Around Hard-Bottom Areas

Currently, rule language exists preventing dredging activities within a 500-meter buffer of significant biological communities, such as high relief hard bottom areas, to minimize impacts to these productive marine areas. Under this rule language "high relief" is defined as relief greater than or equal to one-half meter per five meters of horizontal distance.[45] This rule language was crafted as a result of the 1994 management study coordinated by DCM and North Carolina Sea Grant.

Recently the steering committee heard a presentation by Dr. Larry Cahoon of UNC-Wilmington on his research related to the foraging characteristics of reef-associated fish species and other marine life. Dr. Cahoon's research suggests that there is a "halo" for re-suspended materials around hard-bottom communities within which reef-associated fish species derive a significant portion of their nutritional requirements.[46] A sufficient buffer area around hard-bottom communities is therefore necessary to preserve the role of benthic microalgae as primary producers for reef-associated fish.[47] This halo is estimated to be a distance of 500-meters out from an exposed hard-bottom community.[48]

As a result of the research presented by Dr. Cahoon, the steering committee recommends that CRC rules concerning dredging around hard-bottoms areas (15A NCAC 07H.0208(b)(12)(A)(iv)) be amended to include not only high-relief hard-bottom areas, but rather all hard-bottom areas, including those that are periodically buried with thin, ephemeral sand layers. The 500-meter buffer falls in line with the CRC's existing buffer requirements for high-relief areas and the steering committee recommends that the Commission consider a similar distance.

Development of a "Worst-Case Scenario" State-Level Planning Document

In the event sea level rise progresses at a rate that would make it unwise and uneconomical to continue to maintain certain areas and infrastructure on threatened barrier island segments, or a major storm event were to cause catastrophic damage to the coast, the steering committee recommends development of a "worst-case scenario" State-level planning document that would establish general policies and guidelines for identifying which areas and infrastructure may no longer be supported through public funds. The steering committee recommends that the State prepare a set of coastal barrier island maps that show specific barrier island segments that may be endangered by major storm events and various predicted levels of sea level rise. It is also recommended that policies be developed to determine which areas will be eligible for beach nourishment

[45] 15A NCAC 07H .0208(b)(12)(iv).
[46] *See* Lindquist, D.G., L.B. Cahoon, I.E. Clavijo, M.H. Posey, S.A. Bolden, L.A. Pike, S.W. Burk, and P.A. Cardullo. 1994. Fish stomach contents and prey abundance on hard and soft substrata associated with adjacent artificial and natural reefs in Onslow Bay, North Carolina. Proceedings of the Fifth International Conference on Artificial Habitats for Fisheries, Bulletin of Marine Science 55:308-318. *See also* Thomas, C.J., and L.B. Cahoon. 1993. Stable isotope analyses differentiate between different trophic pathways supporting rocky-reef fishes. Marine Ecology Progress Series 95:19-24.
[47] *See id.*
[48] *See id.*

projects or other measures to protect the coastal infrastructure when sea level reaches a predetermined level. This planning document should be developed by academic institutions with scientific expertise and include the input of multiple agencies, such as DENR, DOA and DOT. These maps would be similar to those used by the federal government for administration of the Coastal Barrier Resources Act.

The committee also supports the use of this document as a basis for a coastal hazards mitigation fund that could be established to provide grants to cover a portion of any buyouts, and recommends that this use be studied as a component of the larger planning document.

CHAPTER 2

OCEAN-BASED ALTERNATIVE ENERGY

As the US looks to decrease its dependency on fossil fuels, interest has grown in developing alternative energy sources such as solar and wind energy. The most recent indication of this is in the Energy Policy Act of 2005, which encourages development of alternative sources of energy as part of a national strategy to make the US more energy-independent. Part of this strategy includes ocean-based alternative energy development, which includes harnessing the power of the ocean itself through currents and waves, as well as capturing the constant flow of ocean winds as a potential alternative to traditional fossil fuel-based energy sources.

"Ocean energy," a term used to describe renewable energies, including wave, current and tidal energies, is a type of hydropower. In the US, hydropower projects onshore are currently regulated by the Federal Energy Regulatory Commission (FERC), pursuant to the Federal Power Act[49] (FPA). Additionally, such projects may be subject to regulation by the Corps and various state-level agencies, depending on the scope of the project.

The major impediments to siting ocean-based alternative energy facilities include: regulatory uncertainties; finance issues; environmental concerns; technological constraints; the ability of the national electrical grids to handle and distribute surplus energy generated by wind turbines; and potential user conflicts.[50] The various alternative energy technologies that may be employed off the coast of North Carolina are addressed in this chapter.

WIND ENERGY

One form of ocean-based alternative energy is wind. Ocean-based wind facilities have been proposed off the coasts of Massachusetts (Cape Wind)[51] and Delaware (Bluewater Wind).[52] Other states, such as New Jersey and Rhode Island, also have efforts regarding wind energy development off their coasts. New Jersey has adopted a renewable energy incentive program[53] and an offshore wind rebate program for the

[49] 16 U.S.C. §791 et seq.

[50] *See, e.g.* "Wind Energy Bumps Into Power Grids Limits," The New York Times (August 27, 2008) (hope of replacing fossil fuels is bumping into a power grid that can not handle the new demands).

[51] In 2001 Energy Management Inc (EMI) proposed a 130-turbine wind field in Nantucket Sound about nine miles from shore. Construction may begin in 2010 or 2011. Geotimes, "The Wind over the Waves: Is offshore shore wind power the renewable energy of the future" (April 2008).

[52] In 2006, Bluewater Wind proposed a large-scale wind farm to be located 17 kilometers (approximately 11 miles) off the coast of Delaware. If the company obtains all the necessary permits, it could be functional by as early as 2013. Geotimes. A June 24, 2008 Washington Post article describes the project as larger than earlier descriptions, stating that the project will consist of 150 wind turbines and generate 600MW. "Agreement Reached on Del. Wind Farm," The Washington Post (June 24, 2008).

[53] New Jersey Board of Public Utilities, "Renewable Energy Incentive Programs," *at* http://www.njcleanenergy.com/renewable-energy/programs/programs.

installation of meteorological towers,[54] as well as awarded a $4 million grant to Garden State Offshore Energy for a 345.6 MW offshore wind facility to be tentatively located 16 miles southeast of Atlantic City.[55] In Rhode Island, interest in wind energy development in coastal and offshore waters will likely rise due to the state's high renewable energy portfolio standard (16% by 2020).[56] To help meet this goal, Governor Donald Carcieri announced in September 2008 that the company Deepwater Wind was chosen to construct a wind energy project off Rhode Island's coast.[57] The project will provide an estimated 1.3 million MWh per year, which would amount to approximately 15% of the electricity used in the state.[58]

The importance of the Cape Wind project cannot be understated, as the original project proposal came at a time when both state and federal regulatory frameworks did not exist that would allow such a facility to be permitted. As a result, the Cape Wind project has been subjected to years of state and federal environmental review. The project has gone through a comprehensive environmental permitting process by seventeen federal and state agencies, under the National Environmental Policy Act and the Massachusetts Environmental Policy Act. As a result of this intensive review, the project has gained the support of national and regional environmental, health, labor and citizens advocacy groups, and furthermore, the project may serve as a regulatory foundation/example for how future ocean-based wind turbine facilities will be sited.

A major distinction between the Cape Wind and Bluewater Wind projects is that while the Massachusetts project was the first marine-based wind facility proposed in the US, the Delaware project represents the first wind energy project proposed for open Atlantic Ocean waters. While both projects represent an important stepping-stone in the lineage of US policy decisions surrounding the permitting and siting of ocean-based wind facilities, the harsh environmental conditions of the open ocean present a unique set of considerations for state's looking to site facilities in similar locations. Previous attempts to site wind turbines in the open ocean, such as the one proposed by the Long Island Power Authority (LIPA),[59] failed due to high construction costs and hazardous environmental conditions.[60] The projected cost of the LIPA project was $150 million

[54] New Jersey Board of Public Utilities, "Board Order on Offshore Wind Rebate Program for the Installation of Meteorological Towers," *available at* http://www.njcleanenergy.com/files/file/Board%20Orders/11-21-08-8A.pdf.
[55] New Jersey Board of Public Utilities, "Board of Public Utilities Approves Grant of $4 Million for Offshore Wind Project Proposal," *available at* http://www.njcleanenergy.com/files/file/Press%20Releases/20081003.pdf.
[56] *See* R.I. Gen. Laws §39.26.4.
[57] State of Rhode Island, "Carcieri Names Deepwater Wind as Developer for Rhode Island's Off-Shore Wind Farm," *at* http://www.ri.gov/press/view.php?id=7202.
[58] *See id.*
[59] In 2005, the Long Island Power Authority proposed a 40-turbine farm in federal waters, anticipating it would be operational by 2009. Geotimes, "The Wind over the Waves: Is offshore shore wind power the renewable energy of the future" (April 2008).
[60] Walter Brooks, "Long Island Offshore Wind Farm Scuttled: Cape Wind predicted this outcome 4 years ago, " Cape Cod Today (August 24, 2007), *at* http://www.capecodtoday.com/blogs/index.php/2007/08/24/long_island_offshore_wind_farm_scuttled?blog=109.

when the project first got underway in 2003, but eventually ballooned to $700 million by the time the LIPA decided to cancel the project.[61] Additionally, the LIPA project met design limitations due to the fact that localized sea conditions in the proposed project area were "three times that of associated state-of-the art offshore wind projects." [62]

Despite the limitations and in-depth review surrounding past projects, some coastal states are attracted to wind not only as a potential alternative energy source, but also as a potential generator of royalty revenues earned from the leasing of State-owned submerged lands. For example, Texas has issued leases to its submerged lands to several different companies, each of which has plans to construct wind energy facilities in state waters. [63] Despite projections for having some of these proposed facilities online by 2009, no wind turbines have been placed in Texas waters. Texas has also indicated interest in entering into more leases, but is having trouble doing so due to recent hurricane activity in the Gulf of Mexico.[64]

Technical issues also surround the installation of ocean-based wind turbines. Specifically, turbine placement in ocean waters is limited by depth. Evidence for this claim is apparent in the projects off Massachusetts and Delaware discussed above, which are proposed for marine locations that are relatively near to the shore. The reason for this is that current technologies only allow wind facilities to be sited in waters 20-meters in depth. Current technologies conceivably would allow wind turbines to be sited in waters up to 30-meters or more in depth,[65] However it is prohibitively expensive to construct the foundations for, and to locate facilities in, water deeper than 20-meters.[66] Of the approximately 1,470 MW of wind energy produced from projects offshore in Europe, most of these turbines have been constructed in waters that are less than 20-meters in depth.[67] This technological dependency on depth provides an interesting requirement for facilities to be located off the North Carolina coast. At times, the 20-meter depth cutoff limits potential wind turbine locations to State waters. For example, in the area of Nags

[61] *Id.*
[62] *Id.*, quoting Cape Wind President Jim Gordon.
[63] On October 23, 2005, 11,000 acres in the Gulf of Mexico was leased to Galveston Offshore Wind, a division of Wind Energy Systems Technologies (WEST). The Associated Press, "Texas Plans Offshore Wind Farms," November 7, 2005. In October 2007, WEST purchased four additional offshore wind leases in the Gulf. *See* Geotimes, "The Wind over the Waves: Is offshore shore wind power the renewable energy of the future" (April 2008).
[64] Peter Fairley, "Wind Power That Floats," Technology Review, *at* http://www.technologyreview.com/energy/20500/?a=f (April 2, 2008).
[65] Geotimes, "The Wind over the Waves: Is offshore shore wind power the renewable energy of the future" (April 2008) ("supports used to anchor turbines… have only been designed for use in shallow waters no deeper than about 30 meters").
[66] Floating turbines are being designed and tested and may provide a solution to locating turbines in deep-water areas. In October 2008, New Jersey approved a project, if built, would be located 16-20 miles off the coast in waters 100 feet deep (approximately 30 meters). The company behind the project plans to use the same technology as used to build oil and gas rigs in the Gulf of Mexico. Ken Belson, "Huge Offshore Wind Farm Wins Approval," The New York Times (October 3, 2008).
[67] *See* Wind Service Holland, "Off- and Nearshore Wind Energy: Operational Projects," *at* http://home.wxs.nl/~windsh/offshore.html (accessed February 2, 2009).

Head, the 20-meter line is at times within three miles of the shore. In other areas along the coast, the 20-meter depth boundary is approximately 10-15 miles offshore.[68]

There are other substantial practical, technological and economic factors that make significant development of wind turbine facilities difficult. First, there is currently a limited supply of the construction equipment required to build a large number of wind turbines.[69] As a result, large-scale production efforts and an immediate dividend from marine-based wind energy would be a challenge. Secondly, construction, operation and maintenance costs of water-based wind facilities are double that of terrestrial applications.[70] Third, the cost of wind energy development in coastal or ocean waters is still not competitive with their land-based counterparts. For example, the projected cost of one MW of electricity generated by the Cape Wind project is $122, as opposed to $66 for existing traditional land-based facilities.[71] Unless oil prices rise as they did in the summer of 2008, the difference in cost may be greater. One final hindrance to large-scale wind energy facility production is that it is unclear how continued market uncertainty and falling oil prices will inhibit investment in expensive offshore wind development[72] or how they may make it more difficult to find financial backers for wind energy projects. Additional government subsidies and tax credits could provide some incentives to direct capital into offshore projects, but the lower costs of land-based wind energy may prove more attractive. In fact, the US already has begun to see a shift in preference to terrestrial applications as exampled by one company in Texas that abandoned its submerged lands leases in the Gulf of Mexico and moved its energies and efforts to developing a land-based wind facility.[73]

Based on the information available for existing and proposed ocean-based wind projects, there should be an examination of a number of characteristics that, when employed in North Carolina's coastal and ocean environments, would generate difficulties or barriers to the instillation of a marine application. First and foremost,

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[68] North Carolina Wind Stations and Nearshore Bathymetry. [computer map]. 1:3,000,000. Department of Marine Sciences [GIS data files]. Chapel Hill, N.C.: UNC Chapel Hill, 2008. Using ArcGIS [GIS software]. Version 9.2. Redlands, CA: Environmental Systems Research Institute, 1992-2008. According to the bathymetry map from the UNC Department of Marine Sciences, the offshore 20-meter and 30-meter depth lines meander off the coast of North Carolina so the distance from shore is not uniform.

[69] Peter Fairley, "Wind Power That Floats," Technology Review, *at* http://www.technologyreview.com/energy/20500/?a=f (April, 2, 2008).

[70] Geotimes, "The Wind over the Waves: Is offshore shore wind power the renewable energy of the future" (April 2008) ("cost can be 50 to 100 percent higher for offshore than onshore").

[71] Geotimes, "The Wind over the Waves: Is offshore shore wind power the renewable energy of the future" (April 2008). In 2008, the Long Island Power Authority released a study concluding over a 20-year period the cost of building and connecting its proposed 40-turbine offshore facility would cost consumers an extra $66 million per year.

[72] "A Few Snags, but Hopes Are Still Hill for Offshore Wind in Texas," The New York Times (October 10, 2008) (WEST is still looking for investors for its proposed 62-turbine farm that would be located off the coast of Galveston, having recently lost two investors, Lehman Brothers and Wachovia, as a result of the 2008 financial downturn.)

[73] *See* Reuters, "Bluewater to work with Delaware on wind farm (November 12, 2007), *at* http://uk.reuters.com/article/environmentNews/idUKN0823936520071112.

turbines are expensive to construct – in the range of $1 billion to $2 billion.[74] Also, turbines occupy a large water area, in the range of 30 square miles,[75] which means that other uses will no longer be able to occupy the substrate, water column or air space in areas where turbines are installed. This segregation of space generates a higher potential for user conflicts, and significant consideration will have to be given to impacts turbines may have on competing biological, commercial and recreational uses. It is highly possible that these competing uses will restrict the permitting of wind facilities, as they will have higher priority for enhancement or protection that has been previously awarded by the State. For example, critical habitats, artificial reefs and significant archaeological resources will have to be avoided. Furthermore, applications or uses characterized by a more mobile or transient characteristic, such as shipping lanes and military air space, must be avoided.

Thirdly, as current technologies and economics relegate turbines to waters no deeper than 20 meters, the facilities will therefore be visible from shore. Another consideration, and perhaps the most significant for North Carolina's coastal climate, is that current technology requires facilities to be sheltered from extreme ocean wave action and storms.[76] Consequently, the risk of tropical storms, hurricanes and nor'easters makes coastal and offshore North Carolina a less than optimal location.

In an effort to encourage development of alternative energy resources a number of states have implemented a variety of ocean-based energy initiatives within their borders. For example, with the passage of its Energy Act in 2006, Florida created a host of incentives to promote alternative energy technologies. These include the Renewable Energy Technologies Grants Program, Solar Energy System Incentives Program and a tax-free event for energy-efficient items.[77] The grants program provides matching funds for projects that relate to renewable energy from a fund of $12.5 million. In its first year, the program funded eight projects, including two wind energy projects.[78] All of these programs provide incentives to private parties, as well as to government agencies to develop and utilize these energy resources. Similarly, California has an incentive-based program.[79] However, neither state currently has incentive programs for prospective projects to utilize ocean energy. Instead, California has exclusive grant programs only for wind energy and solar energy. The state has an array of other grant / incentive programs that could potentially include ocean energy projects, but no funding is

[74] The Cape Wind project is estimated to cost $2 billion. The Bluewater Wind project to be located off the coast of Delaware is estimated to cost 1.6 billion dollars. Reuters, "Bluewater to work with Delaware on wind farm (November 12, 2007), *at* http://uk.reuters.com/article/environmentNews/idUKN0823936520071112.

[75] The Cape Wind project area is described as in the company's Draft EIS/Eir/DRI, p. 1-4, as "24 square miles" which is slightly smaller than the original "28 square miles." *Id.*

[76] *See* Cape Cod Today, quoting Mark Rodgers, Communications Director of Cape Wind, explaining why Horseshoe Shoal in Nantucket Sound was picked as the location for the Cape Wind project.

[77] Information about these programs is available at the Florida Energy Office of the Governor's Office of Energy and Climate Change *at* http://www.dep.state.fl.us/energy/.

[78] Other projects that received funding related to solar energy, biodiesel fuel, and ethanol production. *See* http://www.dep.state.fl.us/energy/energyact/grants.htm.

[79] Information about the different incentive programs is available at the California Energy Commission's website *at* http://www.energy.ca.gov/renewables/index.html.

exclusively dedicated to ocean-based energy. Similarly, Florida has dedicated funding to support solar energy and bio-fuels, but not ocean-based energy.

Despite the challenges water-based wind energy projects face, North Carolina does have significant wind resources. According to the wind resources mapping project conducted by TrueWind Solutions LLC for the North Carolina State Energy Office, North Carolina has significant wind resources along the Outer Banks.[80] Wind facilities potentially could be constructed in sounds, state coastal waters, or in federal ocean waters. Since these wind projects would include placing permanent structures in public trust waters, then federal permits, State permits or perhaps both will be required for construction, operation and maintenance of the facility. Wind facilities, however, do not include only the wind turbines and platforms, but also transmission cables to route energy offshore to land. Therefore, land-based substations, dredging and construction activities, among others, will be required to connect produced energy to the national grid.[81] Therefore, even if a wind energy facility is sited in federal waters off the coast of North Carolina, it is likely that State easements and regulations will apply during the transmission of energy.

[80] NC Solar Center, Coastal Wind Initiative, *at* http://www.ncsc.ncsu.edu/programs/The_Coastal_Wind_Initiative.cfm.

[81] To learn more about how a wind turbine works, visit the Department of Energy, "How Wind Turbines Work," *at* http://www1.eere.energy.gov/windandhydro/wind_how.html. To learn more about how an offshore wind facility works, visit British Wind Energy Association, "How An Offshore Wind Farm Works," *at* http://www.bwea.com/offshore/how.html.

WAVE ENERGY

Wave energy is a term used to describe the electrical energy that can be harvested from ocean waves. Waves possess a great amount of energy that can be extracted from either the motion of the wave's surface or the pressure beneath the surface. There are several devices that can be used to transform the potential energy of the wave into electrical energy.

- **Terminator Devices** are placed vertically in the water. These devices use the changes in pressure beneath the surface of a wave to power a turbine to generate electricity. These devices are suitable for use in shallows, where they are attached to the sea floor, or in deeper waters, where they are attached to a floating grid.

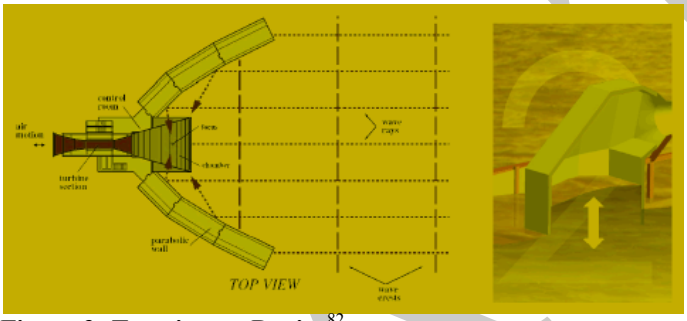

Figure 3: Terminator Device[82]

- **Overtopping devices** operate similarly to dams. They are large reservoirs, constructed to trap incoming waves. The water level within the reservoir eventually rises above the level of the surrounding water. It is then released and as it falls down to the level of the surrounding water, it powers hydroelectric turbines.

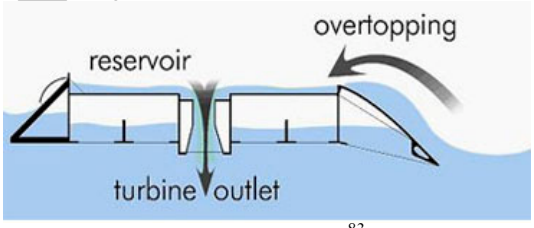

Figure 4: Overtopping Device[83]

[82] Image courtesy Minerals Management Service, Renewable Energy and Alternate Use Program, "Technology White Paper on Wave Energy Potential on the US Outer Continental Shelf, *at* http://ocsenergy.anl.gov/documents/docs/OCS_EIS_Whitepaper_Wave.pdf.

[83] Image courtesy of The Carbon Trust, *at* http://www.carbontrust.co.uk/technology/technologyaccelerator/Wave_devices.htm.

- **Attenuators** are long, segmented cylinders which rest atop the water's surface, perpendicular to the shoreline. As waves pass beneath the cylinders, the differing wave heights cause the segments to flex. This flexing motion activates a hydraulic pump, creating electricity.

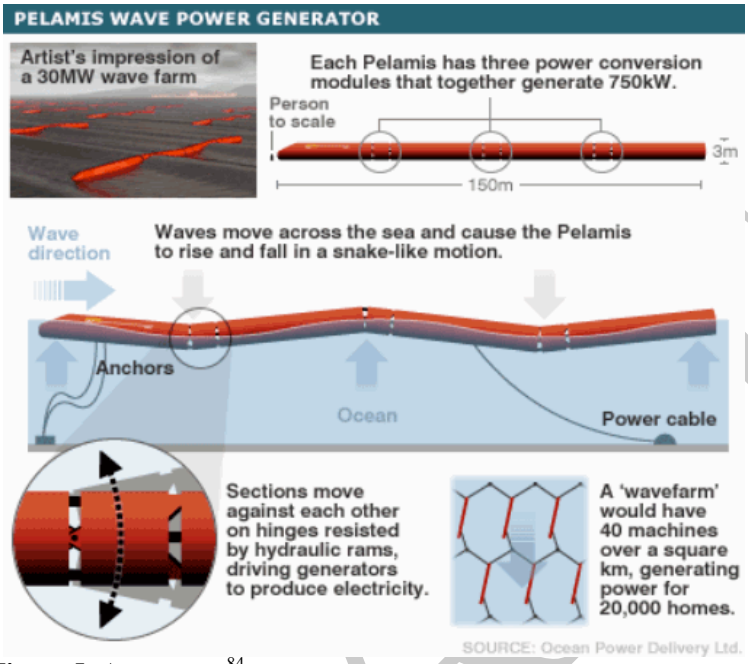

Figure 5: Attenuator[84]

[84] Image courtesy of Pelamis Wave Power, *at* http://www.pelamiswave.com/index.php.

- **Point Absorbers** consist of a fixed outer cylinder and a mobile inner buoy. They are placed vertically in the water. As the wave passes, the changing pressure causes the buoy to rise or fall within the fixed cylinder. The movement of the buoy powers an energy converter.[85]

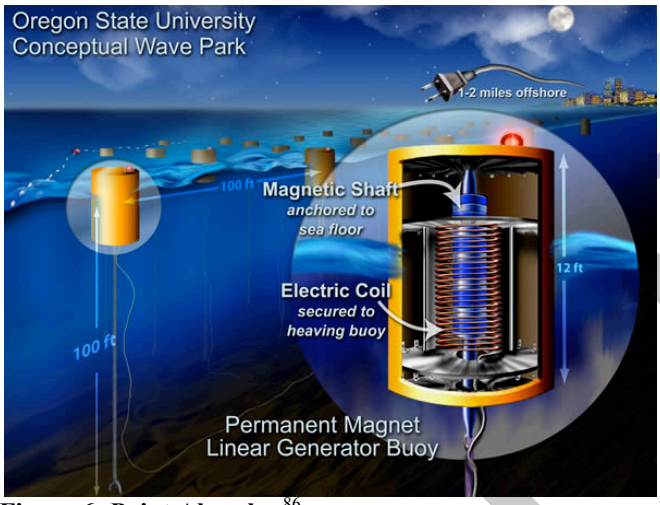

Figure 6: Point Absorber[86]

Terminator devices, for example, are placed vertically in the water, and these devices use changes in pressure beneath the surface of a wave to power a turbine and generate electricity. These devices are suitable for use in shallow waters, where they are attached to the sea floor, or in deeper waters, where they are attached to a floating grid. Additional devices include overtopping devices constructed to trap incoming waves; attenuators, which rest atop the water's surface, perpendicular to the shoreline; and point absorbers placed vertically in the water to react to the changing pressure of passing waves.

Despite the variations in water column or surface placement, each of these technologies will have similar issues and use considerations when sited in the State's coastal environment. While energy facilities may be capable of extracting large amounts of renewable energy, the installation and removal of these facilities must be undertaken with care as their use has the potential to produce adverse environmental impacts. For example, the impact these facilities will have on shipping, boating and other marine uses must be researched and anticipated. MMS has suggested that reduction in wave height,[87]

[85] These descriptions are adapted from Minerals Management Service Renewable Energy and Alternate Use Program, "Technology White Paper on Wave Energy Potential on the US Outer Continental Shelf, *at* http://ocsenergy.anl.gov/documents/docs/OCS_EIS_Whitepaper_Wave.pdf. The white paper itself contains more detailed descriptions of these technologies, as well as energy output estimates.

[86] Image courtesy Oregon State University Wallace Energy Systems and Renewables Facility, *at* http://eecs.oregonstate.edu/wesrf/.

[87] Reduced wave height is cited as a consideration in only certain circumstances, e.g., effect on recreational surfers, and is described as a potential "isolated impact" as a result of wave energy conversion devices. However, this impact would be observed only one to two km away from the wave energy converter in the

noise and spatial conflicts with shipping lanes or fisheries are potential negative impacts of any wave energy facility.[88] However, the facilities may also provide habitat for marine life in years following installation.[89]

States such as Oregon and Hawaii already have begun adding wave energy technologies to their state energy portfolios and are leading the way in wave energy research. For example, Oregon State University's Wallace Energy Systems and Renewables Facility has been researching the feasibility of large-scale wave energy facilities since 1998.[90] Additionally, the State of Oregon is involved in a public-private partnership with the People of Oregon for Wave Energy Research (POWER) in order to develop a wave energy facility on the Oregon coast.[91] A 2004 survey of potential wave energy sites identified seven locations along the Oregon coast that would be capable of supporting a 1500 MWh annual output wave energy facility. The survey also found these sites could support a transition from 1500 MWh to 300,000 MWh output annually from a commercial facility.[92] Oregon has two energy plans that it is implementing that look to increase renewable energy usage in the public and private sectors. These are the State's 2007-2009 Energy Plan[93] and a Renewable Energy Action Plan[94] supervised by the Renewable Energy Working Group, a collaboration involving the Oregon Department of Energy and the Governor's Office.

Hawaii has been a testing wave energy technology since 2004, and the State's alternative energy objectives include increasing indigenous energy production and reducing greenhouse gases.[95] Hawaii has also created Renewable Portfolio Standards that require electric utilities to derive 20% of their energy from renewable resources by 2020.[96] The Hawaii Legislature has introduced two bills that could provide $20 million to support a three-turbine wave energy site proposed for the waters off the north coast of Maui.[97] The project is estimated to be complete in 2009.

Internationally, there have been efforts to develop wave energy projects as well. Recently, the Pelamis Wave Power Company put online the first commercial-scale wave

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direction of the wave travel. This means that onshore impact would not be significant if the converters were a greater distance from the shore. *See* Minerals Management Service Renewable Energy and Alternate Use Program, "Technology White Paper on Wave Energy Potential on the US Outer Continental Shelf," *at* http://ocsenergy.anl.gov/documents/docs/OCS_EIS_Whitepaper_Wave.pdf.

[88] *Id.*

[89] *Id.*

[90] Further information about the facility and its research is available at http://eecs.oregonstate.edu/wesrf.

[91] Further information regarding Oregon's wave energy efforts is available at http://www.oregon.gov/ENERGY/RENEW/Hydro/Ocean_Wave.shtml.

[92] EPRI Survey and Characterization of Potential Offshore Wave Energy Sites in Oregon, May 2004, 2-3, *at* http://www.oregon.gov/ENERGY/RENEW/Hydro/docs/EPRISite_Report.pdf.

[93] A copy of the 2007-2009 Oregon Energy Plan is available at http://www.oregon.gov/ENERGY/docs/EnergyPlan07-09.pdf.

[94] A copy of the 2005 Renewable Energy Action Plan is available at http://oregon.gov/ENERGY/RENEW/docs/FinalREAP.pdf.

[95] Haw. Rev. Stat. §226-18.

[96] B.J. Reyes, *Ocean of Energy*, The Honolulu Star-Bulletin, February 5, 2008, *at* http://hawaii.gov/dbedt/info/energy/renewable/oceanlinx-sb-2008feb5.pdf.

[97] *Id.*

energy "farm" off Portugal, which could power as many as 15,000 homes.[98] Pelamis also is involved in other projects in Scotland and England.[99] Another group, the European Marine Energy Centre (EMEC) is an organization backed by the government of Scotland that can provide developers of wave and tidal energy devices with a performance testing facility that would enable them to link their prototypes to the national electric grid for testing.[100]

While areas of the US coast such as Oregon have strong potential for wave energy development, an important question is whether North Carolina has sufficient wave density to make energy development feasible? As part of an ongoing study conducted by Dr. Len Pietrafesa and colleagues at North Carolina State University,[101] the wave energy signatures off North Carolina and South Carolina were compared to that of Oregon. As the graph below illustrates, Oregon has three times the wave energy of North Carolina, while the average monthly wave heights for North Carolina and South Carolina are comparable.

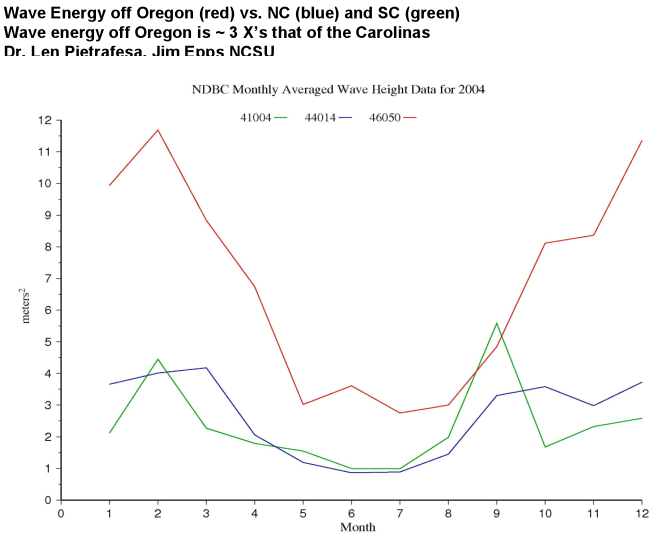

Figure 7
While not dispositive, the graph highlights the need for further study of North Carolina's wave energy potential.

[98] Jason Margolis, *Wave Farms Show Energy Potential*, BBC News, March 2, 2007, *available at* http://news.bbc.co.uk/2/hi/technology/6410839.stm.
[99] *Id.*
[100] More information about EMEC is available at their website at http://www.emec.org.uk.
[101] Pietrafesa, Len, M. Peng, S. Bao and J. Epps, "Winds, Waves and Sea Level on the North Carolina Coast" (manuscript in preparation).

CURRENT ENERGY

Current energy refers to the energy that can be extracted from ocean currents that differ from tidal currents. Ocean currents flow in one direction at a relatively constant speed, whereas the flow of tidal currents is bi-directional and varies regionally and through tidal cycles. The Gulf Stream is an example of a warm ocean current, which flows up the eastern coast of the US. Due to its density, moving water can generate many times the energy of an equivalent amount of airflow.[102] Current energy is a relatively new concept, and there are limited technologies available to convert the energy.

- **Horizontal Axis Turbines** are similar in design to wind turbines. The turbines would be attached to the sea floor in order for it to stay upright as the current flows through the turbines, generating electricity.
- **Vertical Axis Turbines** rotate on a vertical axis, like a revolving door.[103] These also would be attached to the sea floor so that the current can flow through the turbine.

Groups of turbines could be arranged much like proposed wind energy sites. There is potential for exploiting this form of energy, according to a white paper on ocean current energy potential on the OCS that was prepared by MMS:

> The total worldwide power in ocean currents has been estimated to be about 5,000 GW, with power densities of up to 15 kW/m2. The relatively constant extractable energy density near the surface of the Florida Straits Current is about 1 kW/m2 of flow area. It has been estimated that capturing just 1/1,000th of the available energy from the Gulf Stream, which has 21,000 times more energy than Niagara Falls in a flow of water that is 50 times the total flow of all the world's freshwater rivers, would supply Florida with 35% of its electrical needs.[104]

However, there are potential difficulties as well. Since the technology is still in its infancy, the cost associated with its implementation likely would be high. Turbines will have to be protected from corrosion and marine growth because of their location. Therefore, maintenance may be a challenge. Furthermore, finding appropriate sites for such turbines will require detailed research into the characteristics of ocean currents off the North Carolina coast.[105]

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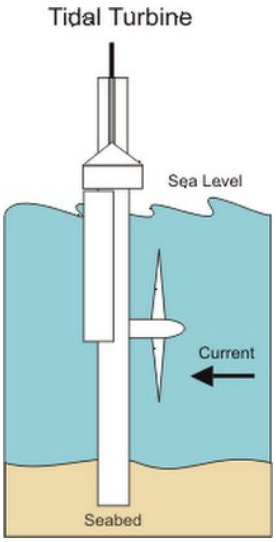
[102] Minerals Management Service Renewable Energy and Alternate Use Program, "Technology White Paper on Wave Energy Potential on the US Outer Continental Shelf, *at* http://ocsenergy.anl.gov/documents/docs/OCS_EIS_Whitepaper_Wave.pdf at 3 ("Water is about 835 times denser than wind, so for the same area of flow being intercepted, the energy contained in a 12-mph water flow is equivalent to that contained in an air mass moving at about 110 mph.").

[103] *Id.* at 3

[104] *Id.* at 3.

[105] The North Carolina Coastal Ocean Observing System (http://ncoos.org) is a useful resource for tracking currents off of the North Carolina coast.



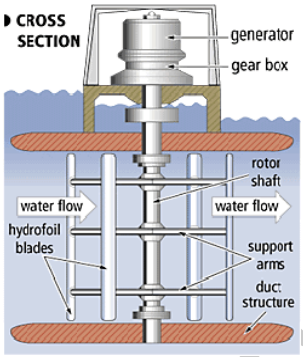


Figure 8: Horizontal Axis Turbine[106] **Figure 9: Vertical Axis Turbine**[107]

Additionally, there may be adverse environmental effects from the construction and placement of these turbines to fish or other marine life. Another concern is the effect that large-scale current energy extraction would have on the ocean current's own energy. If the energy loss of the current is significant, it may have far-ranging effects.[108] Florida Atlantic University's Center of Excellence in Ocean Energy Technology has begun a pilot program that will explore the feasibility of harnessing ocean current energy in the Gulf Stream[109] including the environmental effects of the turbines.

TIDAL ENERGY

Tidal energy is similar in concept to current energy as it extracts energy from flowing water in rivers, bays, estuaries and coastal waters. There are two primary technologies that harness tidal energy, which are tidal barrage plants and tidal in-stream energy conversion (TISEC) devices. Tidal barrage plants operate like dams or overtopping devices. As the tide flows in, it is trapped in a reservoir. When the tide flows out, the water level of the reservoir is higher than the surrounding waters. When the water is released, it rushes down, powering turbines that generate electricity. TISEC devices are horizontal-axis or vertical-axis turbines, like those used to extract current energy. TISEC devices can be bi-directional, extracting energy from incoming and

[106] Image courtesy of the US Energy Information Administration.
[107] Image courtesy of Pure Energy Systems News.
[108] Minerals Management Service Renewable Energy and Alternate Use Program, "Technology White Paper on Wave Energy Potential on the US Outer Continental Shelf, *at* http://ocsenergy.anl.gov/documents/docs/OCS_EIS_Whitepaper_Wave.pdf at 4-5.
[109] Information regarding the pilot program is available at Florida Atlantic University Center for Ocean Energy Technology's website at http://coet.fau.edu/?p=pilot.

outgoing tides, and have fewer environmental impacts because they do not trap tidal waters or substantially alter the natural seascape.[110]

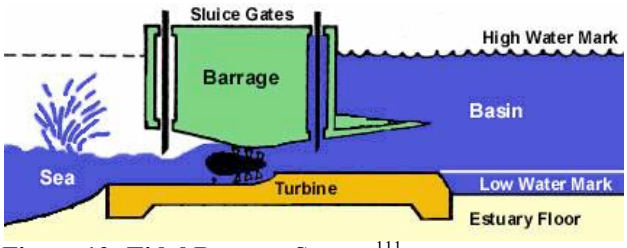


Figure 10: Tidal Barrage System[111]

There is the potential for harnessing tidal energy in the US. A 1998 US Department of Energy study estimated that in the US, "there is an undeveloped in-stream capacity of 70,000 MW. Even if only half of these sites are commercially viable, there could still be upwards of 40,000 MW of power available."[112] Additional efforts, like a 2005 the Electric Power Research Institute (EPRI) study, examined the feasibility of tidal energy sites in the US[113] and stressed tide type (diurnal or semi-diurnal)[114] and tidal current speed[115] as the most important criteria for turbine siting. Since tides, like ocean currents, are fairly stable occurrences there is the potential for a tidal energy system to produce a more predictably energy system than a wind energy application.[116]

The present regulatory scheme for installing a TISEC system is quite complex. Under the FPA,[117] FERC licenses and regulates all hydropower projects, including tidal energy, in the US. However, in order to be licensed by FERC, projects must first get approval from federal agencies such as the Corps, NOAA, Fish and Wildlife Service and Coast Guard, as well as relevant state agencies."[118]

Even with the complex regulatory scheme, one tidal energy project is currently in place. The Roosevelt Island Tidal Energy (RITE) project is an experimental tidal energy system installed in New York's East River. The project uses bidirectional turbines and has provided the city of New York with approximately 50 MWh of electricity.[119] The

[110] Michael B. Walsh, A Rising Tide in Renewable Energy: The Future of Tidal In-Stream Energy Conversion (TISEC), 19 Vill. Envt'l L. J. 193, 202-203 (2008).
[111] Image courtesy Australian Institute of Energy, Tidal Energy Fact Sheet, *at* http://www.aie.org.au/national/factsheet/FS10_TIDAL%20ENERGY.pdf.
[112] *Id*. at 197-98.
[113] All the reports produced by the study are available at http://oceanenergy.epri.com/streamenergy.html#reports.
[114] EPRI Guidelines for Preliminary Estimates of Power Production by TISEC Devices 5, *available at* http://oceanenergy.epri.com/attachments/streamenergy/reports/TP-001_REV_3_BP_091306.pdf.
[115] *Id.* at 7-8
[116] *Id.* at 198.
[117] 16 U.S.C. §791 et. seq.
[118] Michael B. Walsh, A Rising Tide in Renewable Energy: The Future of Tidal In-Stream Energy Conversion (TISEC), 19 Vill. Envt'l L. J. 193, 211 (2008).
[119] Verdant Power, The RITE Project, *available at* http://www.verdantpower.com/wp-content/themes/Verdant/downloads/VerdantPower_RITE.pdf (describing the project's progress and effects so far).

project suffered early setbacks as strong currents damaged the turbine blades.[120] However, the company has begun testing new designs to correct these earlier flaws.[121]

Alternative Energy Development and the Law

As is the case with wind energy, most if not all of the alternative energy projects sited off the North Carolina coast would include placing permanent structures in public trust waters of the state or federal government. As a result, federal permits, state permits or perhaps both will be required for construction, operation and maintenance of the facility. Most facilities will also include more than an energy production platform, including transmission cables to route energy offshore to land. These facilities will also require land-based substations, dredging and construction activities meaning that, even if the facility is located in federal waters, projects will require state easements for the transmission of energy onshore.[122] Despite any technical and economic challenges surrounding alternative energy development in North Carolina's coastal waters or in federal waters off North Carolina, the legal and regulatory framework for permitting such projects at the federal and State levels must be understood. The regulatory components of alternative energy facility siting are discussed below in the context of wind energy, however the laws, regulations and concerns characteristic of offshore wind energy production will be similar to those for any alternative energy technology employed off North Carolina's coast. However, because wave, current and tidal energy facilities and equipment occupy either large areas of the water surface or are suspended from the ocean bottom, they present some issues not associated with wind turbines. Similarly, wind turbines also will have unique considerations as they are affixed to the ocean bottom but also occupy the air space high above the surface of the water.

[120] Anthony DePalma, "East River Fights Bid to Harness Its Currents for Electricity," The New York Times, August 13, 2007, *available at* http://www.nytimes.com/2007/08/13/nyregion/13power.html?_r=2&oref=slogin&oref=slogin.
[121] *Id.*
[122] To learn more about how a wind turbine works, visit the Department of Energy, "How Wind Turbines Work," *at* http://www1.eere.energy.gov/windandhydro/wind_how.html. To learn more about how an offshore wind facility works, visit British Wind Energy Association, "How An Offshore Wind Farm Works," *at* http://www.bwea.com/offshore/how.html.

Federal Law

At the time the Cape Wind project was proposed, the US had no offshore wind policy or regulatory framework. This was one of the chief criticisms of Cape Wind in its earlier phase of the permitting process, and many commented on the potential detriments to ad hoc permitting of offshore wind projects unless the nation addressed the issue. The Energy Policy Act of 2005 addressed this issue peripherally by vesting authority to MMS over federal offshore renewable energy and alternate uses of the nation's offshore public lands along the Outer Continental Shelf (OCS).[123] Authority was vested within MMS because of its long ranging environmental, engineering and regulatory expertise managing energy and mineral resources in federal waters.

In addition to the Energy Policy Act of 2005, other applicable laws regarding the siting of an offshore wind energy facility include NEPA, OSCLA, CZMA, RHA, Clean Water Act (CWA), Clean Air Act (CAA), Endangered Species Act (ESA), Marine Mammal Protection Act (MMPA) and National Historic Preservation Act (NHPA). The additional laws that may be triggered by the proposal of an offshore wind energy projects are discussed below.

National Environmental Policy Act

NEPA requires the federal government to take into account environmental impacts when issuing permits to allow federal actions. When a federal action is proposed, the lead federal agency (since multiple agencies could have jurisdiction over a proposed project, as in the case of an offshore wind project) conducts an Environmental Assessment to determine whether the project's impacts are significant enough to warrant a full Environmental Impact Statement (EIS), which requires a more rigorous review. If the lead agency determines instead that a proposed project will not have a significant impact on the environment, then a Finding Of No Significant Impact (or FONSI) is issued. However, it is likely the impacts of a proposed offshore wind project will be deemed significant enough to warrant a full EIS.

Clean Water Act

The CWA was passed in order to "restore and maintain the chemical, physical, and biological integrity of the nation's waters,"[124] and the EPA was given jurisdiction to administer the CWA and regulate the discharge of pollutants into the waters of the US.[125] There are several implementation strategies of the CWA, a few of which may be relevant to a water-based wind project, including Section 404 for the dredging and filling of wetlands, Section 401 water quality certification from the state with jurisdiction[126] and a

[123] *See* 43 U.S.C. §1337.
[124] 33 U.S.C. §1251.
[125] *See id*.
[126] Section 401 of the CWA requires certification from the relevant state that the proposed activity will not cause or contribute to a violation of relevant state water quality standards, before a federal agency can issue a license or permit for construction or other activity. *See* 33 U.S.C. §1341.

National Pollutant Discharge Elimination System (NPDES) permit for discharge of pollutants from point sources. It is likely a water-based wind energy project would need one or more of these permits, depending on the project and its proposed location.

Coastal Zone Management Act

The CZMA was passed "to preserve, protect, develop, and where possible, to restore or enhance" the nation's coastal resources.[127] The CZMA encourages the participation of coastal states and provides financial and technical assistance as incentives. For states that choose to participate, they first must develop a state-level coastal management plan that defines permissible land and water uses within their coastal zone. Once a federally approved CMP is in place, federal activities or project proposals that require a federal permit can be subject to the consistency provision of the CZMA, which requires an activity to be "consistent" to the maximum extent practicable with the enforceable policies of the affected state's CMP.[128] If the affected state determines the activity is inconsistent with its CMP, then that state may negotiate conditions in order for the activity to become consistent. However, if negotiations cannot be reached and the inconsistency determination remains (thereby disallowing the activity), then the applicant may appeal the state's decision to the Secretary of the US Department of Commerce, who has the authority to override the state's decision.[129]

A water-based wind energy development project will involve the leasing of submerged lands from either a state or the federal government. Since coastal states only have jurisdiction over submerged lands up to three geographical miles,[130] if a party wishes to lease submerged lands beyond this limit, then a submerged lands lease from the US Department of the Interior is needed.[131]

Rivers and Harbors Act

The Corps of Engineers has jurisdiction over navigable waters of the US, and Section 10 of the RHA requires a permit for structures or work in or affecting those waters.[132] A water-based wind project by its very nature would require structures to be built over navigable waters, and thus, a Section 10 permit would be necessary.

[127] 16 U.S.C. §1452.
[128] 16 U.S.C. §1456.
[129] *See id*.
[130] *See* Submerged Lands Act, 43 U.S.C. §§1311-1314. The exceptions to this rule are Texas and the west coast of Florida. Their jurisdiction extends out nine geographical miles because these states had established their jurisdictions over a larger area before statehood. *See* 43 U.S.C. §1312.
[131] The EPAct gave the Department of the Interior authority to develop and implement an alternative energy and alternate use program. *See* Pub. L. No. 109-58, 119 Stat. 868 (codified in 26 U.S.C. and 42 U.S.C.). *See also* OCS Alternative Energy and Alternate Use Programmatic Final EIS *at* http://ocsenergy.anl.gov/index.cfm.
[132] *See* 33 U.S.C. §403.

Endangered Species Act and the Marine Mammal Protection Act

An offshore wind project likely would involve impacts to protected wildlife species. If so, review under the ESA and MMPA also would be needed. Additional review would be needed if a project likely would affect fisheries or essential fish habitat.[133]

National Historic Preservation Act

A wind project proposed off North Carolina's coast could trigger the NHPA due to the location of shipwreck sites along the state's coast. The NHPA requires a federal agency with direct or indirect jurisdiction over a proposed federal, or federally assisted, project and the head of the federal agency having authority to license such project to take into account the effect of the proposed project on any district, site, building, structure, or object that is included in, or eligible for inclusion in, the National Register.[134]

Future Regulation

While not yet effective at the time of this report, the federal government is moving forward with developing a regulatory program for alternative energy development on the OCS. The Energy Policy Act of 2005 authorized the Department of the Interior to grant leases, easements and rights-of-way for energy-related development on the OCS. The OCS is the area of seafloor and subsurface between the seaward boundary of the states' territorial sea and the boundary of federal jurisdiction. Currently, MMS is developing regulations that will shape the development of energy production on the OCS. MMS completed its OCS Alternative Energy and Alternate Use Programmatic Environmental Impact Statement (EIS) in 2007.[135] This EIS outlines the possibilities for alternative energy development in the OCS. In July 2008, MMS unveiled proposed rules to govern alternative energy projects and alternate uses of existing facilities for the OCS. The proposed rules are comprehensive in scope and apply to leasing, construction, operations and decommissioning of facilities.[136] In the meantime, MMS has enacted interim policy to authorize resource assessment and technology testing activities in support of future alternative energy development on the OCS.

[133] *See generally* Magnuson-Stevens Fishery Conservation and Management Act, 16 U.S.C. §1801 et seq. *See also* Essential Fish Habitat Regulatory Guidelines, 50 C.F.R. §600.
[134] 16 U.S.C. §470f.
[135] The full EIS is available online at http://ocsenergy.anl.gov/index.cfm.
[136] To read the proposed rules, visit the MMS web page re: regulatory development and policy for its alternative energy program at http://www.mms.gov/offshore/AlternativeEnergy/RegulatoryInformation.htm. Scroll down to the "rule development" section.

North Carolina Law and Alternative Energy Facilities

Any alternative energy projects sited within three miles of North Carolina's coast or within its estuarine waters would be located in State waters and require authorization by the State. In addition, transmission lines and related infrastructure for bringing power generated by alternative energy facilities, such as wind turbines, located in federal waters, would cross State-owned submerged lands and coastal areas of environmental concern regulated under the CAMA program. Therefore, certain North Carolina laws and regulations will apply to aspects of alternative energy projects located solely in federal waters. Finally, under the CZMA consistency provision, North Carolina also will have a voice on projects looking to place alternative energy facilities in federal waters adjacent to State waters.

Regulatory Framework Issues

North Carolina has not developed policy to govern water-based alternative energy projects or the necessary regulatory framework for the siting of these facilities. Such a framework is needed to provide the legal tools necessary to evaluate project proposals, or components of projects, to be located in State waters. A regulatory framework will provide such projects with the necessary legal rights to proceed with a clear expectation of what would be required by the permitting process. It would also allow the State's Coastal Program to have federally approved enforceable policies in place for the purpose of reviewing projects to be sited in federal waters under the CZMA consistency provision. Among the issues that need to be addressed to create an effective regulatory framework are:

- The roles of the Coastal Resources Commission, State Utilities Commission and Environmental Management Commission, and which commission will take the lead; and
- Which existing statutes and regulations are applicable to water-based alternative energy projects; the gaps that exist within those statutes and regulations; the barriers existing statutes and regulations present to siting these projects in State waters; and the ways in which the State could address any gaps or deficiencies.

Regulatory Authority of the Coastal Resources Commission, Utilities Commission and Environmental Management Commission

One major question is whether primary jurisdiction over permitting a water-based wind project would fall under the CRC, the Utilities Commission or the EMC. With respect to the regulatory authority of the CRC and the Utilities Commission, the question seems to depend on the definition of "development" that is set forth in CAMA, which requires a permit from the CRC if a proposed project will be located in an area of environmental concern.[137] "Development" is defined as:

[137] *See* N.C. Gen. Stat. §113A-118.

> Any activity in a duly designated area of environmental concern (except as provided in paragraph b of this subdivision) involving, requiring, or consisting of the construction or enlargement of a structure; excavation; dredging; filling; dumping; removal of clay, silt, sand, gravel or minerals; bulkheading, driving of pilings; clearing or alteration of land as an adjunct of construction; alteration or removal of sand dunes; alteration of the shore, bank or bottom of the Atlantic Ocean or any sound, bay, river, creek, stream, lake or canal; or placement of a floating structure in an area of environmental concern identified in G.S. 113A-113(b)(2) or (b)(5).[138]

The statute lists exceptions to the definition of "development" including "work by any utility and other persons for the purpose of construction of facilities for the development, generation, and transmission of energy to the extent that such activities are regulated by other law or by present or future rules of the Utilities Commission regulating the siting of such facilities (including environmental aspects of such siting) and work on facilities used directly in connection with the above facilities

Under the NC Public Utilities Act, the Utilities Commission regulates public utilities.[139] The definition of "public utility" includes facilities that generate electricity to be furnished to public for compensation,[140] which would encompass water-based alternative energy facilities. Therefore, *to the extent* that activities associated with the construction, operation, and maintenance of such facilities are addressed in rules of the Utilities Commission, CAMA permit requirements would not apply. However, because presently existing Utilities Commission rules do not address the environmental and other unique impacts associated with placing alternative energy generating facilities in state estuarine AEC or ocean waters AEC,[141] existing CAMA permit requirements would apply to any such development.

Water-based alternative energy facilities, whether located in state or federal waters, will require transmission lines to bring the energy to shore-side receiving facilities. Here there is also a potential conflict between the role of the State Utilities Commission and the CRC. The State Utilities Commission is authorized to regulate transmission lines.[142] N.C. Gen. Stat. § 62-101 states that:

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[138] N.C. Gen. Stat. §13A-118(5)(a).
[139] *See* N.C. Gen. Stat. §113A-103(5)(b)(3).
[140] "Public utility" means "a person, whether organized under the laws of this State or under the laws of any other state or country, now or hereafter owning or operating in this State equipment or facilities for: producing, generating, transmitting, delivering or furnishing electricity, piped gas, steam or any other like agency for the production of light, heat or power to or for the public for compensation; provided, however, that the term 'public utility' shall not include persons who construct or operate an electric generating facility, the primary purpose of which facility is for such person's own use and not for the primary purpose of producing electricity, heat, or steam for sale to or for the public for compensation." N.C. Gen. Stat. §62-3.23(a)(1).
[141] Letter of Robin W. Smith, Asst. Secretary for Environment, NC Department of Environment and Natural Resources, to Renewable Energy Committee of the NC Environmental Management Commission, November 12, 2008, p. 5. *See generally,* N.C. Gen. Stat. §§62-110 and 62-110.1 (environmental considerations not mentioned as factor in granting certificate of necessity and convenience).
[142] *See* N.C. Gen. Stat. §62-101.

> (a) No public utility or other person may begin to construct a new transmission line without first obtaining from the Commission a certificate of environmental compatibility and public convenience and necessity.[143]
>
> An applicant for such a certificate must file an application containing the following information:
>
> (4) An environmental report setting forth:
> a. The environmental impact of the proposed action;
> b. Any proposed mitigating measures that may minimize the environmental impact; and
> c. Alternatives to the proposed action.[144]
>
> The commission may issue the certificate for construction of the proposed transmission line if it finds:
>
> (4) That the impact the proposed transmission line will have on the environment is justified considering the state of available technology, the nature and economics of the various alternatives, and other material considerations; and
> (5) That environmental compatibility, public convenience, and necessity require the transmission line.[145]

Insofar as construction of a transmission line in CAMA AECs is concerned, it is the Utilities Commission that has the ultimate authority over the issuance of the necessary permission to construct the line. Furthermore, it is the Utilities Commission that weighs the environmental impacts of any proposed transmission line. Therefore, because the Utilities Commission would be addressing the environmental impacts, the activity would not be a "development" requiring a CAMA permit.

The EMC also may play a substantial role in the permitting of alternative energy facilities in North Carolina's coastal waters. In 2007, the General Assembly granted the EMC the authority to:

> Establish a procedure for evaluating renewable energy technologies that are, or are proposed to be, employed as part of a renewable energy facility, as defined [and to establish] standards to ensure that renewable energy technologies do not harm the environment, natural resources, cultural resources, or public health, safety, or welfare of the State; and, to the extent that there is not an environmental

[143] N.C. Gen. Stat. §62-101(a). There are some exceptions but none would be applicable to transmission lines coming from water-based alternative energy production facilities. See N.C. Gen. Stat. §62-101(c).
[144] N.C. Gen. Stat. §62-102(a)(4).
[145] N.C. Gen. Stat. §62-105(4) and (5).

> regulatory program, establish an environmental regulatory program to implement these protective standards.[146]

Under this statute, the EMC's authority extends to all forms of renewable energy, whether land-based or water-based, which would include wind energy. What is unclear is what the relationship will be between the CRC and the EMC. Will the EMC defer to the CRC's rules for projects located in AECs? The CAMA program is an existing one and already has rules and standards that would be applicable to water-based alternative energy facilities and has a developed expertise about development in coastal AECs. The two commissions could enter into a memorandum of understanding to clarify how authority over alternative energy projects in AECs will be distributed.

Insofar as the permitting of transmission lines, the Utilities Commission would still appear to be the entity empower to issue the necessary certificate authorizing the construction of such lines. But there is a potential conflict between the authority of the EMC and the Utilities Commission. If the EMC's rules would prohibit the placement of transmission lines in a certain location, is the Utilities Commission bound by the rules. N.C. Gen. Stat. §62-105(a) allows the Utilities Commission to weigh the adverse environmental impacts against the state of technology, the nature and economics of various alternatives, and other material considerations. However, Section 143B-282(a), which is the later statute, would appear to empower the EMC to establish environmental standards that are binding on other state entities, such as the CRC and Utilities Commission, when authorizing renewable energy technologies.

Leases and Easements for Alternative Energy Projects

Another issue of some concern is how a project sponsor may obtain the legal rights to occupy State coastal waters and State-owned submerged lands. It is unclear whether the existing statutes provide adequate authority to grant all the necessary rights needed to place an alternative energy facility and infrastructure on State-owned submerged lands. What is clear is that given the complexity of the issues surrounding placement of alternative energy facilities in State waters, a comprehensive statute should be enacted and a set of rules developed similar to those being developed by MMS for similar activities in federal waters.

Under N.C. Gen. Stat. §146-10, DOA is authorized to lease or rent "vacant and unappropriated" lands, swamplands and lands acquired by the State, upon terms DOA deems proper. However, that authority may not be sufficient to allow the siting of wind turbines in State coastal waters. DOA has authority under §146-10 to enter into leases of State-owned submerged lands, but is missing express authority to lease the right to use the water column and air space above those submerged lands. Energy facilities such as wind turbines are different from piers or isolated structures located in state waters. Although an individual wind turbine may occupy only a small portion of State-owned submerged lands and a small portion of the water column, the total project will occupy a large area of State-owned submerged lands, many segments of the water column, and the

[146] 2007-397 N.C. Sess. Laws 9.

turbines will intrude several hundred feet into the air space. Wave, tidal or current energy equipment may be attached to the bottom, but also will occupy large areas of the surface water or the water column. Section 146-10 does not provide DOA with explicit authority to grant the necessary legal rights to occupy the water column, the water surface or the significant portions of the air space above public trust submerged lands and waters.

N.C. Gen. Stat. §146-11 also grants certain authority to DOA. This statute allows the agency to grant easements, rights-of-way, dumping rights and other interests in State lands when such rights are necessary "to cooperate with the federal government, utilize the natural resources of the State or otherwise serve the public interest." This does provide DOA with authority to grant the necessary permission for the placement of transmission lines in State waters. However, this statute, as is the case with §146-10, does not expressly authorize DOA to grant rights to occupy the water column, water surface or air space above the water's surface. Consequently, a comprehensive statute similar to §146-12 regarding riparian easements should be enacted, and the appropriate commission should develop comprehensive rules similar to those that are being developed by MMS regarding alternative energy and alternate uses of existing facilities on the OCS.

The CRC's Statutory Authority

Although the CRC has statutory authority to develop regulations governing the siting of wind, wave, tidal and current energy generation facilities and equipment in public trust waters, it has not promulgated regulations addressing the unique issues they pose. Expansion of alternative energy facilities is a State priority, and the CRC, by providing a known regulatory framework, could help promote that priority. Having such regulations in place prior to the filing of any application for siting such energy facilities or equipment in State coastal waters or in federal waters would assure that all significant impacts of such projects would be addressed during the application process and would provide meaningful guidance as to CRC policy for entities considering undertaking such projects and a regulatory framework which would encourage investment in such projects. In addition, the State also would have a set of enforceable policies for purposes of CZMA consistency review of any similar projects proposed for federal waters.

The circumstances under which the CRC may deny a permit are set forth in N.C. Gen. Stat. §113A-120 regarding the granting or denial of permits. The statute provides that:

(a) The responsible official or body shall deny an application for a permit upon finding:

(1) In the case of coastal wetlands, that the development would contravene an order that has been or could be issued pursuant to G.S. 113-230.
(2) In the case of estuarine waters, that a permit for the development would be denied pursuant to G.S. 113-229(e).
(3) In the case of a renewable resource area, that the development will result in loss or significant reduction of continued long-range productivity that would

jeopardize one or more of the water, food or fiber requirements of more than local concern identified in subdivisions a through c of G.S. 113A-113(b)(3).

(4) In the case of a fragile or historic area, or other area containing environmental or natural resources of more than local significance, that the development will result in major or irreversible damage to one or more of the historic, cultural, scientific, environmental or scenic values or natural systems identified in subdivisions a through h of G.S. 113A-113(b)(4).

(5) In the case of areas covered by G.S. 113A-113(b)(5), that the development will jeopardize the public rights or interests specified in said subdivision.

(6) In the case of natural hazard areas, that the development would occur in one or more of the areas identified in subdivisions (a) through (e) of G.S. 113A-113(b)(6) in such a manner as to unreasonably endanger life or property.

(7) In the case of areas which are or may be impacted by key facilities, that the development is inconsistent with the State guidelines or the local land-use plans, or would contravene any of the provisions of subdivisions (1) through (6) of this subsection.

(8) In any case, that the development is inconsistent with the State guidelines or the local land-use plans.

(9) In any case, that considering engineering requirements and all economic costs there is a practicable alternative that would accomplish the overall project purposes with less adverse impact on the public resources.

(10) In any case, that the proposed development would contribute to cumulative effects that would be inconsistent with the guidelines set forth in subdivisions (1) through (9) of this subsection. Cumulative effects are impacts attributable to the collective effects of a number of projects and include the effects of additional projects similar to the requested permit in areas available for development in the vicinity.

(b) In the absence of such findings, a permit shall be granted. The permit may be conditioned upon the applicant's amending his proposal to take whatever measures or agreeing to carry out whatever terms of operation or use of the development that are reasonably necessary to protect the public interest with respect to the factors enumerated in subsection (a) of this section.

In examining each of the grounds upon which the CRC may deny a CAMA development permit, it is apparent that only two of the statutory grounds are likely to be relevant to decisions about the siting of alternative energy facilities. Those two subsections are §113A-120(a)(5) regarding public trust waters and (7) regarding key facilities. Subsections §113A-120(a)(8) regarding inconsistency with land use plans, (9) regarding practicable alternatives and (10) regarding cumulative effects may play a role in a particular project. However, only (a)(5) and (7) would have direct application to all proposals to site facilities in public waters and (7) simply incorporates by reference the limitations set forth in (1) through (6).

While existing CAMA regulations do not specifically address the siting of alternative energy facilities in coastal waters, the CRC declared that wind turbines were not water-dependent structures and any proposed project would require a variance from the Commission's rules. Coastal and ocean waters are public trust areas,[147] and generally in public trust areas uses which are not water dependent are not permitted.[148] One test of water dependency is that the structure must be placed in a water site in order to perform an essential function. Wind turbines do not require access to water in order to perform their basic function of generating wind energy and, therefore, have been declared to fall within the general prohibition against siting non-water dependent facilities in public trust waters. On the other hand, tidal, current and wave energy generation facilities and equipment do require placement in coastal or ocean waters in order to perform their basic function and thus would not fall under the same prohibition.

If wind turbines are proposed for coastal ocean or estuarine waters, then the CRC would need to declare wind turbines a permissible non-water dependent use. Although the use standards for public trust areas contain the blanket statement that "uses which are not water dependent shall not be permitted in coastal wetlands, estuarine waters and public trust areas," that blanket prohibition is qualified later in the regulation. 15 NCAC 07H .0208(a)(3) states:

> When the proposed development is in conflict with the general or specific use standards set forth in this Rule, the CRC may approve the development if the applicant can demonstrate that the activity associated with the proposed project will have public benefits as identified in the findings and goals of the Coastal Area Management Act, that the public benefits clearly outweigh the long range adverse effects of the project, that there is no reasonable and prudent alternate site available for the project, and that all reasonable means and measures to mitigate adverse impacts of the project have been incorporated into the project design and will be implemented at the applicant's expense. These measures taken to mitigate or minimize adverse impacts may include actions that will:
>
> (A) minimize or avoid adverse impacts by limiting the magnitude or degree of the action;
> (B) restore the affected environment; or
> (C) compensate for the adverse impacts by replacing or providing substitute resources.

Advocates of water-based wind energy facilities seeking a CAMA development permit may make the following arguments: (1) the long-term energy benefits to the people of the

[147] *See* 15 NCAC 7H.0207(a) (description of public trust areas). *See also* 15 NCAC 7H.0206(a). The use standards for estuarine waters are the same as those applicable to public trust areas. 15 NCAC 7H.0206(d).
[148] 15 NCAC 7H.0208 states: (a) General Use Standards (1) Uses which are not water dependent shall not be permitted in coastal wetlands, estuarine waters, and public trust areas. Restaurants, residences, apartments, motels, hotels, trailer parks, private roads, factories, and parking lots are examples of uses that are not water dependent. Uses that are water dependent may include: utility easements; docks; wharfs; boat ramps; dredging; bridges and bridge approaches; revetments, bulkheads; culverts; groins; navigational aids; mooring pilings; navigational channels; simple access channels and drainage ditches.

State outweighs any long-term adverse effects of the project;[149] (2) open water siting of such facilities is preferable to land-based sites; and (3) steps will be taken to mitigate or minimize any adverse impacts. If water-based wind energy facilities satisfy this standard for non-water dependent facilities, the question is what other specific standards would the proposed facility have to meet.

A potential significant barrier to providing the infrastructure necessary to support offshore alternative energy facilities, especially wind energy development projects, whether located in State or federal waters is the CAMA prohibition on almost all forms of "development" seaward of the erosion setback lines and on or through the beach and dunes.[150] Cutting through the beach and dunes would be necessary for transmission lines coming from offshore alternative energy facilities, but that activity would not be either a permitted CAMA one or an exempted activity.[151] Unless exempted, CAMA rule 15A NCAC 07H .0309 prohibits such activity. CAMA rule 15A NCAC 07H.0309 contains a list of exemptions for some types of non-water dependent development seaward of the oceanfront setback line. However, electrical transmission lines are not one of the exempted types of development. Furthermore, even exempted development is permitted only if it is landward of the vegetation line; involves no alteration or removal of primary or frontal dunes which would compromise the integrity of the dune as a protected landform or the dune vegetation.[152] CAMA rules also allow some types of "water dependent development" seaward of the ocean setback line.[153] It could be argued that transmission lines bring electricity generated by facilities located offshore are "water dependent" because there is no other means, other than crossing the beach and dunes such energy can be brought to shore. Yet, even if viewed as water dependent, such transmission lines do not fall within the exemption.

Addressing CAMA Alternative Energy Issues Through the Variance Process

It is possible that the applications for permits to locate transmission lines in State waters that also pass through beaches and dunes could be addressed through the CAMA variance procedure. N.C. Gen. Stat. §113A-120.1 provides that:

> (a) Any person may petition the Commission for a variance granting permission to use the person's land in a manner otherwise prohibited by rules or standards prescribed by the Commission, or orders issued by the Commission, pursuant to this Article. To qualify for a variance, the petitioner must show all of the following:

[149] One of the legislative goals for CAMA is to establish policies, guidelines and standards for "the economic development of the coastal area." N.C. Gen. Stat. §113A-102(b)(4)(b).
[150] *See* 15A NCAC 7H.0301 et. seq. *See also* 15A NCAC 7H.0306.
[151] The general permit for the installation of aerial and subaqueous utility lines is not applicable to the ocean hazard area AEC. *See* 15A NCAC 7H.1601. The ocean hazard AEC includes the ocean beaches, frontal dunes, and inlet areas as well as other areas. *See* 15A NCAC 7H.0301
[152] 15A NCAC 7H.0309(a).
[153] 15A NCAC 7H. 0309(d).

> (1) Unnecessary hardships would result from strict application of the rules, standards, or orders.
> (2) The hardships result from conditions that are peculiar to the property, such as the location, size, or topography of the property.
> (3) The hardships did not result from actions taken by the petitioner.
> (4) The requested variance is consistent with the spirit, purpose, and intent of the rules, standards, or orders; will secure public safety and welfare; and will preserve substantial justice.
>
> (b) The Commission may impose reasonable and appropriate conditions and safeguards upon any variance it grants.[154]

However, the steering committee believes it is advisable for the CRC to address these questions directly and make appropriate amendments to its Coastal Energy Policies (15A NCAC 7M .0400) that establish clear guidance as to under what circumstances, if any, placement of non-water dependent alternative energy facilities will be permitted for location in State waters and necessary infrastructure, such as transmission lines, will be allowed to be located on or under State-owned submerged lands and across or under beaches and ocean dunes.

[154] *See also* 15A NCAC 7J.0701.

RECOMMENDATIONS

Enactment of Comprehensive Statute And Promulgation of Rules Addressing Granting of Easements and Leases of State-Owned Submerged Lands and Associated Water Column and Air Space for Alternative Energy Projects

In addition to any necessary CAMA or other state agency permits to site alternative energy projects in state waters, the developers of such projects will need easements and leases from the State to occupy of State-owned submerged lands and associated water column and air space. In light of limitations in existing statutes, the steering committee recommends the enactment of a comprehensive statute designed for alternative energy projects. This statute could be modeled after N.C. Gen. Stat. §146-12 (easements in lands covered by water) and could include such factors as:

- Identification of areas that could be occupied;
- Include submerged lands, water column and air space;
- Establishing qualification criteria to be an acceptable applicant
- Duration of the easement or lease;
- Rights of the lease or easement holder;
- Maintenance and decommissioning obligations;
- Performance bonds or other security;
- Compensation to the State;
- Identify other permitted uses in the area;
- Authorize granting of easements for transmission cables; and
- Require all of the above to be subject to CAMA, EMC and Utilities Commission permit requirements.

In addition, a set of comprehensive rules for the siting of alternative energy facilities in State coastal waters should be developed by the EMC or CRC or jointly. These rules could be modeled after the regulations being written by MMS for alternative energy facilities proposed for siting in federal waters. Furthermore, the steering committee recommends amendments to the CRC's rules to establish clear guidance as to under what circumstances, if any, placement of non-water dependent alternative energy facilities will be permitted for location in State waters as well as what infrastructure, such as transmission lines, will be allowed to be located on or under State-owned submerged lands and across or under beaches and ocean dunes.

Review and Amendment of Existing CRC Rules Affecting Alternative Energy Facilities Sited in State and Federal Waters

- The CRC and DCM staff should review 15A NCAC 07M .0400 on Coastal Energy Policies to ensure it adequately covers alternative energy development and is updated to address new technologies. Currently, the regulation focuses on oil and gas development and LNG facilities;
- The CRC adopt a rule creating an exception to the requirement that structures placed in state waters be water dependent, for the siting of non-water dependent alternative energy facilities and infrastructure in state waters; and
- The present rules prohibiting the placement of alternative energy facilities in state waters as well as the location of transmission lines from alternative energy facilities across or under the beach and ocean dunes be reviewed and modified to permit such activity under appropriate circumstances and conditions.

Additional Recommendations

The steering committee recommends that the CRC, EMC and Utilities Commission clarify their respective roles in the development of rules to be applied to alternative energy projects proposed for siting in state waters.

In 2008, the General Assembly authorized the University of North Carolina to study the feasibility of wind energy development in Albemarle and Pamlico Sounds. The steering committee recommends that DCM continue to monitor the progress of this feasibility study.

In light of studies being conducted on the feasibility of wind energy in coastal waters and the sounds, the steering committee recommends that the CRC review its own policies and consider defining wind turbines as non-water dependent structures. Instead of changing the water dependency requirement to allow wind turbines in coastal waters, the CRC could craft an exception for water-based wind turbines and develop a new rule for wind energy projects.

CHAPTER 3

OCEAN OUTFALLS

Wastewater in North Carolina's coastal region traditionally has been disposed of through central collection and treatment facilities or by underground septic systems. Past efforts, including "North Carolina's Ocean Stewardship Area: A Management Study," cited location and local oceanographic conditions as variables contributing to the success or failure of ocean outfall design. In the early 1990s, the widespread distribution of North Carolina's coastal population was seen as a major limiting factor in the development and siting of ocean outfalls, as it adds significant cost to the construction of an extensive collection and disposal system.[155] However, as coastal communities continue to experience significant population growth the demands for municipal sewage treatment will continue to grow.

Ocean outfalls in North Carolina have been the subject of several initiatives, including the 1993 North Carolina Ocean Outfall Forum[156] and a study commissioned by the Regional Wastewater Task Force.[157] More recently, the North Carolina CHPP also contained recommendations relative to ocean outfall development.

Other references to ocean outfalls can be found under N.C. Gen. Stat. §143B-434.01, which calls for the generation of a Comprehensive Strategic Economic Development Plan and contains a reference suggesting that, as part of an environmental review, data regarding the "assimilative capacity of riverine, estuarine or ocean outfalls" is to be included as a first step to developing a plan under the statute. [158] In addition to establishing the EMC and authorizing it to adopt water quality standards for water quality classifications of state water, N.C. Gen. Stat. §143 Article 21 outlines the State's water quality strategy.[159] North Carolina has not developed a classification for its coastal-ocean waters, other than those in place for tidal salt waters. Instead, the EMC in 1983 adopted EPA standards for the discharge of wastewaters to the Atlantic Ocean. Article 21 does, however, specifically prohibit discharges into ocean water:

> Unless permitted by a rule of the Commission, the discharge of wastes…to the open waters of the Atlantic Ocean over which the State has jurisdiction is prohibited.[160]

Furthermore, Article 21 states that, in developing storm water runoff rules and programs, the EMC may "utilize storm water rules established by the Commission to protect classified shellfish waters, water supply watersheds and outstanding resource

[155] North Carolina's Ocean Stewardship Area: A Management Study.
[156] Proceedings of the North Carolina Ocean Outfall Forum. April 19-20, 1993. Atlantic Beach, North Carolina.
[157] Malcolm Pirnie Study (1998).
[158] N.C. Gen. Stat. §143B-434.01(e)(4)(f).
[159] N.C. Gen. Stat. §143-211 through 143-215.
[160] N.C. Gen. Stat. § 143-214.2(c).

waters and to control storm water runoff disposal in coastal counties and other nonpoint sources." [161]

Additionally, there are both direct and indirect references to outfalls in a number of DENR divisional regulations. For example, the Division of Marine Fisheries has adopted regulations pertaining to authority to proscribe fishing in areas adjacent to outfalls.[162] Regulations developed by the NC Division of Water Quality (DWQ) also may be applicable, as they cover coastal water treatment,[163] coastal waste treatment disposal[164] and storm water management,[165] and since DWQ has dictated that it will follow guidelines and requirements established by the EPA for the discharge of wastewaters to the Atlantic Ocean (40 CFR §125.120 – 125.124).[166] Outside these few references, however, ocean outfall information is lacking. Despite a lack of guidance, a CAMA major permit would be required, as the instillation of an outfall would be considered a development activity occurring in the public trust AEC.

One of the interesting questions addressed by North Carolina Sea Grant and DCM's 1994 ocean policy study is that since the construction of an ocean outfall would require a CAMA permit, would the CRC play a role in growth management by examining potential impacts on the public trust and estuarine water AECs from a comprehensive wastewater treatment plan.

Federal Laws and Programs

Part of the reason for this lack of guidance could be that federal legislation places "a rather onerous burden on ocean outfalls."[167] One likely reason for the dearth of State legislation is that the Federal Ocean Discharge Program (§403) and the Secondary Treatment Waiver Program (§301(h) of the CWA[168] operate through the National Pollutant Discharge Elimination System (NPDES) to control some of the issues related to ocean outfalls.

The federal Ocean Discharge Program "requires that all permanent point source discharges to ocean waters cause "no unreasonable degradation to the marine environment."[169] In general, the focus of this program has been regulating discharges from offshore oil and gas facilities, not ocean outfalls.[170]

[161] N.C. Gen. Stat. §143-214.7.
[162] *See e.g.,* 15A NCAC 03K.0107.
[163] T15A 02H .0200.
[164] T15A 02H .0400.
[165] T15A 02H .1000.
[166] T15A 02H .0404(d).
[167] Robert F. McGhee, *Introduction to Day Two of the Forum.* Proceedings of the North Carolina Ocean Outfall Forum. April 19-20, 1993, Atlantic Beach, North Carolina, at 89.
[168] 33 U.S.C. §1251 *et seq.*
[169] Robert H. Wayland, III *Federal Perspectives and Policies.* Proceedings of the North Carolina Ocean Outfall Forum. April 19-20, 1993. Atlantic Beach, North Carolina at 22.
[170] *Id.* at 23.

Section 301 of the CWA, on the other hand, "provided an opportunity for publicly owned treatment works (POTW) to seek a waiver from the law's technology-based secondary treatment requirements" if the POTW could show "that their less-than-secondary discharge will allow for the protection and propagation of a balanced indigenous population of fish, shellfish, and wildlife, and allow for recreational activities in and on the water."[171] Based on the data on hand during the 1993 Ocean Outfall Forum, very few POTWs were granted such waivers.[172] Notably, one quote from a forum participant in response to calls for a science-based approach to wastewater management in coastal waters, was: "the technology-based controls established in law 20 years ago, and now in place for wastewater treatment, have served the nation well."[173]

Recent North Carolina Developments

While it appears that the 1990s saw a great deal of discussion regarding ocean outfalls in North Carolina,[174] relatively little recent action has taken place. The CHPP[175] provides an exception in that included among its goals is a directive to "enhance and protect water quality."[176] Under this broad heading, DENR recommended "[a]dopt[ing] or modify[ing] rules or statutes to prohibit ocean wastewater discharges."[177] Relatedly, "[e]nhanced coordination with and financial / technical support for, local government actions to better manage…wastewater," also was recommended.[178]

The CHPP identified the EMC as the lead to conduct the necessary rulemaking that would implement the former recommendation of adopting or modifying rules or statutes to prohibit ocean wastewater discharges. Despite this charge, it does not appear that the EMC has made much headway in this respect since the CHPP was adopted.[179]

The latter recommendation – to encourage and support local governments to better manage wastewater – is not one that lends itself to rulemaking, according to the CHPP.[180] Instead, the plan proposes a multi-agency approach, spearheaded by DENR, but accompanied also by DWQ, DCM and Environmental Health to bring State and local

[171] *Id.* at 24.
[172] *Id.*
[173] *Id.*
[174] This study presented seven different scenarios for dealing with wastewater in four North Carolina counties (Carteret, Craven, Onslow and Pamlico), two of which included ocean outfalls with tertiary treatment. Of the seven, two (Status Quo and Consolidation of Existing Facilities) were deemed unacceptable from an environmental standpoint. The options incorporating ocean outfalls were seen as beneficial to fresh surface water quality by decreasing the discharge to rivers and estuaries, with the primary disadvantages being 'Regulatory Complications' and the increased costs associated with maintenance and monitoring relative to other options. From a cost perspective, the ocean outfalls were among the costliest options, another key factor to consider.
[175] Michael W. Street *et al*, North Carolina Coastal Habitat Protection Plan (2005), *at* http://www.ncfisheries.net/habitat/chpp2k5/_Complete%20CHPP.pdf.
[176] *Id.* at 494.
[177] *Id.*
[178] *Id.*
[179] *See* Environmental Management Commission, *at* http://h2o.enr.state.nc.us/admin/emc/.
[180] Michael W. Street *et al*, North Carolina Coastal Habitat Protection Plan (2005), *at* http://www.ncfisheries.net/habitat/chpp2k5/_Complete%20CHPP.pdf.

officials together to encourage advances in wastewater management. In a sense, this recommendation is a reiteration of the suggestions that came out of the 1993 Ocean Outfalls Forum; namely, to encourage multidisciplinary and inter-agency cooperation to address the complex issue of wastewater elimination via ocean outfalls in North Carolina. However, there does not appear to be substantial movement on this issue since the forum.[181]

Ocean Outfall Models From Other States

Ocean outfalls have been employed in other states and have met with varying levels of success. Two state programs, Florida and California, will be briefly discussed, and common design components exist between these states due to federal statutes. Primarily, ocean outfalls are required to undergo secondary treatment for disposal[182] and should be directed to deeper waters (generally 200 feet deep). Several older outfalls are still in use in California, which were subject to early EPA waivers requiring only primary treatment of effluent. While the 200-feet depth standard generally requires an outfall terminus to be located significant distance offshore, some outfalls may be in shallower waters. At times, the 200-feet requirement can result in pipes crossing the state / federal jurisdictional boundary. In these cases, a joint permitting process is entered into with the EPA. While the EPA is given primary responsibility for review of ocean outfall sitings, state governments have significant input since plume size and regional ocean currents can direct plumes back into their territorial waters.

Florida

South Florida has six ocean outfalls, primarily for treated wastewater, in the three-county area of Palm Beach, Broward and Dade.[183] This region is characterized by increasing population growth and relatively high population density.[184] The Southeast Florida Outfall Experiment (SEFLOE) studies were undertaken in the 1990s as a joint project between NOAA, the Florida Department of Environmental Protection and the EPA.[185] This study provides up-to-date scientific information on ocean outfalls and their impact on the surrounding environment. From a regulatory standpoint, Florida leans heavily on the CWA, as described previously.[186] However, Florida also has enacted its own Air and Water Pollution Control Act,[187] which is similar to the federal law prohibiting the discharge of untreated wastewater into any state waters. Additionally, a

[181] *But see,* House Bill 1809. "An Act to Authorize the Legislative Research Commission to Study Methods of Disposing of Wastewater at Municipal Wastewater Treatment Systems." April 19, 2007. Authorizing research into alternative types of wastewater disposal, including ocean outfalls.
[182] Required by the EPA under the Clean Water Act.
[183] Koopman et al. *Ocean Outfall Study: Final Report.* Prepared for Florida Department of Environmental Protection. April 18, 2006, *at* http://dep.state.fl.us/water/reuse/docs/OceanOutfallStudy.pdf.
[184] *Id.* at ES-2.
[185] *See* Section 6 EPA report at 6-3, *at* http://www.epa.gov/region4/water/uic/downloads/ra/06-ocean.pdf.
[186] *Supra,* note 246.
[187] Fla. Stat. §403.021 *et seq.*

series of state regulations outline the standards that wastewater effluents must meet.[188] Florida requires secondary treatment for wastewater.[189]

California

There are 37 ocean outfalls in California that discharge over 1.5 billion gallons of wastewater effluent daily.[190] The California State Water Resources Control Board is charged with ensuring the "highest reasonable quality for waters of the State,"[191] but there is little information on the board's policy regarding wastewater treatment requirements for ocean outfall effluents. There is evidence, however, that California is at the forefront of the movement to encourage more stringent tertiary wastewater treatment before effluent is released via ocean outfalls.[192] The push for tertiary treatment may stem from the presence of outdated facilities along the coast. For example, in Los Angeles County, existing ocean outfalls were installed between 1950 and 1970 and have not been inspected since. The Los Angeles County Sanitation District is currently involved in a 2-year campaign to raise community support for a project to update four ocean outfalls. California's existing environmental regulations require water reclamation plants to undergo tertiary treatment, while the Joint Ocean Outfall system in Los Angeles County is only required to go through primary and secondary treatment. Even more stringent are California regulations pertaining to disposal of wastewater into closed estuaries. This practice requires micro-filtration Reverse Osmosis under state law. Whether or not the idea of applying tertiary treatment to ocean outfalls persists will depend on changing public perception of ocean outfalls and balancing increased costs associated with treatment.[193]

[188] Fla. Admin. Code 62-600.420 *et seq.*
[189] Fla. Admin. Code 62-600.420(1)(a).
[190] Surfrider Foundation, State of the Beach: California, *at* http://www.surfrider.org/stateofthebeach/05-sr/state_summary.asp?zone=WC&state=ca.
[191] California Environmental Protection Agency State Water Resources Control Board, at http://www.swrcb.ca.gov/about/swrcb.html.
[192] Record of Decision for Construction and Operation of the Tertiary Treatment Plant and Associated Facilities at Marine Corps Base Camp Pendleton, California (June 22, 2004), at http://www.epa.gov/EPA-IMPACT/2004/June/Day-22/i14107.htm.
[193] Interview by Scott Geis, NC Division of Coastal Management, with Don Avila and Michael Lyons, Los Angeles Regional Wastewater Quality Control Board, Los Angeles, CA (June 12 and 13, 2008).

RECOMMENDATIONS

The steering committee supports the recommendation in the CHPP that there should be no new or expanded ocean outfalls, whether the outfalls are for wastewater or for storm water. The steering committee recommends decommissioning existing storm water outfalls by using a phase-out process. This would include source reduction to existing outfalls, use of best management practices to clean discharge as needed and retrofitting existing outfalls in the interim. Reasons the steering committee cites for its recommendation include costs to reach deep water and to monitor, the public perception of outfalls near swimming areas and risk of spills caused by damage to infrastructure in exposed habitats. Due to increased development along the North Carolina coast and the increased need for freshwater, the steering committee recommends that the State examine the potential for alternative water treatment methods, such as water reclamation and reuse facilities.

CHAPTER 4

MARINE AQUACULTURE

Aquaculture, "the farming of aquatic organisms, including finfish, shellfish, and aquatic plants,"[194] is a method of food production that is becoming of increasing global significance.[195] Current estimates by the United Nations' Food and Agriculture Organization (FAO) estimates that one-half of all fish consumed globally are harvested from aquaculture facilities.[196] Furthermore, the FAO estimates that by 2030 over 145.5 million metric tons of aquatic food will be needed to meet global demand, compared to the 105.5 million metric tons consumed in 2005.[197] Despite these estimates, and while other countries have invested heavily in their aquaculture industries, the US (ranked below the top 10 in total aquaculture production in 2004[198]) has lagged behind in developing aquaculture facilities. Currently, the US imports large quantities of aquaculture products from countries such as Japan, Chile and Norway, resulting in a trade deficit on aquaculture of over $13.4 billion in 2006.[199] While the US aquaculture industry is small compared to countries such as Norway, there is potential for future growth. The question the State must face is how strong is the potential for ocean-based marine aquaculture in North Carolina, or in federal waters off North Carolina's coast.

By expanding its aquaculture industry into federal waters, the US could capitalize on one of its largest competitive advantages, the Exclusive Economic Zone (EEZ). The EEZ covers over 3.5 million square miles and includes a variety of marine habitats.[200] While not all of the EEZ could be used for marine aquaculture activity, the US has the largest volume of "farmable" water in the world.[201] It is estimated that less than 0.01%, or approximately 35,000 square miles, of the EEZ would be necessary to produce approximately 600,000 metric tons of aquaculture products each year.[202] The technology for marine aquaculture facilities has been developed and employed in the territorial

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[194] Rebecca J. Goldberg et al, *Marine Aquaculture in the United States*, Pew Oceans Commission Report, iii, July 09, 2001, a*vailable at* http://www.pewtrusts.org/uploadedFiles/wwwpewtrustsorg/Reports/Protecting_ocean_life/env_pew_oceans_aquaculture.pdf.

[195] National Oceanic & Atmospheric Administration, *Offshore Aquaculture in the United States: Economic Considerations, Implications & Opportunities*, July 2008, pages 73-74 (Pre-Publication Copy), *available at* http://aquaculture.noaa.gov/pdf/econ/Econ_rpt_all.pdf.

[196] *Id*. at page 3.

[197] *Id*. at page 3-4.

[198] Food and Agriculture Organization of the United Nations. *The State of World Fisheries and Aquaculture- 2006*, page 9, *at* http://www.fao.org/docrep/009/a0874e/a0874e00.htm.

[199] National Oceanic and Atmospheric Administration, *Offshore Aquaculture in the United States: Economic Considerations, Implications and Opportunities*, July 2008, page 4 (Pre-Publication Copy), *at* http://aquaculture.noaa.gov/pdf/econ/Econ_rpt_all.pdf).

[200] *Id*. at page 4.

[201] *See* Gunnar Knapp, *Five Economic Considerations in Thinking About United States Offshore Aquaculture,* 23 Feb, 2005, *at* http://adfg.state.ak.us/special/knapp_offshore.pdf.

[202] National Oceanic and Atmospheric Administration, *Offshore Aquaculture in the United States: Economic Considerations, Implications & Opportunities*, July 2008, page 5 (Pre-Publication Copy), *at* http://aquaculture.noaa.gov/pdf/econ/Econ_rpt_all.pdf.

waters of Puerto Rico, New Hampshire and Hawaii.[203] However, these projects have been incorporated under the regulatory framework of each state, rather than being permitted in federal waters where there is currently no regulatory framework for this type of activity.

Presently there are no US marine-based aquaculture operations outside those sited in Puerto Rico, New Hampshire (experimental only) and Hawaii.[204] The lack of facility development is partially attributable to numerous issues associated with marine-based aquaculture. These issues include: (1) a need to ensure a facility's economic and technical feasibility; (2) an assessment whether production systems are compatible with the marine ecosystem; and (3) the need to clarify regulatory ambiguity. While this chapter will explore these issues, it must be noted that marine aquaculture for the purposes of this chapter means operations outside inlets and estuarine waters, which are already in existence in North Carolina and have a regulatory framework in place.

How Marine Aquaculture Works

The process for marine aquaculture begins on land with the harvest of fish eggs in tanks at a hatchery facility.[205] Young fish are then relocated to an on-site location to be cared for until they are ready to be moved to an ocean environment.[206] Marine aquaculture facilities consist of floating net pens or submerged cages, which are designed to house the stock until such time as they can be harvested.[207] Fish remain in these pens until they are ready for harvest and shipment to land-based processing and shipping centers to be prepared for the commercial markets.

Marine aquaculture facilities are constructed so that there is direct interaction between the facility's operations and the marine ecosystem. This interaction leads to a number of practical issues that must be addressed to ensure that production is compatible with the marine ecosystem and that it is both economically and technically feasible.

Below is an illustration of the mooring system design at the University of New Hampshire's Atlantic Marine Aquaculture Center (AMAC). AMAC's demonstration site can hold up to four cages and "is secured by a submerged mooring grid, 440 feet in perimeter and held fast to the sea floor by 12 anchors. The opposing forces of these anchors and submerged floats place tension on the structure, maintaining the desired geometry and preventing loose lines that could ensnare a marine mammal."[208]

[203] *Id*. at page 7.
[204] *Id*. at page 3.
[205] *See generally,* Kona Blue Water Farms, Our Sustainable Farming of Kona Kampachi, *at* http://www.kona-blue.com/sustainability.php.
[206] *Id*.
[207] Thomas R. Head III, *Fishy Business – Regulating Aquaculture Operations in the United States*, NR&E, Summer 2003.
[208] Atlantic Marine Aquaculture Center, Mooring System, *at* http://amac.unh.edu/finfish/finfish_mooring.html.

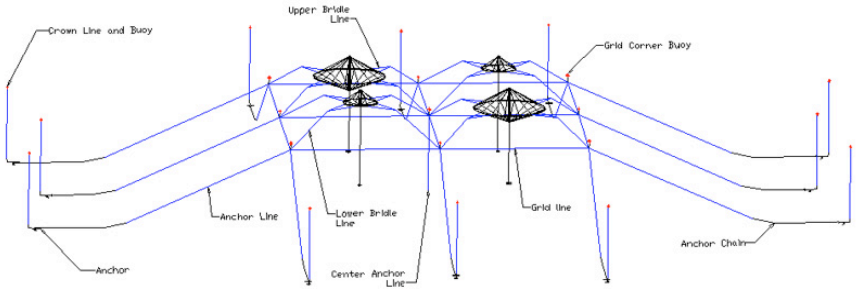

Figure 11: Marine Aquaculture Mooring System

Ocean Shellfish Aquaculture

While marine aquaculture efforts have traditionally involved finfish production, additional technologies are being employed for the development of pelagic shellfish fisheries. Currently, the University of New Hampshire's AMAC is involved in research on the use of submerged longlines to farm blue mussel in the open ocean.[209] Using this technology, submerged longlines are set in ocean waters, taking into account the depth of water; the depth of the line below the surface (submerged mid-water depth); and the length of the longline (distance between anchors).[210] Both surface and submerged longline systems can be used for mussels, scallops, oysters and other mollusks.[211] While surface longlines are static structures utilizing surface buoys to maintain tension, these structures do not require a particular geometry as long as anchors resist strong currents and potential damage from boats during site maintenance and harvest activities.[212] In comparison, submerged lines have dynamic geometric structures that must be brought to the surface from a mid-water position for harvest.[213] The significance of this research to North Carolina is that State waters are within the blue mussel's range and represent a potential development area for future ocean-based aquaculture facilities. Although this technology has limited application in North America, it is believed to have the potential to solve site-specific problems associated with shellfish.[214] Concerns for the practice include:

- Increased wave action may cause mussels to fall off line and scallops and oysters to be stressed;
- Bio-fouling;
- Potential conflict with shipping lanes; and
- Possible lack of access to service the farms during adverse conditions.[215]

[209] University of New Hampshire Atlantic Marine Aquaculture Center, Shellfish Aquaculture, *at* http://ooa.unh.edu/shellfish/shellfish_about.html.
[210] *Id.*
[211] *Id.*
[212] *Id.*
[213] *Id.*
[214] *See* Fukui North America, Submerged Longlines – Technology for Open Ocean Shellfish Culture, *at* http://www.fukuina.com/articles/sept_oct98.htm.
[215] *Id.*

Issues with Marine Aquaculture

A primary concern with marine aquaculture is that the siting and development of these facilities serves as an opportunity for the introduction of non-indigenous species into endemic environments. This introduction stems from the inevitable escape of farmed fish from the facility.[216] The reasons for fish escape are varied and include faulty facility construction, human error and natural events such as storms and hurricanes.[217]

Whatever the reasons for the escape, the interaction between the escaped fish and the marine ecosystem could be problematic for a variety of reasons. One reason is the issue of genetics. Genetic modifications are bred into farmed fish in order to promote commercially beneficial traits, such as increased growth rates.[218] If genetically altered fish escape and reproduced with wild populations, it is possible their offspring could be genetically anomalous.[219] Over time, these anomalous offspring could dilute the genetic traits of wild populations.[220] While this issue has solutions such as sterilization of farmed stock,[221] neither North Carolina nor the federal government has directly addressed this concern.

Another issue of concern is interspecies competition. When farmed fish escape from facilities, they compete with wild populations for resources necessary for survival.[222] This problem is only heightened if the escaped species is genetically modified or non-indigenous, which could allow them to outcompete indigenous stocks for those resources.[223] This, in turn, could in turn disrupt the marine ecosystem.[224] North Carolina only allows fish species native to the area to be harvested in aquaculture facilities. The farming on non-indigenous species may be undertaken only with special approval from the Fisheries Director of the NC Division of Marine Fisheries.[225]

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[216] Erin R. Englebrecht, "Can Aquaculture Continue to Circumvent the Regulatory net of the Magnuson-Stevens Fishery Management Act," 51 Emory L.J. 1187 (Summer 2002).
[217] Rosamond L. Naylor, *Environmental Safeguards for Open Ocean Aquaculture*, Issues in Science and Technology, page 53 Vol. 22 No. 3.
[218] Rebecca J. Goldberg et al, "Marine Aquaculture in the United States," Pew Oceans Commission Report, pg 7, July 09, 2001, *at* http://www.pewtrusts.org/uploadedFiles/wwwpewtrustsorg/Reports/Protecting_ocean_life/env_pew_oceans_aquaculture.pdf
[219] US Commission on Ocean Policy, "An Ocean Blueprint for the 21st Century," 331, 20 Sept. 2004; See Osha Gray Davidson, *The Farmer Goes to Sea,* The Future of Fishing, page 62, Vol. 268, No. 4. *See also* Rosamond L. Naylor, *Environmental Safeguards for Open Ocean Aquaculture*, Issues in Science and Technology, page 53, Vol. 22, No. 3.
[220] *Id*.
[221] Mary Liz Brenninkmeyer, *The Ones that Got Away: Regulating Escaped Fish and Other Pollutants from Salmon Fish Farms*, 27 B.C. Envtl. Aff. L. Rev. 75.
[222] Biliana Cicin-Sain et al., *Development of a Policy Framework for Offshore Marine Aquaculture in the 3-200 Mile US Ocean Zone,* Center for the Study of Marine Policy, University of Delaware, page 98, *at* http://darc.cms.udel.edu/sgeez/sgeez1final.pdf.
[223] Dean and Mark Schwartz, "Fish Farms pose threat to ecology, jobs, report says," Stanford Report, 1 Oct 2003, *at* http://cesp.stanford.edu/publications/fish_farms_pose_threat_to_ecology_jobs_report_says/index.html.
[224] CRS Report for Congress (Open Ocean Aquaculture), May 15, 2007.
[225] 15A NCAC 03I.0104(a)(1).

However, this regulation does not address the issue of genetically modified fish or non-indigenous species that received permission to be farmed. Congress has recognized the issues associated with culturing non-indigenous species and has enacted laws to attempt to prevent their accidental release.[226]

Marine-based aquaculture operations also impact the surrounding ecosystem through the waste that is produced by these facilities. Aquaculture waste includes the chemicals and drugs fed to fish stocks, as well as an abnormal concentration of fish feces. Chemicals of particular concern used within the aquaculture industry are nitrogen and phosphorus.[227] However, there are only a few drugs that are USDA-approved for aquaculture use, and most of these, if not all, require veterinary approval and are heavily regulated.[228] Furthermore, the impacts from these chemicals in the open ocean environment may be reduced because of the rate of experienced in an open ocean setting. It is also less likely that facility wastes will settle in surrounding benthic environments, as ocean currents would play a significant role in the transportation of waste that would neutralize, or at least localize, any impacts.[229]

In either case, during the release of waste materials or the potential introduction of industry related chemicals, North Carolina and the federal government have relevant legislation applicable to these types of activities. The NC Division of Water Quality requires that, in order to discharge waste from an aquaculture facility, the facility must have a National Pollutant Discharge Elimination System (NPDES) permit.[230] The issue with a NPDES permit is whether it would adequately address the unique situation of marine-based aquaculture facilities, in the event chemicals were introduced into ocean waters. More applicable is the EPA's Ocean Discharge Criteria for the discharge of wastewater into the ocean,[231]which requires that discharges not create "unreasonable degradation of the marine environment."[232] Also, a NPDES permit applicant must produce extensive information on the chemicals to be discharged, as well as their possible effects before receiving a permit.[233] Once a NPDES permit is granted, the permit holder must monitor the waste to ensure that concentrations being discharged are within legal limits.[234] North Carolina and the federal government both have specific laws to deal with

[226] 16 U.S.C §4701.
[227] Rebecca J. Goldberg et al, *Marine Aquaculture in the United States*, Pew Oceans Commission Report, page 14, July 09, 2001, *at* http://www.pewtrusts.org/uploadedFiles/wwwpewtrustsorg/Reports/Protecting_ocean_life/env_pew_oceans_aquaculture.pdf.
[228] Interview with Marc Turano, mariculture and blue crab specialist, North Carolina Sea Grant (July 31, 2008).
[229] *See* Charles E. Helsley, "Open Ocean Aquaculture in Hawaii," *at* www.lib.noaa.gov/docaqua/hooarrprept.htm; Osha Gray Davidson, "The Farmer Goes to Sea," The Future of Fishing, page 62, Vol. 268, No. 4.
[230] *See* NC Division of Water Quality, NPDES Documents, *at* http://h2o.enr.state.nc.us/NPDES/documents.html#generalapps.
[231] 2 NCAC 2H.0404(d).
[232] 40 C.F.R. §125.122.
[233] *Id*.
[234] 40 C.F.R. §125.123(d)(3).

the use of pesticides,[235] while the Food and Drug Administration has the authority to approve drugs or prohibit drugs that would be used in marine aquaculture[236] activities and that could potentially harm ocean ecosystems.

Regulatory Ambiguity

Ultimately, aquaculture is a business, and a business needs regulatory certainty to assure investors and to allow for sound financial decisions. Currently, a host of regulatory agencies and entities have some level of control over activities in the open ocean.[237] However, there is currently no process to obtain a permit for marine aquaculture operations in federal waters.[238] To address this lack of regulatory certainty, a bill for the National Offshore Aquaculture Act of 2007 was introduced in Congress.[239] Under the bill, the Secretary of Commerce would be authorized to develop a regulatory framework for aquaculture in federal waters.[240] One of the purposes of introducing the bill is to encourage the establishment of a regulatory system (and, therefore, create some measure of regulatory certainty), so that investors will be more likely to invest – not only in commercial ventures, but also in the continued research and development of technology and in feasibility assessments.[241] If enacted, the bill would:

- Authorize the Secretary of Commerce to issue offshore aquaculture permits;
- Require the Secretary of Commerce to establish environmental requirements;
- Require the Secretary of Commerce to work with other federal agencies to develop and implement a coordinated permitting process for offshore aquaculture;
- Exempt permitted offshore aquaculture from fishing regulations that restrict size, season and harvest methods;
- Authorize a research and development program for all types of marine aquaculture; and
- Authorize funding to carry out the Act and provide for enforcement of the Act.[242]

[235] N.C. Gen. Stat. §143 (2008). *See also* 7 U.S.C. §136 (2008).
[236] 7 U.S.C. §136 (2008).
[237] US Commission on Ocean Policy, "An Ocean Blueprint for the 21st Century," 333, 20 Sept 2004, *at* http://www.oceancommission.gov/documents/full_color_rpt/welcome.html.
[238] National Oceanic and Atmospheric Administration, "Offshore Aquaculture in the United States: Economic Considerations, Implications & Opportunities," July 2008, page 3. (Pre-Publication Copy), *at* http://aquaculture.noaa.gov/pdf/econ/Econ_rpt_all.pdf.
[239] *Id*.
[240] National Offshore Aquaculture Act of 2007, H.R. 2010, 110th Congress (2007).
[241] 33 U.S.C. §1251 (2008). *See also* Mary Liz Brenninkmeyer, "The Ones that Got Away," 27 B.C. Envtl. Aff. L. Rev 75.
[242] National Offshore Aquaculture Act of 2007, H.R. 2010, 110th Congress (2007).

The 2007 bill is based on a similar 2005 bill, which did not get past the Congressional committee stage. The 2007 bill was developed in consultation with industry, conservation groups, states, the research community, as well as other interested groups. For the 2007 proposal, this diverse group of stakeholders recommended revisions in the areas of environmental requirements, permits, the role of the states, and research.[243] Of particular interest to coastal states may be Section 4(d), which allows coastal States to object to new offshore aquaculture development within 12 miles of their coastlines.[244] Based on this section, the Department of Commerce cannot issue any new offshore aquaculture permits within 12 miles of any coastal state that objects by submitting a written notice.[245] However, a caveat states that the coastal state's objection would not apply to permit applications received prior to the receipt of an objection.[246] Finally, a coastal state is allowed to revoke its objection at any time.[247]

In North Carolina, there is a slightly more developed regulatory framework for the leasing of the water column in State waters. The Marine Fisheries Commission has the authority to lease public waters for aquaculture, but this authority is limited to leases regarding shellfish.[248] Legislation pertaining to the shellfish leases also regulates issues such as lease renewals and transferability.[249] However, such legislation does not cover all issues, such as an investor's need for an exclusive right to the waters in which the facility is located, likely waters held in public trust.[250] While shellfish leases might not be directly applicable to finfish aquaculture operations located in state coastal waters or in federal waters, it can be adapted. It is possible that the current shellfish legislation could be a starting point for a future comprehensive regulatory system for a marine-based aquaculture industry in North Carolina, if such a venture is technically and economically feasible in the state's coastal-ocean environment.

Other Concerns

The issues created by any developing industry are complex, and marine-based aquaculture is no exception. The different types of benefits and concerns that an expansion of the industry would create should be fully examined. However, there are some likely issues which merit discussion.

Any developing industry will have a substantial effect on the market. While the exact market impacts of the industry are unknown, there are some possibilities. One possible market impact is the creation of jobs that an expansion of marine-based

[243] National Oceanic and Atmospheric Administration, National Aquaculture Program, *at* http://aquaculture.noaa.gov/us/2007.html.
[244] National Offshore Aquaculture Act of 2007, H.R. 2010, 110th Congress (2007).
[245] *Id.*
[246] *Id.*
[247] *Id.*
[248] N.C. Gen. Stat. §143B-289.52(b)(7) (2008).
[249] NCAC 03O.0201- .0211. *See also*, N.C. Gen. Stat. §113-202 (2008).
[250] Alison Rieser and Susan Bunsick, "Offshore Marine Aquaculture in the Exclusive Economic Zone (EEZ): Legal and Regulatory Concerns," *at* http://www.oceanservice.noaa.gov/websites/retiredsites/natdia_pdf/16rieser.pdf.

aquaculture might offer. While these operations can be automated to an extent, the industry also supports secondary industries such as fish feed production, equipment manufacturing and packaging plants.[251] Of concern is the possibility that high labor costs in the US could lead to an increased presence of automated systems in the industry.[252] Yet, countries with similar wage levels, such as Norway and Canada, have not had a mass implementation of automated systems in their aquaculture operations.[253]

There are also some financial and technological issues that have investors hesitant to finance marine-based aquaculture operations. Financing this type of operation is expensive, with needs for unique equipment and training for the facilities personnel. Due to the location of these facilities, there would be high variable costs, such as fuel, transportation, and security costs.[254] All these expense could create a situation where marine-based aquacultures expansion would not be economically feasible. Federally, there are programs such as the Saltonstall-Kennedy Grant Program that has provided commercial aquaculture projects between $500,000 and $1.7 million annually.[255] Technologically, there are some concerns with the size and design necessary to create a commercially viable facility.[256] There are also concerns on the technological ability to address many of the practical issues involved with such an operation. The National Sea Grant Program has attempted to address such technological issues through promoting the development of disease control, food processing and environmental technology.[257] Sea Grant also has worked internationally to develop a technology exchange between multiple countries for the advancement of aquaculture practices.[258]

Recent Developments

A recent proposal from MMS on offshore energy included language allowing for the alternative use of energy facilities.[259] This proposal focuses on the governing of the developing offshore energy industry; however, it includes language that allows for permits for fish farms on the structures.[260] While the 2005 Energy Policy Act allows MMS to issue permits for offshore energy facilities and other "authorized marine related

[251] *See* US Commission on Ocean Policy, "An Ocean Blueprint for the 21st Century," 20 Sept 2004, *at* http://www.oceancommission.gov/documents/full_color_rpt/welcome.html.
[252] Biliana Cicin-Sain et al., "Development of a Policy Framework for Offshore Marine Aquaculture in the 3-200 Mile US Ocean Zone," Center for the Study of Marine Policy, University of Delaware, page 19, *at* http://darc.cms.udel.edu/sgeez/sgeez1final.pdf.
[253] "Miles Out, Controversy in a Cage," Business Week, page 62, Vol. 3999.
[254] CRS Report for Congress (Open Ocean Aquaculture); December 13, 2004.
[255] National Oceanic and Atmospheric Association, "NOAA's Aquaculture Policy," February 1998, *at* http://www.lib.noaa.gov/docaqua/noaapolicy.pdf.
[256] Alison Rieser and Susan Bunsick, "Offshore Marine Aquaculture in the Exclusive Economic Zone (EEZ): Legal and Regulatory Concerns," *at* http://www.oceanservice.noaa.gov/websites/retiredsites/natdia_pdf/16rieser.pdf.
[257] National Oceanic and Atmospheric Association, NOAA's Aquaculture Policy, February 1998, *at* http://www.lib.noaa.gov/docaqua/noaapolicy.pdf.
[258] *Id.*
[259] Allison Winters, "Bush admin's offshore fish farm rule doesn't hold water, members say," Environment & Energy Daily (September 10, 2008).
[260] *Id.*

purposes," Congress has yet to authorize offshore aquaculture.[261] Lawmakers have expressed concern about MMS' inclusion of this language as well as the ability of MMS to effectively deal with the potential issues of offshore aquaculture.[262] In light of these concerns there is a call for the repeal of this language.[263]

During the 2008 legislative session, the General Assembly passed H.B. 2431, which authorizes the Joint Legislative Commission on Seafood and Aquaculture (JLCSA) to study the feasibility of increasing the production, processing, and marketing of aquaculture products in the State, which includes (among other things) an analysis of the current and potential economic impact of the aquaculture industry in the State; the current and potential environmental impacts of the aquaculture industry in the State; regulatory changes that may be necessary to increase the production, processing and marketing of aquaculture products in the State; and recommend levels of funding necessary to increase the production, processing, and marketing of aquaculture products in the State.[264] In response, the JLCSA has released a request for proposals (RFP) for a consultant to assist in this study, with applications due in February 2009. The RFP includes marine aquaculture as part of the JLCSA's planned study.

Although Congress has yet to authorize a national program for permitting marine aquaculture operations in federal waters, the Gulf of Mexico Fishery Management Council, a regional body that sets fishing regulations for the federal waters of the Gulf of Mexico, approved a fishery management plan (FMP) to allow large-scale marine aquaculture in federal waters in the Gulf at its January 2009 meeting.[265] According to the FMP, which includes a programmatic EIS, sets forth a regional permitting process for "regulating and promoting environmentally sound and economically sustainable aquaculture in the Gulf of Mexico."[266] If the FMP is implemented, an estimated five to twenty marine aquaculture operations could be permitted in the Gulf of Mexico over an approximately ten-year period.[267] The FMP would serve as a basis for evaluating the impacts of issuing permits for marine aquaculture operations in Gulf of Mexico federal waters.[268] The FMP considered ten actions and range of alternatives, as well as environmental consequences, for establishing such a permitting process. Actions include but are not limited to: establishing permit requirements; operational requirements and

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[261] *Id.*
[262] *Id.*
[263] *Id.*
[264] S.L. 2008-181
[265] Chris Kirkham, "Gulf of Mexico Fish Farms OK'd, But Still Face Series of Hurdles," The Times-Picayune (New Orleans), *at* http://www.nola.com/news/index.ssf/2009/01/gulf_of_mexico_fish_farms_okd.html (January 209, 2009). Note: the Magnuson-Stevens Fishery Conservation and Management Act, at 16 U.S.C. §1852, grants the council authority to regulate fisheries in the federal waters of its jurisdiction.
[266] Gulf of Mexico Fishery Management Council and NOAA National Marine Fisheries Service, Fishery Management Plan for Regulating Offshore Marine Aquaculture in the Gulf of Mexico, January 2009, *available at* http://www.gulfcouncil.org/Beta/GMFMCWeb/downloads/Aquaculture%20FMP%20PEIS%20Final%201-13-09.pdf.
[267] *See id.*
[268] *See id.*

restrictions; duration of permits; species the council would allow to be cultured; specific types of aquaculture systems (e.g., cages and net pens) that could be used; siting requirements and conditions; and establishment of restricted access zones around marine aquaculture facilities.[269] However, despite this approval from the council, the FMP will needs approval from NOAA and the Department of Commerce before it could be implemented.[270]

[269] *See id.*

[270] *See* 16 U.S.C. §1852(h)(1). *See also* Chris Kirkham, "Gulf of Mexico Fish Farms OK'd, But Still Face Series of Hurdles," The Times-Picayune (New Orleans), *at* http://www.nola.com/news/index.ssf/2009/01/gulf_of_mexico_fish_farms_okd.html (January 29, 2009).

RECOMMENDATIONS

Technical Assessment

The steering committee recommends that the State conduct a technical assessment of the feasibility of marine aquaculture in North Carolina's coastal and ocean waters. According to Dr. Marc Turano, mariculture and blue crab specialist with NC Sea Grant, an assessment would be beneficial to study the feasibility of marine aquaculture operations in state coastal waters. A primary concern surrounding the feasibility of a marine aquaculture venture is that marine aquaculture facilities have specific water depth requirements for associated structures, and North Carolina's coastal environment may not provide adequate depth. Sufficient water depth may require going many miles off the coast (15 miles or more), which would be in federal waters.[271] Furthermore, a suitable location would need to be where wave action is not too rigorous and should offer some protection from tropical systems.[272] Dr. Turano estimates that a water depth of at least 140 feet would be needed for submerged cages to protect them from tropical systems,. For these reasons, it is debatable whether North Carolina's coastal waters provide a suitable environment for marine-based aquaculture. There are examples where the failure to account for these concerns has resulted in significant problems for the facility. An experimental project off the coast of Mississippi was unsuccessful due to the finfish cage frequently breaking away from its moorings. At one point during a hurricane in the early 2000's, the cage was temporarily lost.[273] As a result, researchers were required to place a GPS device on the cage to aid future retrieval efforts.[274] Such anecdotes highlight the need for a technical assessment for marine aquaculture in North Carolina's coastal waters.

Another issue is whether Congress will pass a national offshore aquaculture bill in the future, particularly in light of the approval by the Gulf of Mexico Fishery Management Council of a FMP for marine aquaculture in Gulf federal waters. The steering committee recommends that DCM continue to monitor the progress of the National Offshore Aquaculture Act of 2007, or similar future bills. If a bill is passed, then the steering committee recommends the State implement relevant policies as part of its coastal management plan for CZMA consistency purposes. The steering committee also recommends that DCM monitor the progress of the Gulf of Mexico marine aquaculture FMP, as it moves through the process to receive approval by the Department of Commerce.

[271] Interview with Marc Turano, mariculture and blue crab specialist, North Carolina Sea Grant (July 31, 2008).
[272] *Id.*
[273] *Id.*
[274] *Id.*

CHAPTER 5

COMPREHENSIVE OCEAN MANAGEMENT

Coastal states such as California and Massachusetts are engaging in state-level planning and policy strategies that look to effectively manage the development and protection of their coastal and marine resources. Over the past several years, this strategy has come to be labeled as comprehensive ocean management or ocean zoning. One of the benefits of this approach is that comprehensive ocean management can be utilized as a tool to minimize user conflicts over ocean resources.[275] The driving force behind efforts to institute these comprehensive programs may very well be the realization that many state governments already practice de facto zoning through the many rules and regulations established and enforced by their environmental agencies. For example, in North Carolina the designation of artificial reefs and Essential Fish Habitat by the Division of Marine Fisheries, and even the dredging component of beach nourishment practices, permitted by the Division of Coastal Management, are a form of zoning because they permit an exclusive use or designation of coastal waters for a specified temporal and spatial extent. Each of the emerging issues discussed prior to this section can be thought of in the context of ocean zoning, as each of these issues will utilize areas of the coastal ocean or estuaries and will present specific user conflict issues.

The benefit of comprehensive ocean management is that this strategy can potentially accomplish one or more of the following objectives: (1) separate heavy, extractive, and industrial uses from less intensive uses such as recreation and research; (2) determine compatible and incompatible marine uses and activities; (3) establish or incorporate existing no-take zones in a variety of key habitats and ecosystems; (4) surround the most protected areas with low-intensity buffer zones; or (5) permit amendments to the zoning plan as better scientific data becomes available.

Obstacles to establishing comprehensive ocean management are both inherent and policy-based. Inherent obstacles include the effectiveness of using any type of zoning strategy to protect mobile marine life populations (known as "ocean zoning"), and the technical difficulty of creating boundaries in a marine ecosystem that does not lend itself to boundaries as easily as land.[276] However, recent developments, such as GIS technology and new undersea mapping technologies, can reduce these inherent obstacles.[277] Policy-based obstacles would be more difficult to overcome.

The US, at both federal and state levels, traditionally has approached ocean management and conservation on an issue-by-issue, species-by-species manner. As a result, different agencies and regulations apply to different activities in coastal and ocean

[275] *See* Elliot A. Norse, *Ending the Range Wars on the Last Frontier: Zoning the Sea*, in Marine Conservation Biology 422, 436 (Elliot A. Norse and Larry B. Crowder, eds., 2005).
[276] *See* Fara, Courtney and Jack Wiggin, *Ocean Zoning for the Gulf of Maine: A Background Paper* at 7 (2003), *available at* http://www.mass.gov/czm/oceanzoningreport.pdf.
[277] *See* Norse at 437-438.

waters. The following list illustrates the various agencies that have jurisdiction over the State's coastal and ocean waters and resources.

- The NC Department of Agriculture and Consumer Services administers aquaculture facility licensing and regulation.
- Within the NC Department of Cultural Resources, the State Historic Preservation Office and Office of State Archaeology identify and protect historic and archaeological sites in North Carolina, including coastal and underwater sites.
- DENR has several divisions that regulate coastal areas. These are:
    - Division of Coastal Management: administers CAMA and the NC Dredge and Fill Law regulating development in the coastal area;
    - Division of Environmental Health: Public Water Supply Section, Shellfish Sanitation and Recreational Water Quality Section and On-Site Water Protection Section all potentially have coastal area applications;
    - Division of Forest Resources: manages and protects coastal forest resources;
    - Division of Marine Fisheries: protects and manages fishery and shellfish resources; develops Coastal Habitat Protection Plans; and administers the Public Trust/Submerged Lands Program and Artificial Reef Program;
    - Division of Parks and Recreation: acquires and manages coastal parks and natural areas;
    - Division of Soil and Water Conservation: assists local coastal Soil and Water Conservation Districts;
    - Division of Water Quality: regulates and protects surface water and groundwater quality; and
    - Division of Water Resources: manages water supply and water conservation efforts, as well as beach nourishment and waterway improvement projects.

Because comprehensive ocean management policies address many issues such as development, fisheries and recreational fishing, habitat and species protection and recreational uses, if there was any institutional disconnect between different types of marine activities them they would need to be addressed in order to create an effective, comprehensive management plan for North Carolina's coastal and ocean waters.

Examples of Comprehensive Ocean Management in Other States and Australia

Australia

Although many marine policy experts have recommended ocean management in the US,[278] only Massachusetts has begun implementing such a plan thus far. Worldwide, however, one of the most commonly cited examples of a successful ocean-zoning regime is the Great Barrier Reef Marine Park in Australia. The park incorporates nine zones ranging from no-take, restricted-access zones to general use zones.[279] Dr. Elliot Norse of the Marine Conservation Biology Institute attributes the park's success to five reasons:

1. The legislation which created the park empowered the park's management authority to punish violators;
2. The park is managed as a whole, rather than on a piece-meal basis;
3. There is "meaningful dialogue" between the park authority and users regarding zoning decisions and regulations;
4. Public and political support for the park; and
5. Park authority has adapted the zones to fit changing patterns of use and new scientific understanding.[280]

Rhode Island

In the US, there currently is not a program as comprehensive as the program for the Great Barrier Reef Marine Park. However, there are coastal states making significant headway into drafting comprehensive plans to manage their ocean resources and state waters. Rhode Island recently announced plans to create an ocean special area management plan (Ocean SAMP) for the state's territorial waters over the next two years.[281] The project is a partnership between the University of Rhode Island and the Rhode Island Coastal Resources Management Council (CRMC).[282] According to the CRMC, the plan:

> Will include a mapping exercise of existing uses of our ocean waters coupled with mapping for critical zones (transportation corridors, military reserves, essential habitat, etc.). Simultaneously, a screening of sites that have suitable characteristics for renewable energy will also be produced. Additionally, a

[278] Both the Pew Ocean Commission and the US Commission on Ocean Policy recommended regional ocean "zoning" programs. The reports can be found at http://www.pewtrusts.org/uploadedFiles/wwwpewtrustsorg/Reports/Protecting_ocean_life/env_pew_oceans_final_report.pdf and http://oceancommission.gov/documents/full_color_rpt/welcome.html.

[279] *See* Great Barrier Reef Marine Park Authority, Zoning, *at* http://www.gbrmpa.gov.au/corp_site/management/zoning. This Web page contains an explanation of the park's zoning scheme as well as maps and explanations of each zone within the park.

[280] *See* Norse at 437.

[281] Rhode Island Coastal Resources Management Council, RI Ocean Special Area Management Plan, *at* http://www.crmc.state.ri.us/samp/ocean.html. The Rhode Island CRMC website has proposal and planning documents available for download that provide more detail into the rationale behind the Ocean SAMP, the process and expected outcomes.

[282] *Id.*

conflict analysis will be performed to determine which area(s) may be desirable for a more intensive screening exercise.[283]

One product from the Ocean SAMP project will be a zoning map, which will be subject to public review and comment and involve state and federal agencies.[284] Rhode Island plans to have a draft version of a "floating zone tool" deployed by February 2009, with the Ocean SAMP itself complete and adopted by the CRMC by February 2010 and permitting completed by June 2010.[285] The Ocean SAMP will include a provision for renewable energy zones, as preparation for renewable energy projects in state and federal waters, including developing regulatory certainty for investors, was an impetus for the project.[286]

Massachusetts

Perhaps the most significant attempt to establish a statewide platform for ocean management is a bill passed in Massachusetts that will create the first comprehensive zoning plan for a state's territorial waters in 2008. The passage of this law was the result of many years of effort and was based on work from a state ocean management task force that was charged with defining the guiding principles for the use of state waters and ocean resources. These guiding principles included:

- Examining Massachusetts coastal policies and the adequacy of the legal framework;
- Determining data requirements for managing state waters; and
- Examining the organization of governance over state waters to ensure that statewide interests are met.

The task force completed its work in 2004, releasing a report entitled "Waves of Change."[287] The report consisted of policy recommendations, which included a comprehensive program for ocean planning. After several years of negotiations, the bill was signed into law in May 2008.[288] The law delegates responsibility of producing an ocean management plan to the secretary of the Executive Office of Energy and Environment Affairs (EOEEA). However, the law does not supersede the authority of the state's division of marine fisheries.[289] The EOEEA quickly began work on drafting an

[283] *Id.*
[284] *Id.*
[285] *Id.*
[286] *Id.*
[287] The full text of the report is available at http://www.mass.gov/czm/oceanmanagement/waves_of_change/pdf/wavesofchange.pdf.
[288] Press Release, Conservation Law Foundation, MA Governor Signs Historic Ocean Management Bill (May 28, 2008), *available at* http://www.massoceanaction.org/news4.html. *See also* Press Release, Gov. Deval Patrick, Governor Patrick Signs Law Creating First-In-The-Nation Ocean Management Plan Balancing Preservation, Uses (May 28, 2008), *available at* http://www.mass.gov/?pageID=gov3pressrelease&L=1&L0=Home&sid=Agov3&b=pressrelease&f=080528_oceans&csid=Agov3.
[289] Sivas, Deborah A. and Margaret Caldwell, "A New Vision for California Ocean Governance: Comprehensive Ecosystem-based Marine Zoning," 27 Stan. Envt'l L. J. 209, 270 n.50 (2008).

ocean plan by creating an ocean advisory commission and science advisory panel.[290] The EOEEA also held several "listening sessions" in the fall of 2008 to solicit public input on the draft plan.[291] The draft version of the Massachusetts ocean plan is scheduled for the summer of 2009, with final promulgation by December 31, 2009.[292]

Oregon

Oregon has approached ocean management differently than Rhode Island and Massachusetts. The Oregon Ocean Resources Management Act[293] mandates the creation of the Territorial Sea Plan as a guide for the management of Oregon's territorial sea. Instead of dividing the sea into zones, the plan outlines management goals and policies, amended in 2001, which prioritize conservation over development.[294] Instead of establishing a new administrative body to implement the plan, it emphasizes incorporation of the plan into each agency with jurisdiction over ocean and coastal resources and coordination among existing agencies.[295] The plan itself is comprised of four parts and describes: 1) the relationships among State laws and participating agencies involved in the management of Oregon's coastal and ocean resources; 2) the establishment of mandatory procedures and standards for carrying out plan goals;[296] 3) a planning framework for specific coastal areas; and 4) uses of the sea floor.

In 2007, a bill providing funding for mapping the State's territorial sea floor was submitted in the Oregon House of Representatives.[297] The bill intends for these maps to be used as a tool for designating sites as Marine Protected Areas (MPAs). As a result, on March 26, 2008, Governor Kulongoski issued an executive order directing the Ocean Policy Advisory Committee (OPAC) to begin the process of recommending sites to be designated as marine reserves.[298] Since this time, Oregon Sea Grant has held a series of public meetings to educate the community about the process. Site proposals were accepted through September of 2008, with full implementation scheduled to begin in 2011.[299]

[290] Massachusetts Executive Office of Energy and Environmental Affairs, "Massachusetts Ocean Plan," *at* http://www.mass.gov/?pageID=eoeeasubtopic&L=3&L0=Home&L1=Ocean+%26+Coastal+Management&L2=Massachusetts+Ocean+Plan&sid=Eoeea.
[291] *See id.*
[292] *See id.*
[293] OR Rev. Stat. §§196.405-515.
[294] Available at http://www.oregon.gov/LCD/OCMP/docs/Ocean/otsp_1-g.pdf.
[295] Available at http://www.oregon.gov/LCD/OCMP/docs/Ocean/otsp_1-f.pdf.
[296] Territorial Sea Plan, Part One: Ocean Management Framework, (F)(1)(a), available at http://www.oregon.gov/LCD/OCMP/docs/Ocean/otsp_1-f.pdf.
[297] H.B. 2924, 74th Leg. Assem., Reg. Sess. (Or. 2007).
[298] Executive Order 08-07 (March 26, 2008).
[299] Regularly updated information about the project is available at http://www.oregonmarinereserves.net/index.php.

California

Finally, California also has made efforts to implement a comprehensive ocean plan. In 2004, the California Ocean Protection Act was signed into law, creatingan Ocean Protection Council (OPC). By statute, the council is responsible for:

- Coordinating the ocean-related activities of state agencies;
- Improving the state's protection of ocean and coastal resources;
- Coordinating the gathering and exchange of ocean and coastal data among agencies; and
- Making recommendations to the governor and state legislature for changes to state ocean policy.[300]

In 2006, the OPC released a five-year action plan outlining its priorities, goals, and strategies.[301] As of February 2008, the OPC is working on all but four of its 36 planned actions. As part of the action plan, two pilot ecosystem-based management programs have been implemented in California: Humboldt Bay and Morro Bay.[302] Authors Brian Baird and Amber Mace cite the flurry of activity in the two years following the plan's creation as positive.[303] However, the OPC has been criticized for its lack of "regulatory authority or management jurisdiction."[304] Because the OPC lacks management jurisdiction over ocean resources, it must rely on other agencies to implement its policy recommendations.

North Carolina

While North Carolina does not currently have a comprehensive, overarching ocean management plan in place, there are examples of piece-meal, de facto management occurring at the State level. For instance, N.C. Gen. Stat. §160A-176.1 and §176.2 authorize local governments to exercise their police powers by regulating activities in adjacent waters. Limiting swimming and personal watercraft operation in certain areas is a type of de facto ocean management as it segregates a use or non-use of an area of public trust water. In practice, many of the permitting activities performed by DENR's divisions may be regarded as de facto management, as they provide individuals with the ability to conduct certain activities within a temporal and spatial window within coastal and ocean waters. An activity can be considered de facto ocean management based on the fact that it prevents another user or activity from occupying the same public trust area for a period of time. CAMA and other agency permits serve the purpose of providing an ability to carry out an activity in a defined location. Even the restriction of an activity could be considered the "zoning" of that particular activity.

[300] Cal. Pub. Res. Code §35615.
[301] The California Ocean Protection Council, A Vision for Our Ocean and Coast: A Five Year Strategic Plan, available at http://www.resources.ca.gov/copc/docs/OPC_Strategic_Plan_2006.pdf.
[302] Information about the Humboldt Bay program is available at http://www.humboldbay.org and information about the Morro Bay program is available at http://www.mbnep.org/index.php.
[303] Brian E. Baird & Amber J. Mace, Regional Ocean Governance: A Look at California, 16 Duke Envtl. L. & Pol'y F. 217, 222-225 (2006).
[304] *See* Sivas and Caldwell at 242.

The North Carolina Coastal Reserve Program is another example of de facto ocean management. Designating specific sites as marine managed areas and limiting permitted uses within their boundaries would qualify. More extensive examples of systems of marine managed areas that are zoned include the Florida Keys National Marine Sanctuary, the Monterey Bay National Marine Sanctuary, the Channel Islands National Marine Sanctuary, the Monitor Marine Sanctuary in North Carolina, and the Snowy Grouper Wreck MPA in North Carolina which is part of a larger marine "wildlife refuge" off the Southeast coast of the US that the National Oceanic and Atmospheric Administration created in January 2009. Washington State also has a network of aquatic reserves that are governed by site-specific management plans. In January 2008, The Washington Department of Natural Resources accepted nominations for additional sites to become aquatic reserves.[305]

A third example is in the North Carolina Critical Habitat Protection Plan (CHPP).[306] In 1997, the General Assembly passed the Fisheries Reform Act (FRA) as a response to concerns about overfishing and protecting fish habitat. The FRA directed the protection and enhancement of habitats supporting coastal fisheries and required the cooperation of DENR agencies and the CRC, EMC and Marine Fisheries Commission to meet these goals. The CHPP emphasizes six habitats as high priority areas that are vital to the productivity of coastal fisheries, details information on each habitat and recommends management actions. The North Carolina Division of Marine Fisheries was charged with writing the plan. The CHPP:

- Documents the ecological role and function of aquatic habitats for coastal fisheries;
- Provides status and trends information on the quality and quantity of coastal fish habitat;
- Describes and documents threats to coastal fish habitat, including threats from both human activities and natural event;
- Describes the current rules concerning each habitat;
- Identifies management needs; and
- Develops options for management action using the above information.[307]

[305] Information about the aquatic reserves program is available at http://www.dnr.wa.gov/ResearchScience/Topics/AquaticHabitats/Pages/aqr_rsve_aquatic_reserves_program.aspx.
[306] More information on the NC CHPP is available at http://www.ncfisheries.net/habitat/index.html.
[307] North Carolina Division of Marine Fisheries, What is a CHPP, *at* http://www.ncfisheries.net/habitat/chpp2.html.

Limitations on the Authority of the CRC to Administer a Comprehensive Ocean Management Plan

CAMA authorizes the CRC to designate AECs,[308] develop use standards for AECs[309] and to issue permits in accordance with use standards and local land-use plans.[310] The CRC designated estuarine waters[311] and public trust waters[312] as AECs. According to 15A NCAC 07H.0203:

> [I]t is the objective of the Coastal Resources Commission to conserve and manage estuarine waters, coastal wetlands, public trust areas, and estuarine and public trust shorelines, as an interrelated group of AECs, so as to safeguard and perpetuate their biological, social, economic, and aesthetic values and to ensure that development occurring within these AECs is compatible with natural characteristics so as to minimize the likelihood of significant loss of private property and public resources.

The rules also set forth individual guidelines for the management of both estuarine waters and public trust areas.[313]

Under CAMA, the CRC does not have adequate authority to develop and administer a comprehensive plan for ocean management. Ocean waters fall within two CAMA AEC classifications: estuarine waters[314] and public trust areas.[315] However the CRC's authority over AECs is limited to the granting or denial of permits for development. However, "development" under CAMA does not include recreational use or activities that do not physically alter the land or water.[316] Therefore, while the CRC

[308] N.C. Gen. Stat. §113A-113(a).
[309] N.C. Gen. Stat. §113A-107(b).
[310] N.C. Gen. Stat. §113A-118.
[311] N.C. Gen. Stat. §113A-113(b)(2).
[312] N.C. Gen. Stat. §113A-113(b)(5).
[313] 15A NCAC 07H.0206 and 15A NCAC 07H.0207, respectively.
[314] Defined in N.C. Gen. Stat. §113A-113(b)(2) as, "all the water of the Atlantic Ocean within the boundary of North Carolina and all the waters of the bays, sounds, rivers, and tributaries thereto seaward of the dividing line between coastal fishing waters and inland fishing waters, as set forth in the most recent official published agreement adopted by the Wildlife Resources Commission and the Department of Environment and Natural Resources." The CRC adopted both categories as AECs in 1977. Their description, significance, management objectives, and use standards are codified in 15A NCAC 07H.0206 and .0207, respectively. Since estuarine waters and public trust waters are classified as AECs, the CRC can issue permits for development within these areas.
[315] Defined in N.C. Gen. Stat. §113A-113(b)(5) as "[a]reas such as waterways and lands under or flowed by tidal waters or navigable waters, to which the public may have rights of access or public trust rights, and areas which the State of North Carolina may be authorized to preserve, conserve, or protect under Article XIV, Sec. 5 of the North Carolina Constitution."
[316] N.C. Gen. Stat. §113A-103(5)(a) defines "development" as "any activity in a duly designated area of environmental concern … involving, requiring, or consisting of the construction or enlargement of a structure; excavation; dredging; filling; dumping; removal of clay, silt, sand, gravel or minerals; bulkheading, driving of pilings; clearing or alteration of land as an adjunct of construction; alteration or removal of sand dunes; alteration of the shore, bank, or bottom of the Atlantic Ocean or any sound, bay, river, creek, stream, lake, or canal; or placement of a floating structure in an area of environmental concern identified in G.S. 113A-113(b)(2) or (b)(5)."

has the authority over extraction, dredging and filling or construction through its permitting authority, it does not have the authority to regulate uses other than "development" as defined by the statute. In addition, even if an activity constitutes a CAMA development activity, the CRC may deny the permit only for one of the limited grounds specified in §113A-120. These statutory grounds may not be broad enough to allow the CRC to control activities not consistent with some aspect of a comprehensive zoning plan. Thus, the CRC's present permitting authority is too limited to effectively administer a comprehensive ocean management plan without amending CAMA.

RECOMMENDATIONS

Update Maps of North Carolina's Coastal Ocean Resources

As North Carolina considers addressing such issues as sand resource management, a beach and inlet management plan and renewable energy development in its sounds and coastal ocean, a comprehensive plan for managing uses in State waters could be beneficial to North Carolina and its communities. A recent bill was passed in the General Assembly authorizing a study of wind energy development in the sounds and wind energy investors are becoming interested in developing projects in North Carolina. MMS has released proposed rules for alternative energy development in the OCS, and these projects could impact North Carolina's coast. Development of a comprehensive plan to address various use issues, providing mapping of ocean resources and providing an atmosphere of regulatory certainty will afford the State an opportunity to promote wise use of its resources to the benefit of North Carolina's coastal communities and various user groups. Coastal states such as Massachusetts, Oregon, California and Rhode Island can serve as models from which North Carolina can learn.

Therefore, the steering committee recommends that North Carolina update maps of its coastal ocean resources. This information is critical for an understanding of the resources the State has in its coastal ocean waters in order to effectively manage their uses. Mapping will be crucial in the development of a comprehensive ocean management plan. The development of such a plan would also entail assignment of responsibility for implementation of the plan according to existing agency jurisdictions; or the State could expand the authority of a rule-making commission like the CRC or delegate primary authority to DENR. Delegation of authority to DENR or expansion of the CRC's authority would likely require legislative action. Examples of such delegation exist in other states such as Massachusetts, where authority for plan implementation was placed in the Executive Office of Energy and Environmental Affairs. In Oregon, there is incorporation of the plan into each relevant agency and coordination among the agencies is mandated, rather than vesting authority in one agency. This is similar to the CHPP in North Carolina.

There is strong support from the Ocean Policy Steering Committee for the continued implementation of the CHPP. The steering committee believes the CHPP can play an important role in any ocean mapping and any ocean management or planning efforts initiated by the State in the future.