A Look at

The Economic and Environmental Aspects

of the Proposed

North Carolina International Terminal

Prepared for NoPort Southport NC, Inc., in connection with a reconnaissance study conducted by the US Army Corps of Engineers, Wilmington District, for the subject project.

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A Look at Economic and Environmental Aspects of the Proposed North Carolina International Terminal

L’environnement! C’est une chose trop grave pour la confier à des militaires.¹

The North Carolina State Ports Authority, a component of the North Carolina state government, has purchased 600 acres of undeveloped land on the Cape Fear River near Southport, and plans to develop an international marine container terminal with an annual capacity of 3,000,000 twenty-foot equivalent units (TEU). The terminal would be called the North Carolina International Terminal (NCIT).

The proposed terminal would serve a new generation of container ships (called “post-Panamax”) that are too large to transit the Panama Canal, now or after the capacity increases under construction for opening in 2014: over 1200 feet long, 185 feet in beam, and drawing 50 feet. A capacity of 12,000 TEU. The terminal would accommodate three of those at once. There are now five in the world.

Although the site purchased for the terminal is only about five miles from the mouth of the Cape Fear River, it is about a mile from the existing channel. That channel is maintained at a depth of 42 feet, and has sharp curves that cannot be navigated by the vessels for which the terminal is intended, or by the slightly smaller post-Panamax vessels that would be able to transit the Panama Canal after 2014 (called “new-Panamax”). Moreover, the continental shelf drops off gradually beyond the mouth of the river; water of sufficient depth for navigation by vessels of 50-foot draft lies at least 17 miles offshore.

Thus to accommodate post-Panamax vessels at the proposed terminal, a new channel and turning basin must be dredged to the existing channel in the Cape Fear River, substantial improvements must be made to the channel to the mouth of the river, and the existing offshore channel to deep water must be deepened, widened, and extended to 17 miles.

¹ Georges Clemenceau. Except that he was speaking of La guerre.
The US Army Corps of Engineers, Wilmington District, is conducting a reconnaissance study to determine whether there is a “Federal interest” in conducting a feasibility study for such channel improvements. The study is being conducted in secret, with no opportunity for review of drafts for comment; this report therefore addresses the issues that such a reconnaissance study would be expected to cover.

The project is characterized by the Wilmington District as a modification of the existing Wilmington harbor project. That project, authorized in 1998, involves deepening the channel in the Cape Fear River from 38 to 42 feet to Wilmington harbor, certain other harbor improvements, and related environmental mitigation measures. The channel to Wilmington harbor was opened at the new depth in 2004.

The channel improvements under study would have only one purpose—access to the proposed North Carolina International Terminal by post-Panamax vessels. All other river traffic could use the existing channel. Without the proposed channel, there can be no North Carolina International Terminal. And without the North Carolina International Terminal, there would be no need for a channel. Thus we must consider the channel, the terminal and the related land infrastructure as a single project, and examine the channel, the terminal, its land connections, and direct and indirect effects.

**Summary**

This report follows the outline for water resources studies in the *Proposed National Objectives, Principles and Standards for Water and Related Resources Implementation Studies* issued in draft by the White House Council on Environmental Quality (CEQ) on December 3, 2009. These were prepared pursuant to a Congressional mandate for revision of the Corps of Engineers *Principles and Guidelines* for such studies.

The draft includes these *National Objectives for Water Resources Planning*:

1. protecting and restoring natural ecosystems and the environment while encouraging sustainable economic development;

2. avoiding adverse impacts to natural ecosystems wherever possible and fully mitigating any unavoidable impacts; and

3. avoiding the unwise use of flood plains, flood-prone areas and other ecologically valuable areas

This report measures project alternatives against these objectives.
The inventory section of this report describes an environmentally sensitive and fragile region, the Cape Fear River estuary, with many unique plant and animal species, some endangered and many threatened. The inventory also describes a container terminal at the Port of Wilmington, operated by the North Carolina State Ports Authority, handling container traffic at about half its capacity. That terminal is being expanded.

The problems identified in the process include (a) channel turns in the lower Cape Fear River that are too sharp and too narrow for many vessels currently using the channel, and (b) unstable beaches at the mouth of the river that are subject to constant erosion with natural replenishment frustrated by the “sediment sink” of a wide and deep navigation channel created by dredging over the years.

Examination of the capacity of the container terminal at the Port of Wilmington and the capacity at nearby ports in light of expected increases in container traffic shows no shortage of capacity in the foreseeable future. Deeper harbors at nearby ports can be expected to attract some traffic from the container terminal at Wilmington when larger vessels are able to transit the Panama Canal after expansion planned for 2014.

Five alternatives are examined. Three involve construction of the proposed North Carolina International Terminal at Southport, with three alternate configurations for the channel. Those are (a) deepening the channel along the existing alignment, (b) creating a “cut-thru” to bypass the existing sharp channel turns, and (c) reopening an old inlet, called “New Inlet” to the ocean to the east of the terminal site.

The other two alternatives are the non-structural, “do-nothing” alternative, and restoration of the channel to a shallower depth by permitting natural shoaling.

The three alternatives involving construction of the proposed container terminal and dredging a deeper channel all have unsatisfactory benefit/cost ratios–none greater than 0.014 against a minimum standard of acceptability of 1.0. All have environmental and social effects ranging from severe to devastating.

The do-nothing alternative is unsatisfactory in that it does not address the problems of the hazardous channel turns and the beach instability.

The only alternative responsive to the CEQ’s statement of National Objectives is the restoration alternative–allowing the channel in the Cape Fear River to fill by shoaling to a lesser depth of 34 to 38 feet. This deserves further investigation to determine whether the economic penalties of reduced accessibility to river commerce are outweighed by environmental benefits.
The Nature and Scope of the Study

Reconnaissance Studies

Projects such as this to facilitate navigation are in the jurisdiction of the US Army Corps of Engineers. Planning for such projects involves an analysis of the feasibility of such a project, and an environmental impact statement. Before initiating such a study, which involves substantial resources of time and money, the Corps is obliged by section 905(b) of the Water Resources Development Act of 1986 to perform a “reconnaissance study of the water resources problem in order to identify solutions to such problem in sufficient detail to permit the Secretary to determine whether or not planning to develop a project should proceed to the preparation of a feasibility report.”

A reconnaissance study typically has the same scope as the feasibility study it precedes, but at a level of detail and depth of inquiry more suited to the limited resources available.

The reconnaissance phase of the planning process is often characterized by the Corps of Engineers as the determination of whether there is a “Federal interest” in pursuing a project. In the language of section 905(b) of the Water Resources Development Act of 1986, “Such reconnaissance study shall include a preliminary analysis of the Federal interest, costs, benefits, and environmental impacts of such project….”

Whether there is a “Federal interest” is generally a matter of whether the project lies within Federal authority and supports Federal objectives. In the Planning Guidance Notebook, Engineer Regulation 1105-2-100, which develops the requirements and the procedures for both the reconnaissance phase and the later feasibility phase of planning studies, the “Federal objective” is defined: “The Federal objective of water and related land resources project planning is to contribute to national economic development consistent with protecting the Nation’s environment, pursuant to national environmental statutes, applicable executive orders, and other Federal planning requirements.”

The first element can be quantified, or seem to be quantified, by comparison of benefits and costs. An excess of benefits over costs would mean the project contributes to national economic development. However, measuring the benefits and costs of something that has not yet happened, and will be in place for fifty years or more, is uncertain at best.

The environmental element is another source of mischief. The engineers who populate the Corps tend to think in quantitative terms (as they should), and environmental issues are only measured by the cost of mitigating environmental damage caused by the project. Then the reference to national environmental statutes, executive orders and other requirements is often read as a limitation on environmental considerations—compliance with law is sufficient.
Thus the environmental aspects of a project have traditionally been treated by the Corps as a procedural step—the proposed action is measured against statutory and regulatory standards, and the boxes are checked. The overall effect on ecosystems—the big picture—is disregarded. In the quantitative evaluation of costs and benefits that drives the Corps’ analytical process, environmental effects (other than the cost of mitigation) are given a value of zero, and weigh not at all in the decision process.

This analytical flaw was once excused by the difficulty in evaluating ecosystem services in the same terms as construction costs and transportation efficiencies. But the field of valuing ecosystem services—ecological economics—has progressed to the point at which such excuse is no longer valid. In the Water Resources Development Act of 2007, Congress stated a national policy of “protecting and restoring natural systems,” and mandated revision of the Corps’s Principles and Guidelines for studies to better address environmental issues by use of the “best available techniques.... .” Sec. 2031.

In the same provision, Congress addressed another flaw in the usual Corps study, the failure to consider interaction with other projects in the region, and required the revised Principles and Guidelines to include “The assessment and evaluation of the interaction of a project with other water resources projects and programs within a region .... .” In this context, that means that the relationship of this project to dredging and port expansion projects in Jacksonville, Savannah, Charleston, Hampton Roads, and perhaps Baltimore and points north should be considered—that is, do we really need all those projects?

Congress specified that the revised Principles and Guidelines be issued not later than two years from the enactment of the act. That deadline has come and gone. The project has, however, been preempted by a White House project to have the Council on Environmental Quality revise the Principles and Guidelines for applicability to other government agencies involved in water resource projects, such as the Bureau of Reclamation.

The Council on Environmental Quality Principles and Standards

The Council on Environmental Quality (CEQ) was established in the executive branch of the Federal government by the National Environmental Policy Act to develop policy in environmental matters and to supervise and coordinate the various administrative agencies in the implementation of that policy.

On December 3, 2009, the CEQ released the second draft of updated National Objectives, Principles and Standards for Water and Related Resources Implementation Studies. These principles and standards, when adopted in final form, will cover all Federal agencies that undertake water resource projects. They will replace the Principles and Guidelines now used by the Corps of Engineers.
The new *Principles and Standards* rank the goal of protecting and restoring the environment equal to the traditional economic objectives. The revised principles consider both monetary and non-monetary benefits to justify and select a project that has the greatest net benefits – regardless of whether those benefits are monetary or non-monetary. For example, the monetary benefits might capture reduced damages measured in dollars while the non-monetary benefits might capture increased fish and wildlife benefits, or biodiversity. The principles also set new standards for the transparency of and public involvement in the planning and implementation process, with the objective of producing better decisions regarding water resource projects.

The President’s message of approval of the new Principles and Standards provides this statement of *National Objectives of Water Resources Planning*:

Federal water resources planning and development should both improve the economic well-being of the Nation for present and future generations and protect and restore the environment. America’s water resources – streams, rivers, wetlands, estuaries, lakes, and coasts – are at the heart of our economy, our environment and our history. These water resources support billions of dollars in commerce, provide drinking water for millions of Americans and supply needed habitat for fish and wildlife and other benefits. The National Objective for water resources planning is to develop water resources projects based on sound science that maximize net national economic, environmental, and social benefits. Consistent with this objective, the United States will demonstrate leadership by modernizing the way the Nation plans water resources projects by:

(1) protecting and restoring natural ecosystems and the environment while encouraging sustainable economic development;

(2) avoiding adverse impacts to natural ecosystems wherever possible and fully mitigating any unavoidable impacts; and

(3) avoiding the unwise use of flood plains, flood-prone areas and other ecologically valuable areas.

The new *Principles and Standards* set out and develop these planning standards:

A. Protect and restore natural ecosystems and the environment while encouraging sustainable economic development.
B. Account for Ecosystem Services.
C. Avoid the Unwise Use of Floodplains and Flood-prone Areas.
D. Utilize Watershed and Ecosystem Based Approaches.
F. Apply a Level of Detail Commensurate with the Potential Decisions
G. Account for the National Benefits and Costs in Appropriate Monetary and Non-monetary Terms.
H. Account for Significant Effects and Mitigate Unavoidable Impacts to Ecosystem Services.
I. Address Risk and Uncertainty, Including the Effects of Climate Change and Future Development.
J. Incorporate Public Safety.
K. Ensure Environmental Justice for Low Income, Tribal and Minority Communities.
L. Ensure the Planning Process is Fully Transparent.
M. Collaborate Implementation Study Activities Broadly.

Many of these standards address deficiencies in the Corps of Engineers planning process discovered by the Government Accountability Office and disclosed in 2006 in testimony before the Subcommittee on Energy and Resources, Committee on Government Reform, House of Representatives: Corps of Engineers, Observations on Planning and Project Management Processes for the Civil Works Program (GAO-06-529T).

The CEQ Principles and Standards also supply a framework for the planning process, listing and describing the steps to be followed. In the belief that planning is by nature forward-looking, we use the CEQ framework, although not yet adopted, as the framework of this report, and follow the steps of the CEQ insofar as resources allow.
Step A. Initiating Implementation Studies

The Wilmington District of the Corps of Engineers cites a resolution of the US House of Representatives dated June 28, 2006, as authority for the study of North Carolina International Terminal (Appendix B).

The proposed terminal and related channel improvements and other infrastructure needs have been defined well by the North Carolina State Ports Authority’s consultants, CH2M Hill, Inc., in a series of comprehensive reports. We also have the benefit of two recent comprehensive reports on the environmental effects of dredging the Cape Fear River, an environmental impact statement prepared in 1996 (the “1996 EIS”) for the deepening of the channel in the Cape Fear River to the Port of Wilmington to its current depth of 42 feet, and the later (2000) environmental assessment of preconstruction modifications to the approved plan for that project.

The subject project has greater dimensions than channel dredging, in that it involves the proposed terminal and its related land-side infrastructure. Impacts would extend well inland and upriver. Brunswick County, where the terminal would be located, has recently completed a land use study pursuant to the Coastal Area Management Act. Because of the environmental sensitivity of North Carolina’s coastal regions, there are also available extensive environmental analyses developed by State agencies with coverage of the Cape Fear region.

Step B. Scoping Process

The CEQ Principles and Standards require that preliminary information regarding the study be shared with interested agencies and parties in an open forum. The Wilmington District of the Corps of Engineers has not done that, and indeed refused a specific request for such a meeting. The District did, however, solicit written comments on the study, but the only information provided to interested parties was a single-page description on its Web site.

The North Carolina State Ports Authority did not make its studies available generally. The State Ports Authority and the Wilmington District of the Corps of Engineers, upon request under the North Carolina Public Records law (in the case of the State Ports Authority), and the Freedom of Information Act (in the case of the Corps of Engineers) released the reports of the consultants to the State Ports Authority to NoPort Southport NC, Inc., a local citizen group, which posted them on its Web site. Some commenting parties drew on those materials, while others limited their comments to their understanding of the project concept.

The comments received (also obtained and posted by the citizen group, but not posted by the Corps) did serve to identify many of the issues that should be addressed in the study.
Step C. Define the Study Area

The CEQ Principles and Standards provide this guidance for the scope of the study:

The study area shall encompass the significant resources affecting the potential need for action or likely to be affected by those potential actions, both directly and indirectly. The watershed, and its surrounding and connected ecosystems, including the coastal and ocean waters into which the watershed may be connected, is generally the most appropriate geographic area. The study area shall be extensive enough to consider synergies and tradeoffs among affected resources, and interactions among existing water resources projects and programs, including watershed planning efforts. This includes any current or future planning by the agency or others and expected implementation that is related to but not part of the study under consideration.

The latter part of this guidance reflects the mandate of the Water Resources Development Act of 2007, which requires the revised principles and guidelines to include “The assessment and evaluation of the interaction of a project with other water resources projects and programs within a region … .” Inasmuch as channel-deepening projects are underway or under study in ports with container terminals from Florida to New Jersey, such improvements and the related capacity increases must be considered in any analysis of benefits of improvements at the Cape Fear.

As for the environmental aspects, the Corps of Engineers Wilmington District recognizes the broad reach of the project in this statement on the Web site: “Because land-side development of road and rail infrastructure and infrastructure for the port itself would be needed in addition to work in the Cape Fear River Channel, extensive environmental assessment, including an Environmental Impact Statement, will be required for the land side of the project.” Although this statement relates to the feasibility study that would follow the reconnaissance study, the US Environmental Protection Agency and the Fish and Wildlife Service of the US Department of the Interior both urge consideration of the effects of the project and related road and rail infrastructure on the affected region in the reconnaissance phase.

Accordingly, we shall consider the environmental and economic consequences of the proposed project in the region of the Cape Fear River estuary, including environmental effects in eastern Brunswick County within the reach of highway and rail improvements related to the North Carolina International Terminal Project. The economic interaction requires a broader reach, consideration of economic costs and benefits “to whomsoever they may accrue” (as required by the Flood Control Act of 1936), and inclusion of economic impacts from activities in other regions, such as construction of competing or redundant facilities.
Step D. Determine Existing and Future Conditions (Part 1, Functional Aspects)

Intermodal Container Traffic

Intermodal containers, which can be transferred from ship to rail to truck, have transformed the international shipping business. Commodities that once required labor-intensive handling to move in international commerce can now be packed in a container at the inland source and not disturbed until reaching the ultimate destination. The efficiency of this method has opened up international markets and stimulated international trade.

The preponderance of container traffic—the traffic for which the North Carolina International Terminal is intended to service—involves movement of consumer goods from Asia to markets in the United States and Europe. There is also trade between Europe and the United States, and between both continents and South America. There is some export from the United States to Asia, although the latter involves mostly bulk materials—scrap metal and paper, forest products, other raw materials. Many containers go back to Asia empty. The US trade deficit with Asian countries, particularly China, reflects this unbalance.

Asian containerized goods destined for markets in the eastern US may arrive at West Coast ports and then be shipped by rail to distribution points in the East. This is called the “land bridge.” Containers may also be brought by ship through the Panama Canal and landed at East Coast ports. Most such goods would be taken to truck to ultimate markets in the East, but there is increasing interest in a “reverse land bridge,” in which containers landed at East Coast ports would be taken west to inland destinations by rail. There is a general view that rail is more economical than trucking for distances greater than 400 miles.

Asian ports and US West Coast ports can accommodate the largest of container ships. Movements from Asia to East Coast ports are currently limited to ships able to transit the Panama Canal—960 feet long, 106 feet in beam, and drawing no more than 40 feet. The larger ships able to call at the West Coast are more efficient, on the basis of cost per container. However, the cost per mile for rail shipment is much higher than for marine transportation, and truck shipment is higher yet, so the analysis of whether to ship a container to an eastern destination through a West Coast port and onward by rail or through an East Coast port can be complex.
The Panama Canal is being enlarged with a third set of locks and other improvements. Ships up 1260 feet in length, 160 feet in beam, and drawing up to 50 feet will be able to transit the canal upon completion. This is planned for 2014.

The increased efficiency of larger container ships then able to call at East Coast ports would add further complexity to the analysis. Add to this the movement of the US population from the Northeast to the South and West, and the inevitable increase in the cost of fuel, and the problem becomes very complex indeed.

The operators of ports in the East, nearly all state or multistate agencies, are moving forward with plans for terminal expansion and channel dredging to accommodate the larger vessels. The proposed North Carolina International Terminal is part of that movement.

**Regional Container Terminals**

CH2M Hill, Inc., engineering consultants to the State Ports Authority, has identified the primary competitors of the proposed North Carolina International Terminal to be the container terminals from Virginia to north Florida, as they exist and would be expanded. Those would include the three terminals at Hampton Roads, and the terminals at Charleston, Savannah, and Jacksonville. To some extent, terminals farther north and on the Gulf Coast compete for the same traffic, and even terminals in Canada and Mexico serve eastern and Midwestern markets by rail connections. For example, the new terminal at Lazaro Cardenas in Mexico is closer by rail to Atlanta than California, and Prince Rupert in British Columbia, another new terminal, connected to the US Midwest by the Canadian National Railway, is two days sail closer to Asia than California.

At this time, only the terminals on the Cheseapeake Bay, Hampton Roads and Baltimore, have the channel depth of 50 feet necessary to accommodate the largest of the next generation of deep-draft vessels expected to pass through the Panama Canal after 2014, should they arrive loaded to the Plimsoll line. However, the ports of Charleston and Savannah have projects underway to dredge to depths in the
range of 46 to 48 feet, and the combined Ports of Newark and Elizabeth, New Jersey have similar plans. Inasmuch as vessel with a design draft of 50 feet would have burned a significant amount of bunker fuel by the time it arrives at an East Coast port from Asia, and container cargo tends to be limited by volume rather than weight, a depth of 46 to 48 feet is thought to be adequate.

The container terminals at Hampton Roads, Charleston, Savannah and Jacksonville have a combined capacity of approximately ten million TEU. That exceeds the current demand, which peaked at approximately 7.4 million TEU in 2007. Those ports have expansion projects underway to double capacity, to approximately 20 million TEU annually.

The table below shows the future capacity, as determined by CH2M Hill, Inc., and by Martin Associates, consultants to the North Carolina State Ports Authority and the ports industry:

<table>
<thead>
<tr>
<th>Southeastern Terminal Capacity (TEU X1000)</th>
<th>Current Capacity (CH2M Hill)</th>
<th>Future Capacity (CH2M Hill)</th>
<th>Potential Capacity (Martin Associates)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Charleston</td>
<td>2.0</td>
<td>3.8</td>
<td>8.9</td>
</tr>
<tr>
<td>Hampton Roads</td>
<td>4.9</td>
<td>7.9</td>
<td>9.0</td>
</tr>
<tr>
<td>Jacksonville</td>
<td>0.9</td>
<td>1.7</td>
<td>2.3</td>
</tr>
<tr>
<td>Savannah</td>
<td>2.4</td>
<td>6.5</td>
<td>6.6</td>
</tr>
<tr>
<td>Total</td>
<td>10.2</td>
<td>19.9</td>
<td>26.8</td>
</tr>
</tbody>
</table>

This does not include the 500,000 TEU planned capacity at Wilmington or 1.5 million TEU that would be added at Jasper County, South Carolina, in a project in the planning stages.

The CH2M Hill, Inc., estimates of future capacity are based on projects now underway, and do not take into account productivity improvements. The Martin Associates estimates represent the potential capacity using productivity improvements that would increase the rate of lifts in the existing space. Such improvements, which are being implemented in Europe and Asia, include increased density of storage and techniques to increase velocity of movements, that is, to reduce the time containers are stored. Martin Associates has reported that with such improvements “Atlantic Coast ports will not likely become capacity constrained in the long-term.” We note that this statement was uttered in 2008, before the current downturn manifested itself.
Growth in Container Movements

Until early 2008, container traffic at United States and world ports had shown substantial growth, driven first by the development of specialized container ships, terminal handling equipment and railroad equipment, and then by expanding manufacturing capacity in Asia, particularly since China joined the World Trade Organization in 2001.

This graph shows national and Atlantic Coast growth since 1990:

From 1990 through 2007, aggregate container traffic at US ports grew at a compound annual rate of 6.4%; for Atlantic coast ports, the rate was 6.1%. From 1990 through 2000, the rate of annual growth at Atlantic coast ports was 7.1%, but the rate for the next seven years dropped to 4.6%.

In 2008, most ports reported reduced movements; nationally, container traffic has reverted to the level prior to 2005. Little or no growth is expected in 2009. Perhaps it will resume in 2010, but most industry prophets predict that 2004 levels will not be reached until 2012.

This downturn, wholly unexpected, demonstrates the difficulty of predicting future growth. But that is the task at hand.

Martin Stopford, a noted maritime economist, examined shipping records back for several centuries, until he could find no more. He determined that the shipping market rose and fell in three discernable cyclic patterns. The longest has a period (distance from trough to trough) of about fifty years, and is driven by expansion and contraction of the world economy, technological change, and political upheavals. All, of course, are unpredictable.

He also notes a short cycle, with a period of about ten years, corresponding to the ebb and flood tides of economic events. Such cycles are more predictable, although few anticipate them in the conduct of their affairs. Finally, there is the annual seasonal cycle, quite predictable and ordinarily considered when deploying assets.

Although the onset of the short cycle and the long cycle are unpredictable, as are their period and amplitude, what is predictable is their occurrence. Thus in any planning for the
long term, one must recognize that what goes up must come down, and search for the long-term trend hidden in the waves.

All forecasting techniques depend, to some extent, on extrapolation of historical trends. Some forecasts are just that, simple extrapolation of past trends of container movements into the future. Others are more analytical, such as basing the forecast of container movements on the relationship between container traffic and gross domestic product, and in turn the relationship of gross domestic product to population. But that depends on the accuracy of the predictions of population growth, and the stability of the relationships of the variables. All are based on history. And all change.

A common error, often deliberately made, is the use of favorable short-term trends, the upward slope of a cycle, to predict future events over the long term. For example, the State Ports Authority used container traffic growth in the period 2004-2007, which was boosted by the opening of a deeper channel in 2004, to predict traffic at the Port of Wilmington for the next several years. Alas, that growth came to an abrupt halt in 2008, and remains at a plateau. Likewise, the entire container shipping industry presumed that the growth that occurred in the six years following the entry of China into the World Trade Organization in 2001 would continue forever, and that industry is now struggling with excess capacity of ships and container terminals.

And before the industrialization of China pushed unprecedented volumes of consumer goods into the United States, the container industry was enjoying an adolescent growth spurt, as the relatively new technology was implemented by large investments in container ships, terminals, and railroad equipment, and bulk and break-bulk cargoes moved to containers.

Thus while the best indicator of what would happen in the future is what has happened in the past, it is necessary to look back far enough to establish the true long-term trends and avoid being misled by short-term transient effects. And there must be some anticipation of major reversals in the future—what comes to mind are the increasing cost and scarcity of petroleum discouraging global carriage of low-value commodities, and the completion of the shift of bulk commodities to containers. Most ominous is the increasing burden of trade deficits with China, which in part have been driven by an artificially-set rate of exchange of Chinese currency to the dollar. Should US efforts to have the Chinese let their currency float succeed, the import/export relationship should come more into balance. Because imports substantially exceed exports at present, and imports have been the determinants of capacity, the system can absorb substantial increases in exports without capacity increases.

But solely for the purpose of evaluating capacity, we look at forecasts prepared by CH2M Hill, Inc., in its *Pro Forma Business Plan* for the North Carolina International Terminal, delivered in 2008 (before the current downturn manifested itself).
CH2M Hill, Inc., used a compound annual growth rate of 6.3% for its “base case,” and 4.3% for the “low case.” The base case rate represents the average annual rate of growth in container traffic in Gulf Coast and East Coast ports for the ten-year period 1997-2006; the firm supports this by reference to “an industry rule of thumb” of container growth rates of twice the rate of growth of gross domestic product for the period, 3.12%.

The CH2M Hill, Inc., “low case” rate of 4.3% represents the historical average annual rate of growth of movements at regional terminals. This is consistent with the rate of growth at Atlantic coast terminals for the period 2000-2007, 4.6%, and the rate of growth at Wilmington, 4.4%. An important difference between the base case and the low case is that the base case assumes significant diversion of movements into the Midwest from West Coast ports to East Coast ports.

This graph shows the growth in container movements at south Atlantic terminals at the 6.3% rate and the 4.3% rate.

This table below shows the dates at which capacity of south Atlantic container terminals would be reached at various rates of growth, using the estimates of future capacity prepared by both CH2M Hill and Martin Associates:

<table>
<thead>
<tr>
<th>Current Capacity (CH2M Hill)</th>
<th>Future Capacity (CH2M Hill)</th>
<th>Potential Capacity (Martin Associates)</th>
</tr>
</thead>
<tbody>
<tr>
<td>At 6.3% annual growth</td>
<td>2016</td>
<td>2027</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2032</td>
</tr>
<tr>
<td>At 4.3% annual growth</td>
<td>2017</td>
<td>2034</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2041</td>
</tr>
</tbody>
</table>

Addition of capacity at Jasper County, South Carolina, would extend each date another year.

Given that the forecasts of container movements are in the high side, disregarding the current downturn, a prudent conclusion would be that container terminal capacity in the South Atlantic region, existing and expected, is sufficient to meet demand for the foreseeable future.
The Container Terminal at Wilmington

The Port of Wilmington Container Terminal

The State Port at Wilmington occupies 284 acres on the Cape Fear River approximately 26 miles north of the mouth. The port handles containers and bulk and breakbulk and liquid cargoes.

The container terminal has an annual capacity of approximately 350,000 TEU per year. That capacity has not been tested; actual movements have never exceeded 200,000 TEU in any calendar year.

The North Carolina State Ports Authority has in progress an expansion program to increase the capacity of the container terminal to 500,000 TEU per year.

The State Ports Authority has recently installed four new cranes of 100-foot gauge, adequate for Panamax vessels and post-Panamax vessels up to 144 feet in beam. Four smaller cranes are also available.

The port is a short distance from interstate highway I40 and is connected by rail to the tracks of CSX Transportation, Inc., one of two major rail carriers in the eastern United States. Although clearances are adequate, CSXT does not offer “double-stack” container service to Wilmington at this time. Such service, with containers stacked two-high in special deep-well cars, is used by major carriers in the West to bring containers from West Coast terminals to Midwest and even eastern markets. There are clearance problems for such trains in the East, and both major eastern railroads have programs to address such problems. The other carrier, Norfolk Southern Railway Company, does not serve the port.
The Port of Wilmington offers substantially lower rates than other container terminals, and North Carolina businesses receive a tax credit for movements through the port. In its best year, 2008, the throughput of the terminal was 196,000 TEU. The port ranks 32nd in the US in container movements. The largest port complex in the East, Port Elizabeth and Port Newark in New Jersey, handled over five million TEU in 2008. The total for the Atlantic Coast was 19.8 million TEU.

Revenues at North Carolina ports do not cover capital costs, and in some years have not covered expenses. The State Ports Authority looks to the North Carolina legislature for capital infusions to cover improvements and heavy maintenance projects. The State Ports Authority relies on the US Army Corps of Engineers to maintain the channel, with funds appropriated by Congress. Channel improvements are funded by both the Federal and State governments.

**Container Movements at Wilmington**

This graph shows container traffic at the Port of Wilmington during the period 1990-2008.

Unlike the relatively consistent annual increases exhibited by national and regional container movements during the same period, the container terminal at the Port of Wilmington displayed a period of little growth for a long time, followed by a sudden increase beginning in 2004.

From 1990 through 2003, the container terminal at the Port of Wilmington experienced growth at a compound annual rate of less than 1%, with movements hovering around 100,000 TEU per year. Then in 2004, the trend of container movements abruptly turned up, growing at an average annual rate of 22% for the next three years. Container movements in early 2008 continued to rise, but at a lower rate, reaching a total for 2008 of about 196,000 TEU, an increase of about 2.6% over 2007.

For the period 1990-2007, the compound annual rate of growth was 4.4%.

The explanation for both the flat trend to 2004 and the sudden rise thereafter is quite likely the capacity of the channel in the Cape Fear River.
During the period shown, the average size of container vessels had been steadily growing. However, the channel in the Cape Fear River, with a depth of 38 feet, could not accommodate the largest vessels in the transpacific/Panama Canal trade until 2004. In early 2004, the channel was opened at a new depth of 42 feet, admitting the largest vessels able to pass through the Panama Canal. The deeper channel restored Wilmington’s competitive position and most of the traffic that had been gradually lost to other terminals in the Southeast.

This is reinforced by a look at Wilmington’s share of the Atlantic coast container traffic over the same period, shown on this graph.

Market share for the container terminal at the Port of Wilmington dropped steadily until the deeper channel was opened in 2004, and then began a rapid climb. Presumably, container movements would continue to increase until the market share prevailing at the beginning of the 1990’s, approximately 1.36% of the Atlantic coast market, is again reached. This is further suggested by the traffic in 2008, which has not suffered as much at Wilmington as at other container terminals.

We consider what container movements would have been had they not been constrained by the channel depth. This graph shows the container movements at Wilmington adjusted for a constant market share of 1.36%, compared to actual movements.

We would expect the trends of adjusted container movements and the actual movements ultimately to converge. That had not happened at the end of 2008, but there was some growth that year, where regional trends were down, bringing the trend lines a bit closer. The market share of the container terminal at Wilmington appears to have reached a certain equilibrium, permitting the current level of movements to be used as the basis for projections of future movements.
The North Carolina State Ports Authority engaged Moffatt & Nichol, a respected engineering firm, to prepare ten-year forecasts of shipments through both the Port of Wilmington and the Port of Morehead City to support a ten-year financial plan. Those were released in early 2010.

Moffatt & Nichol examined historical patterns of growth in container movements at Wilmington and other regional ports, and found them inconsistent and unsatisfactory for forecasts by simple extrapolation. For example, Moffatt & Nichol found that, over three decades, container movements through the Port of Wilmington grew at an annual rate approximately equal to that of the gross domestic product, approximately 2.4%, while container movements at other regional ports–Savannah, Charleston, and Norfolk–grew at twice the rate of the GDP. Moffatt & Nichol attributed the difference to “the lack of supporting infrastructure needed to make the Port of Wilmington competitive for not only its local markets, but the inland markets as well.”

Clearly, a compound annual growth rate of 2.4% would not support the expansion plans of the client, the North Carolina State Ports Authority, so Moffatt & Nichol looked further. The firm undertook a thorough inquiry as to just what is the market for the Port of Wilmington. The firm established, for the 179 Business Economic Areas (BEAs) in the United States, the supply chain costs for all possible ports of entry and exit for 16 regional trade lanes. Each supply chain cost included all components–ocean freight, port fees, trucking costs, and costs of intermodal rail, if the movement involved rail. This is an example, for the Raleigh Business Economic Area:
The example shows that Wilmington is the least-cost port for Raleigh. Moffatt & Nichol determined that the Port of Wilmington was in the least-cost supply chain only for Raleigh and four other areas, all within North Carolina. The State Ports Authority confirmed that 100% of existing container traffic through the Port of Wilmington originated in or was destined for North Carolina.

Moffatt & Nichol further observed that capacity increases at other ports in the region would decrease Wilmington’s share of total container throughput capacity in the Southeast, and concluded that Wilmington’s market would remain within North Carolina. The Port of Wilmington’s opportunity for additional container traffic would have to come from increasing market share within North Carolina.

We note, however, that the Port of Wilmington already offers substantially lower rates than other container ports in the region and has the benefit of a credit against North Carolina income taxes for its customers. This leaves little opportunity to increase market share.

From this point, the analysis disappears behind a curtain and emerges in an unexpected place.

Moffatt & Nichol forecasts growth in container traffic through the Port of Wilmington at a compound annual rate of 6.9% from a low point in 2010 to 2019. Although there must be a valid analytical path to this conclusion, a rate of 6.9% over a long term seems a bit optimistic, when we consider these historical rates of annual growth:

- Container traffic at all US ports, 1990-2007: 6.4%
- Container traffic at Atlantic Coast ports, 1990-2007: 6.1%
- Container traffic at Atlantic Coast ports, 2000-2007: 4.6%
- Container traffic at the Port of Wilmington, 1990-2007: 4.4%
- All seaborne freight, worldwide, 1975-2006: 3%
- Container traffic at the Port of Wilmington, thirty years: 2.4%
- Population growth in North Carolina: 1.4%.

Note that these figures do not include the downturn occurring in 2008 and continuing, which would reduce the average rate. For example, the compound annual growth rate for Atlantic Coast ports for the period 2000-2008 was 4.4%; including 2009 would reduce it further.
The container industry uses a rule of thumb for compound annual rate of growth of container moves twice gross domestic product, which in turn is usually about twice the rate of population growth. That would produce a rate of 5.6%. However, one could speculate (and all of this is speculation) that the factors that cause growth in container movements to exceed gross domestic product by a factor of two, that is, shift of cargoes to containers and consequent reduction in transportation cost, have run their course and future growth may more closely follow growth in GDP. Indeed, it is the use of the rule of thumb of twice GDP growth that has resulted in the over-investment in ships and facilities that now besets the industry.

Using the actual movements at the container terminal at Wilmington as the starting point, we can project movements in the future at various rates.

We use as a “base case” projection a continuation of the historical growth at 4.4% annual rate, assuming the transient effect of the channel deepening is just that—a transient effect, and disregarding the current downturn as another transient.

In case the container movements on the Atlantic coast resume their former vigorous growth of 6.1% annually, and container movements at the Cape Fear are carried along at the traditional market share, we use 6.1% as the “high case.”

If on the other hand container movements adopt the growth rate of a mature freight medium, we use as the “low case” 3%, the annual rate of growth of all seaborne freight from 1975 to 2006, as reported by the Institute for Shipping Economics and Logistics.

The base case yields 515,000 TEU in 2030, approximately the planned capacity of the container terminal at the Port of Wilmington. The high case, about 200,000 TEU more, could also be handled at Wilmington in the available space with adoption of container handling technology now coming into use at various ports.

Thus the container terminal at the Port of Wilmington is quite adequate for the container movements reasonably anticipated for the foreseeable future.
The Site of the Proposed North Carolina International Terminal

The property purchased by the North Carolina State Ports Authority for the proposed North Carolina International Terminal is on the west side of the Cape Fear River, about five miles from the mouth. The location is shown in yellow on this aerial photo:
The area outlined in green is the property of the Brunswick Nuclear Plant. The two reactors are located in the circular area immediately west of the container terminal site. The reactors draw cooling water from the Cape Fear River through a canal directly north and west of the terminal site, and discharge the water into the ocean through another canal running southwest and south.

The red shaded area is the safety “blast zone” for the Military Ocean Terminal at Sunny Point (MOTSU), a terminal for the shipment of munitions for the Department of Defense. The munitions terminal itself is within the blast zone, and includes wharf facilities on the Cape Fear River. A railroad line runs north from this terminal to connect with the tracks of CSX Transportation, Inc. at Leland. A spur of that rail line runs from MOTSU to the south of the nuclear plant and across that property to serve a coal-fired cogeneration plant and chemical plant just south of the terminal property.

Approximately one mile to the south of the State Ports Authority property is the terminal for the ferry to Fort Fisher, and the adjoining new marina and ferry terminal for Bald Head Island. This is the northern limit of the City of Southport, a community of about 2800 permanent residents.

The container terminal property itself comprises three plots of undeveloped land, totaling approximately 594 acres. The Brunswick County tax assessor designates 413 of those acres as "marsh." Approximately 86 acres, on the east side along the Cape Fear River, are salt marsh, shown as estuarine wetlands on the maps of the North Carolina Department of Environment and Natural Resources, Coastal Management Division. Another 20 acres are inland tidal wetlands, and there are seven more acres of ponds.

The portion of the Cape Fear River adjoining the site is separated from the main channel by Snow’s Marsh, an island. Between the site and Snow’s Marsh the depth of the river is one to four feet.

Wetlands adjoining the Cape Fear River
The Navigation Channel
The channel in the Cape Fear River is about 26 miles from the river mouth to Wilmington harbor. It is has been maintained at a depth of 42 feet since being dredged to that depth in 2004. However, when first measured in Colonial times the depth of the river in the natural channel was three to six feet; the entrance to the river over the bar was ten feet deep. The present depth and dimensions of the channel are the result of this succession of projects:

<table>
<thead>
<tr>
<th>Date (Work Completed)</th>
<th>Description of Work Lower Cape Fear River</th>
<th>Ocean Entrance and River Channel, Depth and Width ('Low Water Datum')</th>
</tr>
</thead>
<tbody>
<tr>
<td>1829-1830</td>
<td>During this period, a number of engineering works were undertaken for the purpose of increasing the depths of the lower Cape Fear River in the interest of navigation. The improvements included: (a) construction of contraction jetty in the eight-mile reach immediately below Wilmington; (b) new Inlet through the construction of new inlet dam; and (c) dredging of the river channel shoals. By 1880, the river's navigation channel between the ocean entrance and Wilmington had been developed to a depth of 16 feet and a width of 270 feet.</td>
<td>16' x 270' River Channel (By 1880)</td>
</tr>
<tr>
<td>1967</td>
<td>River channel dimensions increased to a depth of 20 feet and width of 270 feet by dredging. Mowing basin excavated at Wilmington.</td>
<td>20' x 270' River Channel</td>
</tr>
<tr>
<td>1912</td>
<td>Ocean entrance channel dredged to a depth of 22 feet and width of 400 feet. River channel dredged to a depth of 26 feet and width of 500 feet to Wilmington.</td>
<td>26' x 400' Ocean Entrance 26' x 500' River Channel</td>
</tr>
<tr>
<td>1916</td>
<td>Anchorage basin was dredged at Wilmington having a length of approximately 2,000 feet, a width of about 1,000 feet, and a depth of 25 feet.</td>
<td>25' x 400' Ocean Entrance 25' x 200' River Channel</td>
</tr>
<tr>
<td>1926</td>
<td>The ocean entrance channel was dredged to a depth of 30 feet and a bottom width of 400 feet.</td>
<td>30' x 400' Ocean Entrance 30' x 300' River Channel</td>
</tr>
<tr>
<td>1930</td>
<td>Excavation of Snows Cut offering connection of Atlantic Intracoastal Waterway (AIWW) with Cape Fear River.</td>
<td>30' x 400' Ocean Entrance 30' x 300' River Channel</td>
</tr>
<tr>
<td>1932</td>
<td>River channel dimensions increased by dredging to a depth of 30 feet and bottom width of 300 feet. A turning basin having a width of approximately 600 feet was also excavated at Wilmington. Work accomplished between 1931 and 1932.</td>
<td>30' x 400' Ocean Entrance 30' x 300' River Channel</td>
</tr>
<tr>
<td>1948</td>
<td>The river channel was extended 1.25 miles north of Wilmington for the Hilton railroad bridge to an upstream point in the northeast (Cape Fear) River. This extension had a channel depth of 25 feet and a bottom width of 200 feet. Work accomplished in winter 1946.</td>
<td>50' x 400' Ocean Entrance 50' x 300' River Channel to Hilton Bridge 25' x 200' River Channel above Hilton Bridge</td>
</tr>
<tr>
<td>1949</td>
<td>Ocean entrance and river channel dimensions increased to a depth of 82 feet and bottom width of 400 feet. Work accomplished between 1947 and 1948.</td>
<td>52' x 400' Ocean Entrance 52' x 400' River Channel to Wilmington</td>
</tr>
<tr>
<td>1952</td>
<td>Carolina Beach Inlet was opened through barrier beach by earth-moving equipment and explosives. Work accomplished in summer of 1952.</td>
<td>52' x 400' Ocean Entrance 52' x 400' River Channel to Wilmington</td>
</tr>
<tr>
<td>1953</td>
<td>Navigation facilities dredged at Military Ocean Terminal Sunny Point (MOTSU). Basins were dredged to a depth of 300 feet and a width of 34 feet. Entrance channels dredged to a depth of 300 feet and a width of 34 feet. Work accomplished between 1953 and 1955.</td>
<td>52' x 400' Ocean Entrance 52' x 400' River Channel to Wilmington</td>
</tr>
<tr>
<td>1958</td>
<td>Ocean entrance dimensions increased to depth of 35 feet and bottom width of 400 feet. Work accomplished between 1956-1958.</td>
<td>52' x 400' Ocean Entrance 52' x 400' River Channel to Wilmington</td>
</tr>
<tr>
<td>1970</td>
<td>River channel dimensions increased to a depth of 38 feet and bottom width of 400 feet. Work accomplished between 1965 and 1970.</td>
<td>55' x 400' Ocean Entrance 58' x 400' River Channel to Wilmington</td>
</tr>
<tr>
<td>1971</td>
<td>Ocean entrance channel dimensions increased to a depth of 40 feet and width of 500 feet. Work accomplished between 1970 and 1973.</td>
<td>50' x 500' Ocean Entrance 50' x 500' River Channel to Wilmington</td>
</tr>
</tbody>
</table>

1 All depth and width are in feet. To convert to meters multiply by 0.3048.
All of those projects followed the natural course of the river, which includes these turns near the river mouth:
The chart presented above shows the dimensions and course of the channel at the present time. This channel configuration is the result of a project called the Wilmington Harbor Deepening project, authorized by Congress in 1998 and commenced in 2000, to increase the depth of the channel from 38 to 42 feet. The channel was opened at a depth of 42 feet in 2004. Certain aspects of that project—environmental mitigation and dredging of a turning basin at Wilmington—remain in progress, and are planned for completion in 2014.

In the 1996 feasibility study leading to that project, the issue of the configuration of the channel turns arose. The “design vessel” for that study and engineering analysis was a “Panamax” vessel—the largest vessel able to transit the Panama Canal—with an overall length of 965 feet and a beam of 106 feet. The design criteria in Corps of Engineers Engineering Manual 1110-2-1613 require a greater turn radius and channel width for such vessels than can be fit between the banks of this part of the Cape Fear River. See Appendix C. The line on this chart represents the centerline of a channel conforming to the Corps criteria for turn radius. (But this does not have a transition zone between reverse curves—a straight section of five times vessel length is recommended by the Corps of Engineers manual.)
In Appendix D, Engineering and Design, to the Record of Decision released for that project in 1996, the Wilmington District addressed the issue:

Some of the turns did not fit the new criteria as far as the combinations of turn deflection angle and ratio of turn radius to ship length. It was decided that the authorized turn designs were adequate at this time. The turn widths will be studied during preparation of the plans and specifications as part of the ship simulation model.

The Corps contracted for a ship simulator study with a facility equipped with a full-size ship bridge mockup and the ability to simulate conditions in the channel in real-time by computer. The facility permits a pilot to experience maneuvering a vessel in various tidal and current conditions. In the simulations, conducted with various tidal conditions, the pilots were unable to maneuver a Panamax vessel of 960-foot overall length and 106-foot beam around the channel turns at Battery Island without leaving the marked channel. Turns could be executed successfully only by using areas of sufficient depth outside of the marked channel.

Notwithstanding this result, the Wilmington District proceeded to dredge the deeper channel according to the original plans with the non-conforming turns. The Cape Fear River pilots have been able to maneuver Panamax vessels around the turns in question, although there have been groundings. Coast Guard reports include the groundings of the Lijnbaansgracht in 2005 and the Nordon and the YM South in 2006.

Container ship YM South
Highways

This map shows state and Federal highways in Brunswick County and the site of the proposed container terminal (arrow).
The nearest interstate highway, I140, is to the north of US17. There are plans to connect I140 to US 17 west of the intersection with US74/76. The road from the terminal site is a local street, East Moore Street, from Southport. NC87, NC133, and NC211 are two-lane. The terminal site is accessible only from the south, because the intake canal for cooling water to the nuclear power plant next to the terminal site cannot be bridged without risk of interruption or contamination of cooling water flow.

**Railroad**

The railroad line from the Military Ocean Terminal at Sunny Point is a single track of about 17 miles to the CSX Transportation, Inc., east-west line at Leland. The line passes through the City of Boiling Spring Lakes. There are four crossings at grade.

The spur to the vicinity of the site for the proposed container terminal is about five miles. It crosses the property of the nuclear plant to the southwest of the reactors, then crosses the property of a coal-fired generating plant. There are three more crossings at grade on this route, and a bridge over the cooling water discharge canal for the nuclear plant.

Between the Military Ocean Terminal and the City of Boiling Spring Lakes the track passes over a region of sinkholes, which appear unannounced and require support for the tracks.

This is not a common carrier. The line is operated by the US Army for the Military Ocean Terminal at Sunny Point. Cars are moved for the generating plant as an accommodation.
Step D. Determine Existing and Future Conditions (Part 2, Environment)

The Cape Fear Region

The Cape Fear region is both environmentally diverse and environmentally fragile. The area has greater diversity of plant and animal species than any area along the East Coast north of Florida. Many of those species grow nowhere else, and are endangered or threatened.

The region has

* 50 different natural communities
* 300 species of animals and plants
* 19 federally threatened or endangered species
* 63 state threatened or endangered species
* 22 endemic species of plants
* 19 endemic species of animals
* 100% of the world’s native Venus flytraps
* The oldest trees east of the Rocky Mountains, including a 1,700-year-old Bald Cypress
This map from the Brunswick County Land Use Plan shows the nature of the terrain:
Areas designated Class I (green) are regarded as suitable for development. Class II
(yellow) is less suitable, comprising beneficial non-coastal wetlands, flood zones, and areas
vulnerable to storm surge. Class III is suitable only for conservation areas and preservation as
open space. Over 50% of the area of Brunswick County is Class III. Part of the site for the
proposed North Carolina International Terminal is a Class III area, and any new access road
for the terminal site would cross Class III areas.

This passage from the inventory of the North Carolina Natural Heritage Program
describes the Brunswick County environment:

The mainland portion of Brunswick County is characterized by nearly flat topography,
with occasional bluffs along the Cape Fear and Waccamaw Rivers. There are extensive
elevated peatland areas that support pocosin communities and provide water sources for
many of the county’s streams. In the southern portion of the county, relict dune ridge-
and-swale systems formed by an ancient ocean shoreline support longleaf pine
communities on the ridges and pocosin or swamp communities in the swales. Sandhills
have been formed by reshaping of relict dunes, and they support longleaf pine
communities. Especially in the southeastern region of the county, limesink ponds have
been formed by the localized underground collapse of limestone deposits, creating
surface depressions. Carolina bays are found throughout the county. These elliptical
depressions encircled by sand ridges support pocosin communities in the interior and
longleaf pine communities along the bay rims. Along the Atlantic Coast are found barrier
islands, which are dynamic landforms comprised of river sediments that are transported
and deposited along the shore.

Brunswick County is a hotspot of species diversity along the U.S. Atlantic Coast. Several
species are known only from Brunswick County or the immediate area around the
county. The county has some pine savannas that contain more species per acre than do
almost all other areas in temperate North America. There are 11 Federally Endangered or
Threatened plant and animal species in the county, some associated with the beaches and
a number of others associated with the longleaf pine forests and savannas.

The significant natural heritage areas of Brunswick County can be grouped by ecological
features from the coast inland. There are several significant islands and marshes
associated with the mouth of the Cape Fear River. At the mouths of other rivers and
along the Intracoastal Waterway there are coastal edge communities. Several rivers have
significant tidal wetland communities. The Waccamaw River has unique sites due to its
unusual features. A number of sites found in the county’s interior are comprised of
longleaf pine, pocosin, and pond communities.

North Carolina Natural Heritage Program, An Inventory of the Significant
Natural Areas of Brunswick County, North Carolina (1995).

The United States Fish and Wildlife Service, in its comments to the Corps of
Engineers, points out the variety of exemplary natural communities in Brunswick County and
the unique plants and animals that these communities support. Natural communities considered
to be critically imperiled include coastal fringe sandhill, coastal plain marl outcrop, maritime evergreen forest, calcareous coastal fringe forest, and coastal fringe evergreen forest. The Service has expressed special concern for certain inhabitants: the painted bunting, king rail, and migratory shorebirds; swallow-tailed kite, rusty blackbird, Swainson’s warbler, and prothonotary warbler; sharp-tailed sparrow, Bachman’s sparrow, brown-headed nuthatch, and Federally-endangered red-cockaded woodpecker; American alligator, Carolina gopher frog, and Cape Fear threetooth; eastern fox squirrel, northern bobwhite quail, and eastern tiger salamander. There are also plants of concern, most notably the Venus fly trap.

**Cape Fear River Estuary**

The Cape Fear River in the area of the proposed channel is tidal, with substantial inflow of fresh water from upstream. Water salinity, at various locations and various depths, ranges from a few parts per thousand to almost the concentration in the ocean.

The rising sea level and navigation improvements (channel dredging) have resulted in increases in salinity farther upstream, and changes in the nature of swampy areas along the river.

The 1996 EIS reported that the waters of the Cape Fear River in the lower reaches were rated “SA,” suitable for commercial and recreational fishing, commercial shell fishing, and bathing.

**Groundwater**

The Castle Hayne aquifer, which provides fresh water to much of eastern Brunswick County (and extends from New Jersey to Georgia), lies under the terminal site and extends under the Cape Fear River. At the terminal site, test wells place the top of the aquifer at 43 feet below sea level. The aquifer has a downward tilt west to east.

The issue of aquifer penetration by dredging and resulting potential for contamination of groundwater by salt water was raised in the 1996 EIS. The Division of Water Resources of the North Carolina Department of Environment and Natural Resources conducted an analysis, using a computer model, which showed that the normal flow in the aquifer was west to east, and that fresh water from the aquifer normally discharged into the river. The study indicated that, absent disturbance of normal conditions by drought or pumping by individual and community water systems or industrial use, the dredging of the Cape Fear River to a depth of 42 feet in the existing channel “would not produce detrimental changes to the aquifer system.”
The study used for the 1996 EIS was based on data from several years earlier. Although the 1996 EIS promised monitoring of the aquifer, the original study has never been updated.

Population growth since the 1990’s and resulting withdrawal of water from the aquifer presents very different circumstances today. The aquifer is now subject to salt water intrusion and parts of the aquifer have been designated as a “capacity use area” where usage exceeds replenishment.

Air

The Corps of Engineers did not address air pollution in the 1996 EIS because neither Brunswick County nor New Hanover County were designated “non-attainment” areas by appropriate agencies, and a conformity determination was not required by law. Those counties are still not designated as non-attainment areas. However, for an area to be designated as a “non-attainment,” air pollution must be quite awful.

Brunswick County currently ranks among the worst in North Carolina and the United States in emissions of carbon monoxide, sulfur dioxide, and volatile organic compounds. Emissions of nitrogen oxides are also higher than the national average.
Aquatic Natural Resources

Most of the eastern half of the Cape Fear River and the eastern shore is included in the John H. Chafee Coastal Barrier Resources System, and is otherwise protected by Federal, state and private preserves, including the Bald Head Island Natural Area.
The lower Cape Fear River is a nursery and habitat for several hundred species of fish. Among the most abundant are Atlantic menhaden, Atlantic croaker, spot, star drum, penaeid shrimp, mullet, weakfish, bay anchovies, killfish, silversides, blueback herring, American shad, hickory shad, striped bass, and Atlantic sturgeon. The shortnose sturgeon, an endangered species, is also present in the river. The Atlantic Ocean near the shore at the mouth of the river is permanent home to black sea bass, longspine porgy, Atlantic bumper, inshore lizardfish, and searobins. Migrant species include bluefish, Spanish and king mackerel, cobia, Florida pompano, and spiny dogfish.

The nearby ocean is also on the migratory path of right whales, an endangered species.

In the area around Snow's Marsh, 38 benthic species were collected in a 1985 study. There are significant shellfish beds the areas east of the existing channel, the shallow areas through which the new channel would be cut.

The North Carolina Department of Environment and Natural Resources has identified primary and secondary nursery areas in the lower Cape Fear River. The National Marine Fisheries Service observes that “the shallow waters of the Cape Fear River and coastal marsh adjacent to port property out to Snows Marsh function as a primary nursery areas, especially for penaeid shrimp.”

The National Marine Fisheries Service also points out:

The South Atlantic Fishery Management Council (SAFMC) designates the rocky outcrops in the proposed offshore channel as a Habitat of Particular Concern (HAPC); SAFMC also designates tidal inlets, including their ebb and flood-tidal shoals, as HAPC for penaeid shrimp. HAPCs are a subset of essential fish habitat (EFH) and afforded special recognition because of their ecological importance, rarity, or susceptibility to human-induced degradation. Tidal inlets have this designation because of the unique role they play as migratory corridors connecting ocean and estuarine waters that serve as spawning and nursery areas. It should be noted that areas in close proximity to the mouth of the Cape Fear River are state designated FNAs, which emphasizes this important linkage role for this particular inlet. Detailed information on the EFH requirements of species managed by SAFMC is provided in a comprehensive amendment to the fishery management plans; SAFMC prepared that amendment in 1998. The area also includes waters which the Mid-Atlantic Fishery Management Council (MAFMC) designates as EFH for summer flounder, butterfish, and bluefish. Detailed information about the EFH requirements of species managed by MAFMC are included in separate amendments to individual fishery management plans.
The North Carolina Division of Marine Fisheries adds that “Shell bottom habitat is found throughout the proposed alignment of the ship channel from the mouth of the Cape Fear to the terminus at Snow’s Marsh. Particularly important are intertidal populations of oysters and sub-tidal populations of hard clams.”

That agency also expressed concern about the habitat at and beyond the mouth of the river: “Hard bottom habitat is also found in the Cape Fear River and nearshore Atlantic Ocean. In the Ocean it is important for juvenile and adult snapper, grouper and other marine species for protection and as a forage area. Deepening of the channel will destroy any hard bottom habitat in the alignment of the channel.”

The United States Fish and Wildlife Service points out that population levels of anadromous fish species (species that depend on coastal freshwater systems for spawning and nursery habitat) such as sturgeon, American shad, and striped bass have declined over the past two centuries due to human molestation of the Cape Fear River; the Service seeks to restore these and other fish and wildlife resources to more sustainable levels. The Service does not welcome additional damage that would frustrate that objective.

Submerged aquatic vegetation is an essential part of fish habitat and has ecological value in its own right. Such vegetation is habitat for penaeid shrimp, red drum, and snapper/grouper species.
Terrestrial Natural Resources

The shoreline along the lower Cape Fear River is rich in terrestrial natural resources, largely unspoiled. Many areas are reserved, such as the lands of the Bald Head Island Conservancy on the east side of the river, and Battery Island, an important rookery for the white ibis and other shore birds, administered by the National Audubon Society. Some areas, equally important, are not reserved but remain in a largely natural state. Among the latter is the terminal site, 600 acres of undisturbed marsh, woodland and meadow, with small areas that have been farmed. Approximately 86 acres is coastal wetlands, a diminishing and irreplaceable resource. Snow’s Marsh, an island near the terminal site, is held by Progress Energy in its natural state as a shield for the entrance to the cooling water intake canal for the Brunswick Nuclear Plant.

The map on the right shows “Significant Natural Heritage Areas.” The arrow shows the terminal site.
This is the key to the map shown on the preceding page (not all areas are shown on the map segment).
These descriptions of “Significant Natural Heritage Areas” at the mouth of the Cape Fear River have been taken from the inventory the North Carolina Natural Heritage Program:

**Bald Head Island** (2) is a 1700-acre island contains extensive maritime natural communities, including one of the largest and best quality Maritime Evergreen Forests. Other natural communities include Maritime Shrub, Dune Grass, and Upper Beach. Eight rare animals are known from the island, including the Federal and State Threatened loggerhead sea turtle (*Caretta caretta*) and green turtles (*Chelonia mydas*). The island provides habitat for 12 rare plant species, which include the Federal and State Threatened seabeach amaranth (*Amaranthus pumilus*). The natural communities have been impacted by golf courses and residential development. Part of the island is privately owned and not protected. The Smith Island Land Trust owns part of the site. Other sections are owned by the NC Division of Coastal Management and the NC Division of Parks and Recreation. The Bald Head Island Coastal Reserve is a Dedicated State Nature Preserve.

**Battery Island** (3) supports one of the largest heronries on the Atlantic Coast. The birds that breed here include little blue heron, snowy egret, tricolored heron, and glossy ibis. The plants found on the island include the Federal and State Threatened seabeach amaranth and the rare dune bluecurls (*Trichostema* sp). The island is owned by the NC Department of Environment and Natural Resources and is leased to the National Audubon Society. The site is a Registered Heritage Area.

**Fort Caswell Dunes and Marshes** (20) consists of several rows of dunes at Fort Caswell, plus extensive salt marshes at the back side of Oak Island. The lawns and developed areas at the fort are excluded. Many rare plants grow on the dunes, including dune bluecurls, moundlily yucca (*Yucca gloriosa*), and seabeach amaranth. Loggerhead sea turtles and rare green turtles nest on the beaches. Part of the site is protected as part of a conservation easement with the North Carolina Coastal Land Trust, the remainder is privately owned.

**Bluff Island and East Beach** (9) has an assemblage of good quality communities and rare species. The natural communities include a high quality Maritime Evergreen Forest and a rare Interdune Pond. The Federal and State Threatened loggerhead turtle nests on the beach. Nine rare plants are known from the site, including dune bluecurls and tough bumelia (*Sideroxylon tenax*). Part of the site is owned by the NC Wildlife Resources Commission. Most is owned by the NC Division of Parks and Recreation as part of the Bald Head Island State Natural Area, and is a Registered Heritage Area.

The **Lower Cape Fear River Aquatic Habitat** (33) includes the open, estuarine, tidal waters of the lower Cape Fear River and its tributaries. These waters support the Federal and State Endangered manatee (*Trichechus manatus*) and shorthose sturgeon (*Acipenser brevirostrum*), as well as the State Threatened American alligator (*Alligator mississippiensis*). Four estuarine fish species that are considered Significantly Rare also occur here. The site is owned by the State as public waters.
The **Lower Cape Fear River Bird Nesting Islands** (34) is a series of dredge spoil islands in the active river channel that are used by colonial waterbirds for nesting. This is the largest population of ground-nesting colonial waterbirds in North Carolina. Birds found here include the gull-billed tern, snowy egret, tricolored heron, black skimmer, and brown pelican. The islands are owned by the NC Wildlife Resources Commission, and part of the site is a Registered Heritage Area.

**Zeke's Island Estuarine Sanctuary** (67) is a 1650-acre area comprised of islands, marshes, tidal flats, and shallow estuaries. There is extensive, high quality Salt Marsh natural community. Colonial water birds nesting here include the gull-billed tern, black skimmer, least tern, and common tern. Plant species include the Federal and State Threatened seabeach amaranth, and other rare species such as dune bluecurls and tough bumelia. The site is owned by the NC Division of Coastal Management, and it is a Dedicated State Nature Preserve.

**Middle Island** has long sand ridge and tidal marshes support high quality Maritime Evergreen Forest and Salt Marsh. The site is privately owned. A small portion is protected under a conservation easement to the Bald Head Conservancy.


Beach areas on the barrier islands either side of the mouth of the Cape Fear River–Bald Head Island on the east and Caswell Beach (on Oak Island) on the west–cannot be described as “unspoiled” due to development of residential areas. However, there is increasing recognition of the need to preserve and even restore the natural state of these areas by restricting further development and limiting rebuilding when the inevitable storm or high water damages or destroys ocean-front buildings. There is recognition in all communities of the Cape Fear of the need to respect and maintain the function of the beaches as wildlife habitat, particularly for the various species of sea turtles.

The barrier island beaches and the coastal waters are a complex, dynamic system. Sand and sediments are constantly in motion. Although vectors of littoral drift may change seasonally, the net direction of movement has been observed to be southward along the east side of Bald Head Island, both eastward and westward along the south side of the island, and northward along the beach on the west side facing the river mouth. The Caswell beach side of the river mouth has a sea wall fronting the location of Fort Caswell.

Previous to the establishment of shipping channels in the mouth of the Cape Fear River, sand moved freely across the river mouth to regenerate the beaches at both Bald Head Island and at Caswell Beach and other beaches to the westward on Oak Island. Historical records show that the natural depth at the mouth of the Cape Fear River in Colonial times was about ten feet. Beginning in the nineteenth century, a succession of dredging projects has created a channel, which acts as a “sediment sink,” capturing sand and interrupting the normal
movement and natural regeneration of beaches. This is a phenomenon experienced at inlets along all along the coast. The usual, and usually only partly successful, remedy has been construction of groins and other structures to prevent erosion and to capture shifting sand. On Bald Head Island sand-filled groins have been placed along the beach on the south side.

The erosion of beaches from this capture of sand reached a critical stage of disequilibrium with the last dredging project (beginning in the year 2000), in which the channel was deepened to 42 feet at a width of 500 feet, and realigned to the east to avoid rock formations. Erosion had been anticipated, and a plan was developed to use the dredging spoil from biennial maintenance dredging to renourish the beaches on both sides of the channel at the river mouth. Thus commenced a perpetual cycle of beach erosion and sand capture in the channel, and restoration by dredging the sand back out and replacing it on the beaches.

This has been less than successful. The “Sand Management Plan” developed prior to the commencement of construction in 2000 provided for scheduling to mitigate the effect on nesting sea turtles, shore birds and the intertidal macroinvertebrate creatures on which they feed, and for sharing of the sand by the beaches to the east and west, Bald Head Island and Caswell Beach on Oak Island. Bald Head Island was to receive sand in two out of three maintenance cycles.

Bald Head Island received sand from the first two dredging cycles, but the shoreline receded nonetheless. A consultant engaged by the Village of Bald Head Island noted the net loss of 567,000 cubic yards of sand from the Bald Head Island shoreline. Matters reached a state of emergency in 2009 with the third biennial dredging, when large parts of the western beach of Bald Head Island fell into the dredged trench.

Because the sand removed from the channel was due to be used to renourish Caswell Beach in that cycle, the residents of Bald Head Island taxed themselves to finance the renourishment of their beaches from material dredged from offshore.

The situation remains unresolved.
Wetlands

The terminal site includes 86 acres of salt marsh, shown on the maps of the North Carolina Department of Environment and Natural Resources as estuarine wetlands, and 20 acres of inland wetlands.

The ecological value of coastal wetlands, and their retreat from the forces of civilization, are both well-known. In the Coastal Habitat Protection Plan, the North Carolina Department of Environment and Natural Resources says:

Wetlands are well known for the ecological services they provide. Wetland services improve the quality of adjacent habitats with their capacity for water control and filtration. They can also protect upland habitats from erosion. Wetlands play a vital role in providing abundant food and cover for juvenile and adult finfish and shellfish.

Any visitor to the region would also remark on the variety and vitality of avian life in the remaining salt marshes of the Cape Fear. The US Fish and Wildlife Service names these groups “(1) waders, (2) shallow-probing and surface searching shorebirds such as sandpipers, plovers, knots and oystercatchers, (3) deep-probing shorebirds, such as godwits, willets, and curlews, (4) serial searching birds such as terns, gulls, skimmers, pelicans and kingfishers, (5) floating and diving birds such as ducks, grebes, loons, cormorants and swans, and birds-of-prey such as osprey, hawks, eagles and owls.”

A major area of concern in any development project is the secondary and cumulative impact of development in inland communities that would be required to serve the proposed terminal–railroad yards, truck stops, service facilities and the like. The regions between the terminal site and highway connections in the northern part of Brunswick County include flood plains and various kinds of wetlands, including pocosin. The most significant area, which lies directly in the path of any new road for terminal traffic, is the Boiling Spring Lakes wetland complex:

**Boiling Spring Lakes Wetland Complex** is a 23,000-acre site that contains an outstanding mosaic of community types in fair to excellent condition over a large contiguous area. The natural communities include most of the known distribution of a rare Wet Pine Flatwoods variant and a rare Pine Savanna variant. There are many Carolina bays overlain on relict dune ridges; these features are known to occur together
in only five locations. The Federal and State Endangered red-cockaded woodpecker
(*Picoides borealis*) occurs in longleaf pine communities at this site. Twenty-one rare
plant species are known from the area, including the Federal and State Endangered
rough-leaf loosestrife, the State Endangered Carolina goldenrod (*Solidago pulchra*), and
the State Threatened savanna indigo-bush (*Amorpha georgiana var. confusa*). A portion
of the site is owned by the NC Department of Agriculture’s Plant Conservation Program.

–North Carolina Natural Heritage Program, *An Inventory of the Significant
Natural Areas of Brunswick County, North Carolina* (1995).

**Endangered and Threatened Species**

Potentially affected threatened and endangered species identified in the 1996 EIS
include aquatic mammals (right whale and other whales, West Indian manatee), birds (bald
eagle, wood stork, red-cockaded woodpecker), five species of sea turtles, the shortnose
sturgeon, and several species of plants. The Carolina District Population Segment of Atlantic
sturgeon has been proposed for Federal listing as threatened or endangered.

Appendix D has the list of endangered and threatened species for Brunswick County
identified by the US Fish & Wildlife Service.

Greenfield Ramshorn snails, thought to be extinct, have been discovered in a freshwater
portion of Town Creek, a tributary of the Cape Fear River.
Cultural Resources

The list of cultural resources along the lower Cape Fear River starts with the City of Southport, the location of the proposed container terminal. The City was established in 1792, and has been relatively unmolested by development.

The historic district of the city and two specific buildings, the old court house (now City Hall) and Fort Johnson are listed on the National Register of Historic Places.

Southport

The Register also includes several buildings on Bald Head Island, most notable being the Bald Head Lighthouse, “Old Baldy.” This was built in 1817, and although retired as an active light, remains in place near the channel past Bald Head Island.

The Price’s Creek lighthouse, first lit in 1851 and abandoned in 1863, lies just south of the terminal site.

The region has numerous sites of early settlements, fortifications, and battlefields. Fort Fisher, the last coastal fortification of the Confederacy to fall, is across the Cape Fear River from the terminal site.

The Cape Fear River bottom hides 167 shipwrecks of historical interest, 37 of which are on the National Register of Historic Places. The map on the following page shows five of those wrecks, identified by the North Carolina Department of Cultural Resources, along the sides of the navigation channel near Southport and between the site of the proposed terminal and the sea.
Known Shipwrecks of Archeological Interest in the Lower Cape Fear River

(Map supplied by North Carolina Department of Cultural Resources)

The Kate, a side-wheel steamer built in 1852, sank in shallow water about a half-mile above Southport (then named Smithville) in 1862. A successful blockade runner during the Civil War, the Kate was believed responsible for bringing an epidemic of yellow fever to the port of Wilmington.

The CSS North Carolina is one of two ironclads built in Wilmington. Commissioned in 1863, it was not able to cross the ocean bar and was assigned to protect the lower entrance to the Cape Fear River. It was subject to attack by teredo worms because it had been built without copper sheathing on the hull. When it sprang a leak in 1864, it was towed to Battery Island and abandoned in shallow water. After having the iron removed, it was burnt to the waterline.
The *Belfast* was a schooner barge built in 1913. After being damaged in a storm in 1929, it was abandoned near Battery Island and sank.

The wreck noted on the map as the Fort Caswell steamer is believed to be the sidewheel steam tugboat *Fayetteville*, lost after a boiler explosion in 1853.

A result of the yellow fever epidemic brought by the *Kate* was the establishment of quarantine stations on the Cape Fear River to inspect incoming vessels. These were built at various shore locations, but in 1895 a large quarantine station was built on pilings out in the river east of Southport. That is shown in the center of the upper portion of this section of chart from 1900:

That quarantine station was used until 1937, and then decommissioned. In 1951, a large part was destroyed by fire, leaving the concrete platform for a steel tower and water tank.
Socioeconomic Resources

The lower Cape Fear region has a history of economic disappointment and deprivation that has caused it to welcome activities that other communities would summarily reject–an ammunition transhipment terminal and a nuclear power plant, both on the very doorstep of the City of Southport. So there were times when an activity wholly incompatible with a residential community such as a large container terminal might have been welcomed.

But the economic picture has changed in the last decade as the march of retirement communities up the Atlantic coast reached the Cape Fear. The tranquility once due to economic slumber has now become the basis of economic vigor. Brunswick County has become one of the fastest growing counties in North Carolina due to the influx of retirees seeking, and finding, a region of tranquility, charm, character, historic interest, and natural beauty—all elusive and fragile qualities in a community. Those retirees are joined by visitors and tourists, seeking those qualities in a region of winter warmth and summer breezes. And interested in doing a bit of fishing.

Public Services and Facilities

Roads and utilities in the Cape Fear area are sufficient and suitable for the low-density residential nature of development. Nevertheless, the arterial roads are shown in North Carolina Department of Transportation maps as needing improvement. Sewer systems and public water supplies serve some communities, but many areas rely on groundwater and septic systems. Public water supplies rely on groundwater as well as water drawn from the Cape Fear River in Bladen County to the north.

Electricity is at hand in large quantities.

The residential community on Bald Head Island is connected to the mainland by a private ferry service operated from a terminal adjacent to the terminal for the State-operated ferry to Fort Fisher. Utilities are supplied by submarine cables and pipes located at the mouth of the river.

Fire protection is provided by local volunteers, assisted by the fire department at the Military Ocean Terminal at Sunny Point. Each incorporated municipality has its own police department; the Brunswick County sheriff’s department covers the unincorporated areas.
Recreational and Esthetic Resources

The 1996 EIS (section 4.14) has this passage about the lower Cape Fear River:

The Atlantic Intracoastal Waterway follows the Cape Fear River channel from Fort Caswell up to Snow’s Cut. It carries a large amount of transit recreational boating, as well as local recreation in the vicinity of Southport. On calm summer days the area from Southport to the mouth of the river near Baldhead Island is heavily used by all types of recreational boating. The lower Cape Fear River region is very scenic, with many miles of ocean beach, historic homes and lighthouses, and large expanses of salt marsh bordering the river.

Southport is the location of the State Fourth-of-July celebration and many annual events focused on the natural environment, such as the US Open King Mackerel Tournament and the Audubon Society White Ibis Festival.

The North Carolina Department of Commerce estimates that tourists spent $393 million in Brunswick County in 2008, and that tourism accounted for 4880 jobs with a payroll of $79 million.
Step E. Identify and Describe Problems and Opportunities

Problems

The preceding inventory discloses two problems:

- The turns in the navigation channel near the mouth of the Cape Fear River are too narrow and too sharp for the largest vessels calling at Wilmington harbor; and
- The littoral system at the mouth of the river is unstable: the navigation channel is a sink for sand and sediment moving along the shore, resulting in constant and rapid erosion of the beaches which can only be addressed by constant mechanical nourishment.

Those problems, however are not the impetus for the study. That impetus is the plan of the North Carolina State Ports Authority to construct a very large container terminal at an undeveloped site on the Cape Fear River, which would require dredging a connection to the shipping channel in the river and substantial enlargement and modification of that channel to accommodate a new generation of vessels that may appear on the Atlantic coast after the opening of new locks in the Panama Canal.

That problem, if it is one, however, has another level. Since the new channel would serve only one facility, the proposed North Carolina International Terminal, we must treat the terminal and the channel improvements as an integrated project. That means we must identify a problem that would be solved by construction of the terminal itself as well as its channel. If there is no problem to be solved by the proposed container terminal, then there is no problem to be solved by navigation channel improvements to serve it exclusively.

We observed in the preceding pages that the container terminal at the Port of Wilmington is operating well below capacity, and that with improvements now underway for more efficient container handling and storage in the existing space, that terminal will have sufficient capacity to serve its market—the State of North Carolina—for the foreseeable future.

The Port of Wilmington will not be able to handle cargoes from larger ships than now call because such larger ships cannot get there. The depth and width of the channel limit vessel size to a draft of about 38 feet and beam of 106 feet. The ability of the channel turns to accommodate large vessels is already being exceeded in practice by 960-foot long container ships, which can only make the sharpest turns by leaving the marked channel.

Thus when such vessels are able to reach the Atlantic coast through the Panama Canal, some container traffic can be expected to be diverted to other ports with deeper channels. The issue, then (and it is more an issue than a problem) is whether there is a valid case for constructing a new container terminal and its necessary channel improvements to retain that container traffic, or should that traffic simply be routed through ports in neighboring states.
Opportunities

This project provides the opportunity to address the problems of channel turns and channel-related beach instability, problems that have not been adequately addressed and whose solutions should not be deferred.

However, finding an opportunity for a new deepwater container terminal on the lower Cape Fear River is as challenging as finding a problem it would solve. The Cape Fear River is not a natural deepwater harbor. Except on the route of the existing channel, which has been created by successively deeper dredging projects, the depth of the river is measured in single digits. Most of the eastern part of the river in the lower reaches lies within the John H. Chafee Coastal Barrier Resource System and is environmentally sensitive.

The continental shelf at the Cape Fear drops off only gradually. Water of sufficient depth for the new-Panamax and post-Panamax vessels that would call at the proposed terminal—55 feet—is at least 17 miles offshore. Even Panamax vessels now visiting the river must follow the dredged channel approximately seven miles beyond the mouth of the river to reach adequate depths of 45 feet.

The Castle Hayne aquifer, which provides fresh water for much of eastern Brunswick County, lies under the river. At the terminal site, the top of the aquifer is approximately 43 feet below sea level, well above the depth of the channel necessary for a deepwater port.

The terminal site itself presents many challenges. Among them:

- Of the 600 acres of the site, 86 acres are salt marsh, which would be destroyed by dredging for the channel and vessel berths. Construction of the terminal itself would bury another 27 acres of wetlands.

- The tributary of the Cape Fear River on which the terminal site is located can only be navigated by watercraft with the draft of a kayak.

- Immediately to the west of the site lies the Brunswick Nuclear Plant. The intake canal that draws cooling water from the river for that plant passes across the north side of the terminal site. This canal cannot be bridged without jeopardizing the cooling system for the nuclear reactors. Thus the only land access to the site is from the south, through the tranquil residential community of Southport.

- The site is served by a rail spur from the CSX Transportation, Inc., tracks passing through Leland, 23 miles away. However, that rail spur is a single track, passing through private property, the property of the Brunswick Nuclear Plant (and crossing the cooling water discharge canal), the Military Ocean Terminal at Sunny Point (the largest ammunition port in the western hemisphere), a region of sinkholes, and then bisecting...
the residential community of Boiling Spring Lakes. The rail spur is not a common carrier, but is owned and operated by the US Army for the Military Ocean Terminal.

- The nearest existing or planned highway of more than two lanes is approximately 20 miles away. The nearest planned interstate highway would be approximately the same distance away. In between are residential communities, pristine forest, upland marsh, and the habitat of the red-cockaded woodpecker, an endangered species.

Consideration of a new container terminal and related channel improvements does create the opportunity to address the existing problems with the river. Channel improvements to accommodate larger vessels would resolve the inadequacy of the existing channel turns. And consideration of enlarging the channel through the river mouth would compel resolution of the beach erosion issue, because a wider and deeper channel in the same location would only exacerbate that problem.
Step F. Specify the Study Objectives

Section 905(b) and the Federal Interest

The resolution of the US House of Representatives Committee on Transportation and Infrastructure, on which the Corps of Engineers relies to conduct the subject study, requests the Secretary of the Army to “review the report of the Chief of Engineers on Cape Fear–Northeast (Cape Fear) River published as House Document 164, 105th Congress, and other pertinent reports to determine whether any modifications of the recommendations contained therein are advisable in the interest of navigation improvements and associated water resource development opportunities for Wilmington Harbor, North Carolina.” The referenced document covered the deepening of the channel in the Cape Fear River to Wilmington and related mitigation measures.

We observe that it takes a broad reading indeed to find authority for a study for channel improvements for the proposed North Carolina International Terminal at Southport in that resolution, but that is all there is. It is the same river. And wars have been fought on less Congressional authority.

The reconnaissance study to which this report is addressed responds to the requirement of section 905(b) of the Water Resources Development Act of 1986 to perform a “reconnaissance study of the water resources problem in order to identify solutions to such problem in sufficient detail to permit the Secretary to determine whether or not planning to develop a project should proceed to the preparation of a feasibility report.” That section adds that “Such reconnaissance study shall include a preliminary analysis of the Federal interest, costs, benefits, and environmental impacts of such project…”

Whether there is a “Federal interest” is generally regarded by the Corps of Engineers as a matter of whether the project lies within Federal authority and supports Federal objectives. In the Planning Guidance Notebook, Engineer Regulation 1105-2-100, which develops the requirements and the procedures for both the reconnaissance phase and the later feasibility phase of planning studies, the “Federal objective” is defined: “The Federal objective of water and related land resources project planning is to contribute to national economic development consistent with protecting the Nation’s environment, pursuant to national environmental statutes, applicable executive orders, and other Federal planning requirements.”

CEQ Guidance

Federal water resources planning and development should both improve the economic well-being of the Nation for present and future generations and protect and restore the environment. America’s water resources – streams, rivers, wetlands, estuaries, lakes, and coasts – are at the heart of our economy, our environment and our history. These water resources support billions of dollars in commerce, provide drinking water for millions of Americans and supply needed habitat for fish and wildlife and other benefits. The National Objective for water resources planning is to develop water resources projects based on sound science that maximize net national economic, environmental, and social benefits. Consistent with this objective, the United States will demonstrate leadership by modernizing the way the Nation plans water resources projects by:

(1) protecting and restoring natural ecosystems and the environment while encouraging sustainable economic development;

(2) avoiding adverse impacts to natural ecosystems wherever possible and fully mitigating any unavoidable impacts; and

(3) avoiding the unwise use of flood plains, flood-prone areas and other ecologically valuable areas

The CEQ’s proposed standards require formulation of study objectives, a statement of desired effects on which to focus study activities, with this directive: “One or more of the study objectives must clearly contribute to the National Objectives and one or more of the agency’s missions.” This is the mission statement of the Corps of Engineers:

The U.S. Army Corps of Engineers (Army Corps) provides design and engineering services, and construction support for a variety of military and civilian projects worldwide. One of the Army Corps’ primary civil roles is to manage the nation’s waterways and wetlands. The Army Corps activities include, but are not limited to, constructing projects approved by Congress for flood control, commercial navigation, or shipping channel maintenance; emergency response to natural disasters; operating and maintaining flood control reservoirs and public reclamation facilities; and regulating activities in wetlands including issuing dredge and fill permits and authorizing the establishment of wetland areas.

We also find in the CEQ Principles and Standards a list of proposed planning standards, with this at the top: “A. Protect and restore natural ecosystems and the environment while encouraging sustainable economic development.”
The Study Objectives

On the basis of the House resolution, the requirements of section 905(b) of the Water Resources Development Act of 1986, Corps of Engineers mission statement and traditions, and the CEQ proposed Principles and Standards, we tender this formulation of study objectives.

1. Determine the channel improvements, if any, having the best relationship of functional attributes, environmental aspects and lowest cost to accommodate the intended purpose of the proposed North Carolina International Terminal while resolving the current problems of channel turns and beach erosion inherited from the channel dredging project commenced in 2000.

2. On the basis of such an optimized channel configuration, consequences, and cost, determine whether the proposed terminal, such channel, and all other related infrastructure improvements would have a surplus of benefits over costs, both monetary and non-monetary.

A formidable and complex undertaking.

Step G. Specify the Planning Constraints

This report is intended as a review and commentary on the reconnaissance study conducted by the Wilmington District of the Corps of Engineers; however, that study is not available for comment. The District has refused to release drafts of its work or disclose the study or its conclusions in any form prior to review and approval by the South Atlantic Division.

This report thus does not have the benefit of the foundation of any analysis by or for the Corps of Engineers, and cannot comment on specific conclusions. This report is a volunteer effort by retired professionals of various disciplines, with no budget whatever, using materials available from public sources, including the Internet, and such materials as have been discovered using the Freedom of Information Act and the North Carolina Public Records law.
Step H. Formulate Alternatives

The Proposed North Carolina International Terminal

In order to formulate alternatives, we first define the proposal for the North Carolina International Terminal and outline its infrastructure needs.

CH2M Hill, Inc., consultants to the North Carolina State Ports Authority, have prepared preliminary plans for both the proposed North Carolina International Terminal and its related infrastructure, including a proposal for channel improvements. Such plans, although preliminary, provide sufficient information for evaluation of the feasibility at the level customary for reconnaissance studies.
The proposed container terminal would be the largest container terminal on the East Coast of the United States, except the combined facilities at Port Elizabeth and Port Newark, New Jersey. The preliminary plan prepared by CH2M Hill, Inc., describes an automated facility to load and unload containers from the latest generation of very large container ships. The “design vessel” is 1263 feet long, with a beam of 185 feet and draft of 50 feet. Such a vessel has a capacity of 12,000 TEU. The plan view shows three of those vessels at the berths. The berth area would be 4600 feet long.

Such vessels are not be able to transit the Panama Canal, even after completion of new locks and other improvements in 2014. The largest vessels that could then be accommodated, called “new-Panamax” would be almost as large–1200 feet long, 160 feet wide.

CH2M Hill, Inc., suggests that most vessels calling at the proposed terminal would be smaller, in the 8000 to 10,000 TEU range. Four of the smaller vessels could be accommodated at the berth. CH2M Hill, Inc., anticipates that eight vessels would call per week, on average.

CH2M Hill, Inc., assumes for infrastructure analysis that half of the containers arriving by ship would move inland by road, and half by rail. Operations would be conducted 24 hours a day, 364 days a year. Trucks would move in and out of the terminal sixteen hours a day, five and half days a week.

When operating at its design capacity, the terminal would receive approximately 4400 truck visits per day, on average, with peaks of 5700 per day. Such truck movements will require completely new highway infrastructure to connect with planned interstate highways approximately 20 miles to the north. Supporting facilities–truck stops, service shops, container storage yards and the like–do not now exist and must be anticipated.

The one-half of containers to be moved by rail would require an average of ten trains per day, each approximately 10,000 feet long. Peak movements would be fifteen per day.

CH2M Hill, Inc., proposes sending those trains over a rail line currently used for movements to the Military Ocean Terminal at Sunny Point and operated by the US Army, to connect with the CSX Transportation, Inc., tracks at Leland. A spur runs from that rail line around the Brunswick Nuclear Plant nearly to the terminal site. The total distance from the terminal site to the CSXT connection is about 23 miles.

CH2M Hill, Inc., has determined that the existing rail line would require improvement and additional right-of-way. Improvements include changes to the CSXT Davis yard at Leland to handle the long trains, yard facilities outside of the terminal site, and seven grade separation structures (bridges).

A support yard for railroad operations will be necessary with four tracks 13,000 feet in length and attendant storage and maintenance facilities.
The berthing area for the vessels would be alongside a 4600-foot long wharf, and would be approximately 1000 feet wide. A turning basin 1900 feet in diameter would be required adjoining the berth area. From there to deep water, which is about 22 miles away, 17 miles out to sea beyond the river mouth, a channel 52.5 feet deep (plus a two-foot overdredge) and 600 feet wide is specified by the State Ports Authority’s consultants.

We do not attempt to assess alternative highway routes or configurations. It is sufficient for this report to accept that a new highway, whether over existing routes or over new routes, would be part of the plan and that the cost would be approximately that estimated by the consultants to the State Ports Authority.

Likewise, we accept the estimates of the consultants for the railroad improvements, although there is no assurance that the railroad line, which is operated by the US Army, would be available for the project.

Channel Alternatives

A: The existing channel

This plan would involve use of the existing channel to the maximum extent. The berthing area at the proposed terminal site and the turning basin, all as proposed by the consultants to the State Ports Authority, would be connected to the existing channel by a short new channel. The existing channel would widened and deepened along its existing alignment, and then extended the additional length necessary to reach deep water. To reach water of 55-foot depth, a ten-mile extension would be required. The turn near Battery Island would be enlarged and reshaped to the maximum practical extent.

Inasmuch as the turn at Battery Island cannot be configured to comply with the Corps of Engineers design manual within the confines of the river, this alternative would require the use of tugboat assistance for the larger vessels. See Appendix C.

This alternative should be considered at various depths from the existing depth of 42 feet to the depth embodied in the State Ports Authority proposal, 52.5 feet.
The consultants to the State Ports Authority, in their studies of infrastructure needs of the proposed container terminal, found that the standards of the Corps of Engineers design manual could not be met for the “design vessel,” a container ship of 1260-foot overall length and 185-foot beam, in the turns of the channel around Battery Island “without causing obvious impacts at the east end of Caswell Beach or the riverfront at Southport.” The consultants therefore proposed a different alignment for the channel to avoid navigation hazards. That alignment, a straight route east of Battery Island, is shown in the following diagram:

The channel proposed by CH2M Hill, Inc., consultants to the State Ports Authority

This alternative should also be developed with various depths to the recommended depth of 52.5 feet.

The consultants also investigated the extension of the channel to deep water, shown in the following diagram. Such an extension would be required for either alternative A or B.
Extension of the channel to 55-foot depth as recommended by CH2M Hill, Inc.

The channel out to sea must be deeper than the inshore channel, to account for wave action. Thus the existing channel and this extension, ten miles beyond the end of the existing channel, would be dredged to a depth of 55 feet under the consultants’ plan. The dogleg in the circle on the diagram is to avoid a rock formation.

For channel depths less than 55 feet, the length of the extension would be less. For example, a channel of 50 foot depth, corresponding to an inshore channel of 48-foot depth, would be about five mile shorter.
C: New Inlet.

The Cape Fear River is separated from Onslow Bay and the Atlantic Ocean on the east by a thin and low-lying barrier strand. There is a small inlet, called “New Inlet,” across the river from the site of the proposed container terminal. That is shown on the following chart:
The inlet designated on current charts as “New Inlet” is shown on early charts as “Gold Leaf Inlet.” There was another inlet, called “Corncake Inlet,” about a mile to the south, into Buzzard Bay. When that was closed (with help from the Corps of Engineers), its name was applied to Gold Leaf Inlet for a period.

The original New Inlet was to the north, opening into The Basin just below Federal Point. That was created by a storm in 1761. It became the main navigation channel into the Cape Fear River as the depth of the river at the mouth decreased due to change in flow of the river, and remained so for more than a century. New Inlet was used by blockade runners during the Civil War, protected by the guns at Fort Fisher on Federal Point.

During the period 1870-1891, the Corps of Engineers constructed a sea wall, called “The Rocks,” to block New Inlet and redirect the course of the river to the original mouth. New Inlet gradually closed due to natural migration of sand and silt. The name “New Inlet” was applied to Gold Leaf Inlet, a.k.a Corncake Inlet, in charts from the 1960s onwards.

Water of the requisite depth for the vessels proposed to be accommodated at the new container terminal lies about twelve miles offshore to the east—about five miles closer to the shore than at the mouth of the river. The inlet now designated as “New Inlet” is about 2.2 miles from the intersection of the main shipping channel in the Cape Fear River with the new channel that would be required to reach the proposed terminal site. Constructing a new channel through this inlet would make the distance from the terminal site to deep water about fifteen miles, seven less than the route through the river mouth.

Reopening the original New Inlet would make possible a route from the terminal site to deep water about a mile longer than a route through the new New Inlet, sixteen miles total.

Both distances would be shortened by selection of a depth less than 55 feet for the seaward channel.

Use of either of these routes must be approached with caution. The original New Inlet is now completely closed, and the Corps of Engineers has a policy against opening a navigation channel through fast land. This area is littered with wrecks of archeological significance, including the *CSS Raleigh*, one of two ironclads built at Wilmington (the other is the *CSS North Carolina*, lying next to Battery Island). The other route, through the now-named New Inlet, has never been a navigation channel, and has ecological value that would be at risk. Both locations are part of a state reserve, the Bald Head Island Natural Area, and the John H. Chaffee Coastal Barrier Resource System, a Federal reserve.

Use of either of these routes as a new navigation channel, however functionally attractive, calls to mind the Mississippi River–Gulf Outlet, a similarly attractive short-cut that attracted massive storm surges during hurricane Katrina and had to be closed.
**D: No action—the primary non-structural proposal alternative**

Plan D would be to leave the Cape Fear River channel at its present depth and configuration. The current Wilmington Harbor Deepening project would continue with the environmental mitigation measures long deferred. Solutions would have to be found for the flaws in that project, that is, the non-conforming channel turns and the instability of the beaches at the river mouth.

In this alternative, the proposed North Carolina International Terminal would not have any functional advantage over the terminal at the Port of Wilmington, and would not be built. Container ships would continue to call at the container terminal at the Port of Wilmington. Should its capacity become filled, additional container movements for its market area would be served by the ports at Hampton Roads and Charleston.

**E: Restoration.**

This alternative gives consideration to solution of the problems with the channel turns and the beach instability at the river mouth by restoring the Cape Fear River channel to a depth that prevailed prior to 2000. This can be done, for the most part, by permitting natural shoaling of the channel to take its course. At the river mouth, it may be necessary to partially fill the channel to attenuate more rapidly the trapping of material flowing along the shore, which interrupts natural restoration of the beaches.

The channel depth immediately prior to the most recent dredging was 38 feet. It may be desirable to allow the channel to shoal to a lesser depth, to the limits necessary for the operations of the Military Ocean Terminal at Sunny Point. The channel serving the wharf areas at Sunny Point is now at a depth of 32-34 feet, and that has been adequate since 1958. We note that ammunition ships may be obliged to call at ports throughout the world, some of which may not be as deep as large commercial ports, and that concentrating large amounts of ammunition in the largest vessels may not be wise.

In this alternative, the North Carolina International Terminal would not be accessible for its intended ship traffic, and would not be built. The container terminal at the Port of Wilmington would be limited to vessels of draft less than the Panamax size, and container movements would be expected to be diverted, to some extent, to other ports.
Step I. Evaluate the Potential Effects of the Alternatives

Benefit/Cost Analysis

Investments in public projects, particularly transportation improvement projects, ordinarily do not return the cost directly. Thus the worth of the project must be determined by comparing project costs to potential benefits accruing to users of the project, over the life of the project. Such an analysis would determine first, whether such a project deserves public investment, and second, how such a project ranks when compared to other public projects competing for public funds.

Cost/benefit analysis methods have evolved from their first general use for dams by legislative mandate in the Flood Control Act of 1936. Although traditionally called cost/benefit analysis, the process is now more commonly called benefit/cost analysis by project sponsors. The order of the terms suggests the outcome.

A proper analysis compares the project to a base case, and to alternatives. For example, for an analysis of construction of a new channel in the Cape Fear River, the base case would be doing nothing, that is, continuing to maintain the existing channel at the 42-foot depth so that container ships drawing 40-feet or less would continue to call at the Port of Wilmington.

The costs to be counted are those to be expended by the entities providing the project. In the usual case of channel dredging, that would be the federal government, acting through the Corps of Engineers, with financial support from the non-Federal sponsor. In this case another entity, the State of North Carolina on is contributing to the project cost through the construction of the terminal and associated land-side infrastructure. The costs must be combined in the analysis because all such costs must be incurred to generate the benefits; the channel cannot generate benefits without the terminal and its infrastructure, and the terminal cannot generate benefits without the channel. Matching benefits to the cost of the system generating those benefits is fundamental to successful analysis.

Environmental and social costs, whether or not quantifiable, would not be included in the cost calculation, except to the extent of mitigation measures included in the project (such costs would be set off against benefits in the benefit determination). Costs would include all to be encountered in the life cycle: planning, construction, maintenance, and deactivation.

The benefits to be counted are those to be received by the users of the project, and those directly affected. For a transportation project, such benefits are usually limited to the actual reduction in the cost of transportation provided by the project--time and distance saved, economies of scale. The universe of beneficiaries is not limited: The language of the Flood Control Act of 1936, which guides the Corps, is "benefits to whomsoever they may accrue."
Such a scope of benefits would also include negative effects. In the calculus of cost/benefit analysis, those are not counted as costs, but as "negative benefits," or "disbenefits," because they fall on the users or society, and not the project sponsor. Such disbenefits might include noise effects, construction delays and dislocations, and habitat and air and water quality impacts. In the case at hand, moving the container terminal downriver creates a disbenefit of longer land carriage, which would be set off against the benefit of the shorter vessel trip.

Some negative effects, such as damage to ecosystems, can be quantified in the relatively new science of valuation of ecosystem services. Many negative effects are difficult or impossible to quantify. Traditionally, the Corps of Engineers has relegated such effects to an environmental impact statement, with the result that they are assigned a value of zero. The new Principles and Standards proposed by the Council on Environmental Quality would elevate the importance of such non-monetary effects so that they are considered equally with monetary effects, but that is outside of the benefit/cost calculation.

Direct economic effects would also be counted in the benefits column. Those might be reductions in business operating costs and household cost of living, to the extent not included in reductions in transportation costs. But benefits must be counted only once—beneficial effects of transportation cost reductions cannot be added. And only those effects should be counted as benefits (or disbenefits) that involve consumption or savings of real resources with economic value. If money or other resources are merely moved around among members of the affected group, those movements are called “transfer payments” and should not to be counted. Tax revenues are regarded as transfer payments and would not be counted in any accepted method. A Corps of Engineers analysis of the benefits of navigation improvements ordinarily counts only transportation cost savings.

Methods of analysis and presentation of results vary, but they all include these steps:

1. Identify and define types of costs and benefits, ensuring that the costs of the benefit generating system are properly matched to the benefits generated.

2. Measure dollar values and times of occurrence for each cost and benefit.

3. Convert to comparable measures by discounting to net present value, total each of costs and benefits, and compare.

There are many accepted procedures for cost/benefit analysis, with variations in factors to be included, discount rates used for present-value determination, and presentation of results. The Corps of Engineers has established its own methods for benefit/cost analysis over the course of many years. The California Department of Transportation has another, but similarly rigorous, method described in detail on its Web site.
A major challenge in benefit/cost analysis is the comparison of amounts occurring at different times. Project costs occur at the beginning of the project; benefits occur at times well into the future. Selection of discount rate to bring future amounts to the present for comparison substantially influences the outcome. The Corps uses a rate established annually by headquarter, based on the prevailing interest rate on long-term government bonds.

Rather than comparing the sums of the present values of costs and benefits, the Corps calculates average annual costs and benefits for comparison. The Corps establishes a base year for benefits (when the project begins to produce benefits). Increases in benefits for future years would be converted to present worth and added to the base year benefits.

Costs are determined by estimating the “project first costs,” that is, the costs of construction; then interest during the construction period to the base year is added to obtain the “project financial cost.” That is amortized with interest over the estimated life of the project to obtain the annual cost. To that would be added the annual cost of maintenance, to obtain the average annual cost. For navigation projects, the Corps uses a life of 50 years.

Then the annual expected benefits, the transportation cost savings, would be determined and divided by the average annual cost to obtain the benefit/cost ratio. A ratio of greater than one justifies the project going forward.

For example, in the 1996 analysis for the recent project to dredge the Cape Fear River to a depth of 42 feet, the project cost was estimated at $249,539,000. Amortized over 50 years at 7.625%, the then prevailing rate, and adding the cost of maintenance dredging, the equivalent annual cost was determined to be $19,799,000. The Corps of Engineers determined that annual benefits would be $24,663,000, which consisted of savings to shippers of using larger vessels that have lower operating costs per ton of load. Although most of those benefits accrue to foreign shipping lines, they were counted in the analysis. The benefit/cost ratio, determined by dividing the annual benefits by the annual cost, was 1.2. This met the Corps’ test of economic feasibility—a benefit/cost ratio of greater than one. The project went forward.

When that was revisited in 2007, project costs had doubled. Benefits were recalculated by reference to escalation of costs saved, which was determined to be 59%. The interest rate had gone down 36%, thus increasing the present value of future benefits. The project still met the test of a benefit/cost ratio greater than one. However, in this example, the Corps did not determine whether the anticipated vessel movements had actually occurred; the original estimates were simply adjusted for the cost escalation and change of interest rate.
The Council on Environmental Quality Principles and Standards

For this step in the investigation, the CEQ Principles and Standards go beyond the traditional Corps of Engineers methods of evaluation the determination and comparison of costs and benefits. This step represents the most significant advance by the CEQ in water resources project evaluation.

The CEQ sets out these categories and subcategories for evaluation:

(A) Monetary effects. “The beneficial and adverse effects on the economy that can be measured as changes in the value of the output of goods and services, and expressed in monetary units. These can include methods for monetizing non-market goods and services such as ecosystem services and other social effects.”

1. National effects. “Changes in the economic value of the output of goods and services, both market and non-market.”
2. Regional effects. “Changes in the distribution of regional monetary effects.”

(B) Non-monetary effects: “Effects on ecological resources and attributes, risks to humans from natural disasters, and other types of social effects including aesthetics, cultural resources, and the portion of ecosystems that are not successfully monetized.”

1. Natural resources.
2. Public safety.
3. Other social effects.
   (a) urban and community impacts
   (b) life and health impacts
   (c) displacement of people, business and farms
   (d) long-term productivity
   (e) cultural and historic resources
   (f) aesthetics
The North Carolina International Terminal—The Common Element

Alternatives A, B and C all involve the proposed North Carolina International Terminal. The terminal would depend on one of those alternatives for a channel, and each of those channel alternatives has no purpose other than to serve the proposed terminal. So while the effects of the proposed terminal would be part of the effects of each of those alternatives, we can evaluate the effects of the proposed terminal as a separate task and then add those to the effects of each of those channel alternatives.

This separate task is only to avoid repetition. The costs, costs, benefits and non-monetary effects of the terminal and landside infrastructure, while separately developed, cannot be separately used for determination of the project’s worth. Likewise, the costs, benefits, and non-monetary effects of channel alternatives A, B, and C have no meaning without the costs, benefits, and non-monetary effects of the terminal and its land infrastructure. Benefits must be matched to the cost of the system generating those benefits.

Monetary Effects—Benefits

To determine the monetary benefits, we must first estimate the container movements through the proposed terminal and the proportion of container movements that would have the benefits of the economies of scale of the larger vessels. Then we must estimate the amount saved, taking into account any other changes in transportation costs.

In a closed system, the process is relatively straightforward. But this is not–other choices are available to move containers from overseas origins to inland destinations, and vice versa. We must consider the net effects, not just the effects at the subject project. The CEQ Principles and Standards call for regional and national effects to be determined.

The CH2M Hill, Inc., Business Plan Forecast.

CH2M Hill, Inc., consultants to the North Carolina State Ports Authority on this project, have prepared a business plan for the North Carolina International Terminal and delivered that in early 2008. That business plan is styled a “pro forma” business plan. This qualification is significant; the firm explains that their plan “is intended solely as a presentation of conceptualized data or information, where certain values or concepts are hypothetical or tentative.” There is not any further elaboration of that qualification, or indication of which values or concepts are hypothetical or tentative. However, many conclusions are presented in soft language, such as “demand growth suggests capacity shortfall” and “the North Carolina International Terminal could capture market share.” Such language is entirely appropriate for the nature of the forward-looking statements in the plan, but it must be kept in mind.
However hypothetical or tentative, the report includes estimates of container movements through the proposed container terminal at several points in the future, and those projections have then been used as the basis for conclusions as to feasibility. Such conclusions are equally hypothetical and tentative.

In preparing its forecasts of container movements through the North Carolina International Terminal in future years, CH2M Hill, Inc., did not use the history of container movements at Wilmington as the starting point and extend the historical growth. Instead, their analysis

*first*, projected growth of container movements for the market served by terminals in the Southeast, and

*second*, estimated market share for the new container terminal.

The graph below shows the CH2M Hill, Inc., resulting “base case” forecast of container movements for the North Carolina International Terminal, using this method. (The firm also developed “high case” and “low case” forecasts for its report.)

The graph also shows the extrapolation of historical movements at the Port of Wilmington at annual rates of growth of 6.1% and 4.4%. Those lower lines represent the same data as presented in the graph on the section of this report on existing and future conditions, but the vertical scale has been compressed to accommodate the CH2M Hill projection.

By comparison with the projections of the historical trend, the CH2M Hill, Inc., projection of container movements for the proposed North Carolina International Terminal is so high as to suggest grievous analytical error. The CH2M Hill, Inc., projection for the year 2030 is 3,000,000 TEU annually; normal growth of the Wilmington market suggests annual movements of about 500,000 TEU, plus or minus 200,000 TEU. CH2M Hill, Inc., in its *Pro Forma Business Plan*, does use the word “could” to qualify its statement.

To find the reason the CH2M Hill, Inc., projection is so much higher than the historical rate of growth, we look at the two components of the CH2M Hill, Inc., projections: the rate of growth, and the market share.
CH2M Hill, Inc., projected increases in demand for container movements in the Southeast to the year 2030 at the rate experienced at East Coast and Gulf Coast ports in the ten years before 2007, approximately 6.3% compound average annual growth rate. The consultants also considered a low case of 4.3% compound annual rate, and a high case using a rate of 8.3% for the period 2014--2020 (anticipating a surge after the increase in vessel size capacity at the Panama Canal), then returning to 6.3%. The “base case” for the CH2M Hill projection, displayed in the preceding graph, uses a compound average annual growth rate of 6.3%. That is not substantially different from the 6.1% shown in the graph as an extension of the Wilmington history at the Atlantic Coast historical rate, which would produce projected container movements of approximately 725,000 TEU in the year 2030. That does not explain the discrepancy.

The second element of the CH2M Hill, Inc., projection is market share. Increasing the market share of the proposed terminal by six times the share that would result from normal growth in the Wilmington market is based on capacity limitations at other terminals and a “focused marketing strategy.”

We have examined existing and planned capacity at other terminals in the region in the section of this report on existing and future conditions, and found that such capacity will exceed demand for the foreseeable future.

With capacity adequate at competitive terminals, there would have to be some other reason other terminals would be vulnerable to capture of additional market share by a terminal on the Cape Fear River.

That would not be channel depth. Hampton Roads is now at depth sufficient for 50-foot draft vessels. Charleston Harbor has a depth of 45 feet in channels to the container terminals, and has a project underway to increase that to 50 feet. Georgia also has plans in progress for increasing depth of the channel to Savannah harbor to 48 feet.

As for distance from traffic origination points at foreign ports, CH2M Hill, Inc., in its Pro Forma Business Plan for the North Carolina International Terminal, examined the relative distances by ship to the terminal and to its south Atlantic competitors. These are the findings:

- Compared to the terminals at Hampton Roads in Virginia, the proposed North Carolina International Terminal would offer an advantage of about eight hours in sailing time from the Panama Canal, and would be at a 12-hour disadvantage in sailing time from Europe and the Suez Canal.

- Compared to the terminals to the south, Charleston, Savannah, and Jacksonville, the North Carolina International Terminal would have a few hours sailing time disadvantage with respect to the Panama Canal, but would be closer to Europe and the Suez Canal by about eight hours, more or less.
CH2M Hill, Inc., also examined the distances from the various terminals to markets by road and by rail. These are the findings:

- Compared to the other terminals, the distance by road from the North Carolina International Terminal is shorter to Raleigh, but other terminals are closer by road to other northern, southern, and Midwestern destinations. Even Winston-Salem is closer by road to Hampton Roads in Virginia. The terminal at Charleston is closer to Charlotte, Charleston and Savannah are closer to Atlanta, and Hampton Roads is closer to the markets in the Midwest.

- Compared to the other terminals, the distance by rail from the North Carolina International Terminal is shorter to North Carolina destinations, but other terminals are closer to other northern, southern, and Midwestern destinations. Rail distances usually are considered relevant only for movements more than 400 miles.

Not noted by CH2M Hill, Inc., in their report is the lack of service to the North Carolina International Terminal by Norfolk Southern Railway Company, the competitor of CSX Transportation, Inc., in the East. Both railroads have extensive networks throughout the East and Midwest, and connections to the western roads. The rail connection from the North Carolina Terminal would be to CSXT at Leland. All other terminals in the Southeast are served by both CSXT and Norfolk Southern. Although interchange of traffic from CSXT to Norfolk Southern is possible, the element of competition to assure the best rates and service for the North Carolina International Terminal would be missing.

The incremental cost of a ton-mile by ship is less than that for rail, and the incremental cost for rail is less than that for truck. Thus the lowest cost route would have the shortest road or rail distance, even if the voyage is slightly longer.

Putting these elements together, the only market in which the North Carolina International Terminal would offer reductions in transportation costs, relative to out-of-state terminals, is eastern North Carolina, the traditional market served by the Port of Wilmington. This is also the conclusion Moffatt & Nichol reached with their least-cost market analysis for the Port of Wilmington, reviewed in this report in the section on existing and future conditions.

Even the market share of Wilmington may not be achieved. Distances to all markets from the proposed container terminal would be about 20 miles longer over land than from the existing terminal at Wilmington.
The broad range of possible rates of growth considered by experts and the above examination of competitive position of the proposed North Carolina International Terminal suggests that the only prudent method of estimating container movements in the future would be extension of the historical trend for the Port of Wilmington, a compound annual growth rate of 4.4%. But even that would not be used for an investment decision. Because of the uncertainty, any investment would have to be justified by traffic growth at the lower end of the range, perhaps 3% compound annual growth rate, but the facilities should have expansion capacity to accommodate growth at a more optimistic rate, perhaps 6%.

Such growth is shown above, in the section headed *Forecasts for the Port of Wilmington*. At 4.4%, the result is an estimate of 515,000 TEU container movements in 2030, whether at the container terminal at the Port of Wilmington or at the proposed container terminal downstream at Southport. Of course, that may be more or less; the likely range is plus or minus 200,000 TEU.

Although market factors and geography suggest that container movements at the proposed North Carolina International Terminal would be approximately the same as at an expanded container terminal at Wilmington, there is one factor in favor of the proposed new terminal—the depth of the channel proposed to serve the terminal.

The container terminal at the Port of Wilmington had lost market share in the period before 2004 because the channel in the Cape Fear River could not accommodate the largest vessels able to transit the Panama Canal. Other terminals in the region had deeper channels. That was remedied in 2004, and container movements increased dramatically. After completion of the third locks in the Panama Canal (scheduled for 2014), even larger vessels would be able to move through the Canal. If the container vessel fleet serving the Asia/Atlantic coast trade acquires a significant proportion of deep draft, post-Panamax vessels, the Port of Wilmington may again be at a disadvantage because of the 42-foot channel depth in the Cape Fear River. The plans for the new terminal include a deeper channel that would accommodate vessels of 50-foot draft. Competitive terminals also will have such deepwater channels.

This graph on the next page shows what may happen.
The historical growth of container movements through the Port of Wilmington is plotted to 2008. Container movements are projected thereafter at the same average annual rate of growth, 4.4%. That is the upper line; it reaches 515,000 TEU in the years 2030.

From 2015 onward, another line, nearly horizontal, shows growth at an annual rate of 1%. That line represents the rate of growth of container movements at the Port of Wilmington if the limitation of channel depth at 42 feet has the same effect as the limitation of channel depth at 38 feet had during the period before 2004. That reaches 315,000 TEU in 2030.

The difference between the two trend lines after 2015 represents the additional container movements that would be expected at the proposed North Carolina International Terminal with a channel able to accommodate post-Panamax vessels of 50-foot draft. This assumes substantial use of post-Panamax vessels in the Atlantic Coast trade; the actual extent of construction of such vessels and assignment to Atlantic Coast service is unknown. The lower the proportion of such vessels in the fleet, the lower the effect of the deeper channel.

Any difference in annual traffic, 200,000 TEU or less, would be attributable entirely to the new channel and the larger ships that could use it. The balance would be carried in smaller vessels.

Such smaller vessels will continue in the world fleet, due to greater flexibility in service assignments. This table, obtained from Dynamar, B.V., a Dutch company that provides credit and marketing reports in the maritime sector, provides an estimate of the numbers of vessels of various sizes in 2015:

<table>
<thead>
<tr>
<th>2015 (basis 2008 fleet &amp; orderbook)</th>
<th>Operated fleet</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>TEU Share</td>
</tr>
<tr>
<td>New Post Panamax</td>
<td>4%</td>
</tr>
<tr>
<td>New Panamax</td>
<td>8%</td>
</tr>
<tr>
<td>Smaller</td>
<td>88%</td>
</tr>
<tr>
<td>Total ships</td>
<td>100%</td>
</tr>
</tbody>
</table>
This table was prepared in 2008, before the growth in the size and numbers of container vessels came to an abrupt halt. Orders for new vessels have been canceled and existing vessels, large and small, have been taken out of service temporarily or permanently. The composition of the container vessel fleet in future years cannot be estimated with any certainty at this time. This chart does, however, show that very large ships of the size intended to be accommodated at the proposed container terminal (and for which the new channel would be needed) would constitute a relatively small proportion of the world’s container vessel fleet in even the most optimistic circumstances.

We can examine the size composition of the existing container vessel traffic by looking at recent vessel calls at Long Beach, California. That is the largest container terminal in North America. The harbor at San Pedro Bay is deep, accessible by the largest vessels. Thus the size of vessels calling at Long Beach is driven by market and operational considerations rather than draft restrictions.

The following graph shows the number of dry cargo vessels of various drafts (in feet) calling at Long Beach in 2006, the last year the data are available from the Corps of Engineers:

![Graph showing Long Beach Vessel Calls and Drafts](image)

A total of 2338 dry cargo foreign vessels called at Long Beach in 2006. Of those, 271, about 12%, drew more than 40 feet. Although not weighted for capacity, as is the Dynamar table, this chart and that table show that the very large container ships for which the subject project is designed constitute, and will constitute, a quite small proportion of the world’s container fleet.
This permits us to use the estimate of 200,000 TEU annually as the container traffic that would pass through the proposed container terminal in the larger vessels able to take advantage of the deeper channel planned, and so provide economies of scale.

**Marine Transportation Cost Efficiencies**

We next estimate the transportation cost savings of the availability of the container terminal for calls by larger vessels.

We begin with these assumptions:

- Moffatt & Nichol has determined that the market for container movements through the Port of Wilmington is limited to the five business economic areas within the State of North Carolina. That determination would be equally applicable to the proposed terminal, which would be twenty miles downriver and have slightly more disadvantageous land connections.

- The container terminals in neighboring states, at Hampton Roads and Charleston harbor, and perhaps Savannah, have sufficient capacity for the foreseeable future, when current expansion projects are taken into account. Those terminals have adequate interstate highway and rail connections to North Carolina markets.

The base case—without the proposed new terminal on the Cape Fear River and associated channel—is that some container traffic destined for North Carolina markets (or originating in North Carolina) would move through the container terminal at Wilmington. We have estimated that to be approximately 300,000 TEU annually in 2030.

The balance of the container traffic that is the product of normal growth in North Carolina, approximately 200,000 TEU annually, would be diverted to container terminals in neighboring states—those at Hampton Roads and Charleston, perhaps Savannah. Any economies of scale from larger vessels would be realized by use of such terminals.

The effect of the three alternative plans involving construction of the proposed container terminal and associate channel improvements would be retention of some proportion of that normal growth component—the 200,000 TEU annually—that would otherwise be diverted to other terminals. The amount so retained would depend on the depth of the channel—the full depth of 52.5 feet would recapture all of the container movements, lesser depths, to the existing depth of 42 feet, somewhat less.

The effect of the proposed project, then, would be to shorten the distance a container destined for North Carolina markets must travel. The proposed project would have no effect on the size vessel used—that would be determined by other factors. The only issue is whether the
proposed terminal or another facility would be used by larger vessels, and that would be based on trip distance.

We look first at the ocean voyage.

CH2M Hill, Inc., in its studies for the North Carolina State Ports Authority, determined that Hampton Roads is about eight hours sailing time farther than the Cape Fear from the Panama Canal, but twelve hours closer to Europe and the Suez Canal. The firm also reported that Charleston is about two hours closer to the Panama Canal but six hours farther than Europe and the Suez Canal. In any case, the difference for a journey from Asia is about three percent.

For the purpose of this analysis, we conclude that the differences in distance would tend to cancel each other out, and in any event are small, so there is not any significant transportation cost savings for the ocean voyage.

That leaves the trip on land.

Land transportation savings

That portion of container movements attributable to the deeper channel, about 200,000 TEU for 2030, would otherwise move through container terminals in other ports in the region, Hampton Roads and Charleston. The distance to some markets that would be served by the North Carolina International Terminal from those other terminals is slightly greater, so the North Carolina International Terminal would offer a benefit in reduced cost of land transportation.

We consider these markets:

Wilmington and eastern North Carolina. This market, which is relatively small, is easily served by the container terminal at the Port of Wilmington. The distance to other ports is so much greater that we can treat this market as served solely by a the container terminal at the Port of Wilmington anyway, if the proposed new terminal is not built, and treat the container movements attributable to this market as part of the 300,000 TEU movements that would occur without the proposed new terminal. Thus we do not include these movements in the benefit calculation for the project.

Charlotte. This is a major market. The distance from Charlotte to Southport is about the same as the distance from Charlotte to Charleston–210 miles–so there is not any benefit in land transportation for any movements diverted from Charleston to the new terminal. Indeed, the travel time from Charleston to Charlotte is less.
**Winston-Salem and Greensboro.** This is another major market for container movements. But the distance from Winston-Salem to Southport is one mile more than the distance to Portsmouth at Hampton Roads, Virginia—261 miles—so there would not be any benefit in land transportation for container movements diverted from Hampton Roads to a new terminal at Southport.

**Raleigh-Durham.** This market, with a current population of about 1.7 million, is 15 miles closer to Southport than Portsmouth, Virginia. At $1.80 per mile, about $27 would be saved per trip. If we assign all of the projected container movements attributable to proposed new terminal—all 200,000 TEU—to the Raleigh-Durham market, and all go by truck, that would be 120,000 annual trips; $3,240,000 would be saved each year.

The aggregate annual savings in land transportation attributable to the proposed new terminal would therefore be $3,240,000. Over fifty years at 4.625%, the rate specified by the Corps of Engineers for use in 2009, that is $62,750,000.

We next consider the value of this benefit for depths less than the depth recommended to serve the terminal by the consultants to the State Ports Authority, 52.5 feet, because the alternatives to be considered include such shallower depths, and shallower depths may limit the container ship calls. Referring to the graph of vessel calls and drafts at Long Beach, and adding three feet to the draft to assure clearance, we see that substantially all of the benefits of larger vessel size would be captured by a channel depth of 50 feet, and that even a depth of 48 feet would make most of the benefits available.

An additional factor in choice of depth is the depth of other ports in the East. Container vessels do not discharge all cargo at a single destination, but make calls at several ports. So it does little good to have a channel deeper than the other ports at which such vessels would call.

This is a summary of depths at other container terminals:

- Jacksonville 40 feet
- Savannah 42 feet, with project advancing for 48 feet
- Charleston 45 feet, with planning for undetermined greater depth
- Hampton Roads 50 feet
- Baltimore 50 feet
- Delaware River 45 feet
- New York (Newark) 45 feet, with planning for 50 feet

This confirms that 50 feet would be sufficient depth to earn a stop on the voyage of the deepest draft vessels serving the East.

Using the Long Beach data for container vessel size mix, we can next determine the approximate amount of container movements that would move through the proposed terminal at various channel depths.
We use as the upper limit the proposed depth of 52.5 feet and the figure of 200,000 TEU per year, which we forecast for 2030 as the expected container movements for a terminal at the Cape Fear unrestrained by vessel draft limitations (that is, with a channel of 52.5 foot-depth) less the base case, the movements that would otherwise occur through the Port of Wilmington. The lower limit would be zero, the container movements attributable to the proposed terminal at a channel depth of 42 feet, because the existing channel to the container terminal at the Port of Wilmington is maintained at that depth and the proposed terminal would provide no reason for an increase in movements relative to that existing terminal.

The result is shown in this table:

<table>
<thead>
<tr>
<th>Channel Depth</th>
<th>Maximum Vessel Draft</th>
<th>Container Movements</th>
<th>Annual Benefit</th>
<th>Total Benefit</th>
</tr>
</thead>
<tbody>
<tr>
<td>52.5 feet</td>
<td>50 feet</td>
<td>200,000</td>
<td>$3,250,000</td>
<td>$62,750,000</td>
</tr>
<tr>
<td>50</td>
<td>47</td>
<td>200,000</td>
<td>3,250,000</td>
<td>62,750,000</td>
</tr>
<tr>
<td>48</td>
<td>45</td>
<td>197,000</td>
<td>3,200,000</td>
<td>61,800,000</td>
</tr>
<tr>
<td>46</td>
<td>43</td>
<td>160,000</td>
<td>2,600,000</td>
<td>50,200,000</td>
</tr>
<tr>
<td>44</td>
<td>41</td>
<td>120,000</td>
<td>1,950,000</td>
<td>37,650,000</td>
</tr>
<tr>
<td>42</td>
<td>39</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Voyage shortening—container ships.

The proposed terminal is 20 miles closer to the sea than the container terminal at the Port of Wilmington. Container ships calling at the proposed terminal would save three hours (each way) by calling at the proposed terminal instead of the Port of Wilmington.

To give maximum effect to this voyage shortening, we presume that all containers moving through the Cape Fear region would move through the proposed terminal, whether arriving in post-Panamax vessels or smaller vessels, and that the container terminal at Wilmington would be converted for other cargoes.

We cannot convert annual TEUs to vessel calls using vessel capacity because vessels do not discharge the entire cargo at a terminal but make calls at several ports. We look instead to practice. In fiscal 2009, 149 vessel calls at the Port of Wilmington discharged and loaded 194,000 TEU. For the 300,000 TEU we project for the Wilmington container terminal in the design year, 2030, 230 vessels would be presumed to call.

The six-hour shorter sailing time for those vessels, using an average operating cost of $2950 per hour, would save $4,070,000 per year. The present value of the savings over fifty years would be $78,800,000.
Land transportation disbenefit

The proposed container terminal at Southport would be about 20 miles farther from markets than the terminal at Wilmington, and containers moving through the proposed terminal would have to be carried overland approximately 20 more miles than if moving through the Port of Wilmington. Land transportation, whether by road or rail, is more expensive than marine transportation.

The additional cost of land transportation for those movements must therefore be treated as a negative benefit, or “disbenefit,” and deducted from project benefits.

The estimate of total movements for the design year, 2030, is approximately 500,000 TEU. Of that, approximately 200,000 TEU is attributable to the accessibility of the port by post-Panamax vessels. The remaining 300,000 TEU represents containers that would move through the Port of Wilmington were it to remain as the only terminal on the river. Those container movements would be transferred to the proposed terminal at Southport, and would thus be subject to the costs of carriage of the additional distance by truck or rail.

That converts to approximately 180,000 containers per year, given the usual mix of 40-foot containers and 20-foot containers.

The railroad route to the Port of Wilmington to the connection to the CSXT trunk line at the Davis yard in Leland is somewhat circuitous, and the proposed terminal is not a significantly greater distance by rail from that yard. We treat the 50% of container movements that CH2M Hill, Inc., assumes will move by rail as having no cost disadvantage due to the location of the proposed terminal

The remaining 50% is assumed to move by truck. We use these assumptions to calculate the cost of the added distance:

Containers per year: 90,000
Proportion of truck trips loaded: 70%
Total truck trips per year: 129,000
Additional distance: 27 miles to I40, 19 miles to US74/76
Trucking cost: $1.80 per mile.

Assuming half of the movements would go to I40 and the other half to US74/76, the additional cost of land transportation would be $5,340,000 per year. The present value over fifty years would be $103,400,000. This more than the savings from voyage shortening.

If rail service is not instituted and all containers must move by truck, the value of this disbenefit would double.
Monetary Effects–Costs

CH2M Hill, Inc., has provided this estimate of costs of the project and the associated infrastructure (excluding the channel), in 2008 dollars.

<table>
<thead>
<tr>
<th>Description</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Container terminal</td>
<td>$1,430,229,000</td>
</tr>
<tr>
<td>Roadway and bridges</td>
<td>260,826,000</td>
</tr>
<tr>
<td>Rail line and bridges</td>
<td>72,779,000</td>
</tr>
<tr>
<td>Project development</td>
<td>72,770,000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$1,836,604,000</strong></td>
</tr>
</tbody>
</table>

The business plan of the North Carolina State Ports Authority developed by CH2M Hill, Inc., is based on a public/private partnership in which a long-term concession is granted to a private operator. The concessionaire would be expected to pay the $1.4 billion cost of constructing the terminal and would be granted an exclusive concession for a period of 30 to 50 years, sufficient to recover the capital investment with a satisfactory rate of return.

This approach has two problems:

1. The business plan depends on capturing container moves from other terminals in the Southeast, particularly the terminals at Hampton Roads, Charleston harbor, and the Savannah River. Those terminals have excess capacity, and have plans to increase that capacity. Thus there is little likelihood of capturing business except by undercutting the price at the other terminals by a sufficient amount to make up for the location and road and rail infrastructure disadvantages of a terminal in southeastern North Carolina. The Port of Wilmington already offers substantially lower rates than other container terminals in the East, so low that operating costs are not consistently covered and capital costs are not covered at all. This is not an attractive investment opportunity. It is more likely that the North Carolina State Ports Authority would be obliged to finance and operate the terminal itself, as it does at the Port of Wilmington. Experience at the Port of Wilmington teaches that, due to a competitive environment, revenues from container moves rarely and barely cover operating costs. This would leave the capital costs for the account of the State of North Carolina.

2. If the project does succeed in attracting a private investor, the investor would be obliged to impose container handling charges sufficient to recover the capital and the cost of borrowing and still earn a rate of return. Such charges would only be possible if transportation savings made them possible, and the investor/operator would have first claim on any such savings.

Whether the cost of the container terminal is paid out of taxes or out of revenues, it represents an outlay specific to the project fundamental to the generation of benefits, and should be included on the cost side of the benefit/cost analysis.
The roadway and bridges would be for the account of the State of North Carolina and should be counted as a cost.

CSX Transportation, Inc., the railroad carrier with tracks through Brunswick County, does not own the line to the terminal site. Most of that line is the property of the US Department of Defense. The spur to the terminal site passes over the property of Progress Energy and Archer-Daniels Midland, and is owned by those property owners.

Railroad companies expect customers to bear the costs of special connections to their lines, such as the rail line improvements determined necessary by CH2M Hill, Inc. Thus the cost of those improvements would be borne by the terminal concessionaire, if any, the North Carolina State Ports Authority, or the State of North Carolina. In any case, those improvements must be counted as a cost.

Development costs, which include the costs of environmental and other studies, would be for the account of the North Carolina State Ports Authority and counted in the cost column.

CH2M Hill, Inc., did not include the cost of the terminal site itself, $30,000,000, presumably because it would not be consumed. At the end of the project life, it would still be there. But the money invested has a cost. At the interest rate used by the Corps of Engineers in 2009, 4.625%, the annual cost would be $1,387,500, which has a present value, over fifty years, of $26,871,000.

We assume that maintenance of terminal and the rail connection would be covered by user fees, and that maintenance of the highway would be covered by fuel taxes.

Thus the total monetary cost of the proposed container terminal and its infrastructure, excluding the channel, would be $1,866,604,000. Using the interest rate specified by Corps headquarters for use in 2009, 4.625%, the annual cost over 50 years is $96,382,000.
Non-Monetary Effects

Natural Resources

The following effects on natural resources can be anticipated from the proposed container terminal and its land-side infrastructure:

- **Pollution of the Cape Fear River from vessel discharges.** The plans for the proposed terminal do not include pumpout facilities for the vessels, leaving no alternative but to discharge untreated sewage into the river or the sea. Ships also take on and discharge sea water for ballast at each port-of-call. Such ballast discharges are a common source of invasive organisms.

- **Groundwater loss or contamination.** Dredging in the area of the terminal site for vessel berths to any depth contemplated for the project would penetrate the Castle Hayne aquifer over a large area. Depending on the relative pressures of the aquifer and river, that would result in excessive loss of groundwater into the Cape Fear River, or contamination of the groundwater by salt water from the river.

The terminal plans call for storm-water runoff to be collected in a holding pond, which would permit percolation into the underground aquifers. Such storm-water runoff would be contaminated by diesel fuel, motor oil, hydraulic fluid, and whatever substances the containers stored on the site may have acquired in their travels.

- **Air pollution from vessels.** The intention of this project is to facilitate substantial increases in container vessel movements in the Cape Fear River. The amount of additional emissions the area would receive from vessels is a complex problem, due to the uncertainty of estimating future vessel traffic. However, container ships, largely unregulated as to emissions, are notorious polluters. The main propulsion engines are diesels of up to 100,000 horsepower, normally fueled by the least expensive fuel available, high-sulfur residual fuels. Each ship also has auxiliary diesel engines, as many as five, to power on-board electrical equipment. The plans for the container terminal do not include shore power, so those auxiliary diesel engines will be running while a ship is in port. For the nature of air pollution from vessels, see *Floating Smokestacks* and *US Container Ports and Air Pollution: A Perfect Storm*, cited below.

Tugboats would be required for the docking and undocking of vessels calling at the container terminal, to assist in turning the vessels around, and possibly for escort and assistance in negotiating the turns in the channel. Such boats have diesel engines of 3000 to over 6000 horsepower. There are not any plans for tugboat dock facilities, so the tugs may have to travel down the river from their base at Eagles’ Island, near Wilmington. Such tugboats would be subject to regulation as to emissions.
Air pollution from terminal equipment. Preliminary plans for the North Carolina International Terminal facility specify electric gantry cranes and other equipment to handle containers and load trucks, rather than diesel-powered lift trucks. There should be little or no on-site air pollution from this equipment. Loading railcars and certain other activities would require diesel-powered equipment, however.

Air pollution from trucks. The primary air pollution threat (other than vessels calling at the terminal), would come from diesel-powered over-the-road trucks entering and leaving the terminal and idling at gates and loading areas. The consultants to the State Ports Authority estimate approximately 4400 truck trips on area roads each day on average would be necessary to carry one-half of the containers moving through the proposed container terminal. Peak movements would be 5700 per day, over 400 per hour. Although tightening of emissions standards for new trucks is scheduled in the period before the terminal would be opened, not all trucks are new. Experience at other terminals shows that most trucks in this service are owned or leased by the drivers and may be up to 30 years old. And the reduction in emissions is not elimination. Substantial emissions of carbon dioxide, carbon monoxide, oxides of nitrogen, unburned hydrocarbons, and particulate matter must be expected from 4400 trucks per day.

Air pollution from railroad locomotives. The consultants to the State Ports Authority have assigned the remaining one-half of container movements at the proposed terminal to rail. They estimate ten trains a day will be necessary on average; peak movements would be fifteen trains per day. Each such train would be 10,000 feet long, typically drawn by three road locomotives of 3000 horsepower or more. Although newer generations of locomotives would offer reduced emissions, locomotives, whether hauling trains or idling in the yard (locomotives normally are left running continuously), present a concentrated source of air pollution not present in the area today.

Loss of wetlands habitat at the terminal site. Eighty-six acres of estuarine wetlands would be removed for vessel berth areas. An additional 20 acres of tidal marsh and ponds would be buried by construction.

Loss of terrestrial habitat at the terminal site. The 500 acres that would be taken for the terminal, and the hundreds of acres that would be taken for rail and highway access, are acres lost to wildlife. In the case of the terminal site, such loss is particularly grievous, because the terminal site is the part of a larger undisturbed area comprising the lands maintained by Progress Energy as a buffer for the Brunswick Nuclear Plant and the “blast zone” for the Military Ocean Terminal at Sunny Point, which zone is also kept in its natural state. The military reservation includes high quality natural areas and the habitats of the red-cockaded wood pecker, the American alligator, and the Cape Fear threetooth, as well as 22 rare plant species. Part of this is a Registered Heritage Area. This is an integrated ecosystem that would be severely damaged by placement of a large industrial enterprise in the middle.
• **Loss of terrestrial habitat to roads.** Although part of the highway access to the terminal site would be by existing roads, widened and improved, most of the 20 miles to adequate highway connections would require new highway alignments. Those new alignments have not been determined, but they must pass through undeveloped areas, woodland and upland marsh, including pocosin. Most of those areas are “Significant Natural Heritage Areas” and some are reserved. Highways are disruptive for wildlife beyond the areas they occupy, because migration and foraging patterns are interrupted. Highways are also sources of contaminated runoff that affects wide areas.

• **Loss of terrestrial habitat to railroad facilities.** The plans of the consultants to the State Ports Authority include a support yard for railroad equipment consisting of four tracks 13,000 feet long and attendant maintenance and storage facilities. The location has not been specified, but the only available locations outside of residential areas are in undeveloped areas of woodlands and upland marsh.

**Public Safety**

• **Hazardous materials at the terminal.** Container terminals routinely handle hazardous materials. Some are solid materials, even solid explosives, packed in ordinary containers. There are special containers for bulk commodities—many very hazardous— in solid, liquid and gas states, some under pressure. A special problem with container terminals is the concentration of such materials. The preliminary design for the North Carolina International Terminal provides for storage of 47,680 twenty-foot equivalent units (TEU), which is about 28,600 containers, given the usual mix of 40-foot and 20-foot containers. Four thousand eight hundred forty TEU of space would be dedicated to hazardous materials. That is about 2900 containers. At typical loadings, perhaps 58,000 tons–116,000,000 pounds–of hazardous material could be in those containers on the terminal site at one time.

We note that the two nuclear reactors and the above-ground storage facility for spent and radioactive fuel at the Brunswick Nuclear Plant are located approximately 2500 feet from the border of the terminal site.

• **Hazardous materials in transit.** The hazardous materials arriving or departing at the proposed terminal must be carried by truck or rail through the residential communities of Brunswick County and beyond.

• **Highway safety hazards from trucks.** The route to be used by trucks serving the proposed terminal would, in part, be the same route used for commuters from the area to Wilmington, and used by students and faculty at the South Brunswick High School and
Middle Schools. Mixing 4400 trucks per day, about one every eight seconds, with that traffic would create abundant opportunities for serious and life-taking accidents.

- **Congestion of evacuation routes.** The road to be shared by passenger car traffic and trucks is also the primary evacuation route for southern Brunswick County in case of hurricanes and nuclear emergencies. The former are common; the latter less so.

- **Terrorist attack.** The proximity of the nation’s primary ammunition terminal and a nuclear plant to the proposed container terminal presents an extraordinary opportunity for terrorist attack, when one considers that very few containers are inspected, and most come from the Far East and some from the Middle East. The Congressional Research Service, in a recent report, even postulated that a simple nuclear device, a *Hiroshima*-type bomb, could be manufactured using enriched uranium, plutonium not being necessary, and concealed in an ordinary shipping container.

**Other Social Effects**

- **Community Impacts.** The sponsors of the container terminal promise jobs and more jobs, not so much in the terminal, which would be highly automated, but in related activities, such as railroad yards, truck stops, and distribution terminals. Such development, however, does not suit the character of the area. The Fish and Wildlife Service of the US Department of the Interior expressed this concern: “The project, when considered in its entirety, is very likely to result in permanent loss of environmental value and would convert the area from residential use with commerce based on recreation and tourism to an industrial center and transportation hub.” Moreover, the CAMA land use plan recently prepared for Brunswick County identified most of the undeveloped areas in southeast Brunswick County proximate to the terminal site as unsuitable for development, too fragile to support high density uses. Most are areas designated as Natural Heritage Areas.

The promised prosperity is not assured. On the contrary, evidence in other communities around the country shows that rates of unemployment and poverty are higher in districts around container terminals than in surrounding metropolitan areas. A recent national study concluded that “The same ports that serve as ‘economic engines’ for the region and the nation may be the cause of economic decline and deterioration in the immediate areas that surround them.” Lisa M. Grobar, *The Economic Status of Areas Surrounding Major U.S. Container Ports: Evidence and Policy Issues* (2008).

The community of Boiling Spring Lakes is bisected by the railroad line that would serve the proposed terminal. Rail traffic would increase from approximately three relatively short trains per week to ten to fifteen trains of 10,000 feet per day.
• **Noise and Light Pollution.** The container terminal will operate around the clock, 364 days a year. Vessels may call at any time of the day or night. Constant light can confuse animals, particularly birds, and disrupt feeding and breeding. The noise that emanates from large container terminals is equally disruptive and likely to drive away native species. People don’t like it much, either.

• **Life and Health Impacts.** Air pollution from diesel exhaust concentrated in port areas, especially particulate matter, has long been recognized in California as a contributor to respiratory disease and asthma, and responsible for shortening the lives of those who live in areas proximate to the container terminals at Long Beach, Los Angeles and Oakland. Recent reports also document the same effect at other large container terminals around the country.

  The Environmental Protection Agency places a value of $6 million on each avoidable premature death. In testimony before the Senate Environment and Public Works Committee in 2008, Dr. John G. Miller, an emergency physician in San Pedro, California, near the container terminal at Long Beach, attributed 246 of the 1400 premature deaths in a single year from air pollution in southern California to the container terminals at Long Beach and Los Angeles. If a price can be put on those deaths, the price would be $1,476,000,000 per year. Approximately the estimated cost of the container terminal proposed for Southport, every year.

• **Cultural and Historic Resources.** The historic district of the City of Southport, which is on the National Register of Historic Places, is approximately two miles from the site of the proposed container terminal. The City of Southport is in the path of all truck movements because other approaches to the terminal site are blocked by the Brunswick Nuclear Plant and its cooling water canal. The cultural and historic resources of this city would not survive the onslaught of trucks and other activities related to the container terminal.

• **Aesthetics.** The photos below show the waterfront at Southport and a typical large container terminal.
Alternative A: The Existing Channel

This plan would involve use of the existing channel to the maximum extent. The berthing area at the proposed terminal site and the turning basin, all as proposed by the consultants to the State Ports Authority, would be connected to the existing channel by a short new channel. The existing channel would widened and deepened along its existing alignment, and then extended the additional length necessary to reach deep water. To reach water of 55-foot depth, a ten-mile extension would be required. The turn near Battery Island would be enlarged and reshaped to the maximum practical extent.

Inasmuch as the turn at Battery Island cannot be configured to comply with the Corps of Engineers design manual within the confines of the river, this alternative would require the use of tugboat assistance for the larger vessels. See Appendix C.

This alternative includes consideration of various depths from the existing depth of 42 feet to the depth embodied in the State Ports Authority proposal, 52.5 feet.

This alternative includes the container terminal and its land-side infrastructure.

Monetary Effects–Benefits

This channel alternative does not provide any independent positive benefits. Any such benefits would be derived from the container terminal. There is a negative benefit for this alternative—a disbenefit that must be set off against any positive benefits—and that is the need for tugboat assistance for larger vessels to navigate the channel turns.

Tugboat assistance

Tugboat assistance would be required for docking and undocking the larger vessels calling at the container terminal. Thus the cost of tugboat assistance for navigating the channel turns would be only the additional hourly cost for escort and assistance from and to the mouth of the river.

We use these assumptions:

Annual container movements in post-Panamax vessels: 200,000 TEU

Number of annual vessel calls at 1000 TEU per call: 200 (the consultants to the State Ports Authority assume 400 vessel calls annually)

Tugboats required: three, with an aggregate charge of $2100 per hour.
Time required: two hours for each channel movement, or four hours per vessel call.

This yields an annual cost for tugboat assistance of $1,680,000. For fifty years at 4.625%, the total cost would be $32,500,000.

**Monetary Effects—Cost**

CH2M Hill, Inc., consultants to the State Ports Authority, estimated that the channel recommendation that emerged from their analysis (which we use herein as Alternative B) would require the removal and disposal of 68.3 million cubic yards of material. Using that estimate as a starting point, we can estimate the amount of material for Alternative A.

The difference between Alternatives A and B is that Alternative B uses a “cut thru,” a new channel east of Battery Island through an undisturbed area of very shallow water, from the northern end of Lower Swash Channel (the channel in front of the City of Southport) to the northern end of Smith Island Range (which passes through the mouth of the river). That distance is approximately 2.3 nautical miles. That section would require the removal of approximately 38 million cubic yards of material for a depth of 54.5 feet.

Alternative A, retention of the existing alignment west of Battery Island, although somewhat longer, would require removal of only about 13.6 million cubic yards for that depth to connect the same two points because the channel on that alignment is already 42 feet deep. It would require widening and some reshaping of the turns. This would be 25.4 million cubic yards less than the Alternative B “cut-thru.”

Using the CH2M Hill, Inc., estimate for the entire channel from terminal site to deep water (which includes the new channel to the terminal site from Lower Swash Channel, and the deepening and extension of the channel to deep water), and reducing the total by the difference attributable to using the existing alignment west of Battery Island (25.4 million cubic yards), we have an estimate of 42.9 million cubic yards for Alternative A at the full depth.

CH2M Hill, Inc., determined that the most recent cost of dredging for new construction (as opposed to maintenance) in the Cape Fear River was about $10 per cubic yard. This does not include extra costs of rock removal, engineering cost, environmental mitigation, post-project monitoring and review, or contingency. By reference to the cost of the current project to deepen the Cape Fear River to Wilmington harbor, with an estimated $533 million final cost for 27.3 million cubic yards, we use for the purpose of this analysis a total cost of $20 per cubic yard.

This disregards most of the cost of rock removal, which can be many times the cost of removal of softer material. Rock will be encountered at the terminal site and site of the turning basin, and at the mouth of the river for a distance of about 6000 feet. This also disregards the
cost of removal and preservation of four wrecks of archeological interest along the existing channel alignment.

Another cost not included is whatever measures are necessary to isolate the channel and berthing area at the terminal site from the entrance to the cooling water intake canal for the Brunswick Nuclear Plant. That canal draws a million gallons a minute from the river, and must be kept free of contamination or interruption.

This is a summary of cost for various depths:

<table>
<thead>
<tr>
<th>Depth</th>
<th>Dredged Material</th>
<th>Total Cost</th>
<th>Annual Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>52.5 feet</td>
<td>42,900,000 cubic yards</td>
<td>$858,000,000</td>
<td>$44,300,000</td>
</tr>
<tr>
<td>50</td>
<td>35,400,000</td>
<td>708,000,000</td>
<td>36,600,000</td>
</tr>
<tr>
<td>48</td>
<td>29,400,000</td>
<td>588,000,000</td>
<td>30,400,000</td>
</tr>
<tr>
<td>46</td>
<td>23,400,000</td>
<td>468,000,000</td>
<td>24,200,000</td>
</tr>
<tr>
<td>44</td>
<td>17,400,000</td>
<td>348,000,000</td>
<td>18,000,000</td>
</tr>
</tbody>
</table>

Maintenance cost should be the same for all depths. Maintenance costs for the existing channel have been estimated by the Corps of Engineers (prior to construction) at approximately one million dollars annually. Over 50 years, that has a present value of $19,400,000.

To these costs must be added the cost of the terminal and land side infrastructure: $1,866,604,000 total, or $96,382,000 annually over 50 years.
Non-Monetary Effects

Natural Resources

The following effects on natural resources can be anticipated from the channel dredging.

- **Turbidity in the river.** Dredging operations and related blasting churn up sediments, which remain suspended in the water for some time. Although the turbidity from initial construction eventually would be dissipated, the depth of the channel relative to the depth of the surrounding riverbed suggests constant shoaling and correspondingly constant maintenance dredging.

  There is also the continuing effects of propwash of deep draft vessels. This will become a significant issue with 30-foot diameter screws driven by 100,000 horsepower engines, turning near the bottom of the channel.

- **Salt water intrusion upstream.** The proposed channel would present a larger cross-section to tidal flows, with the result that tidal amplitudes upstream would increase, and water of high salt content would reach farther up the Cape Fear River and tidal tributaries.

  The expected results would be changes in vegetation along tidal rivers and creeks, with the loss of certain trees less tolerant of salinity. Town Creek and Rice’s Creek are particularly sensitive, with stands of centuries-old cypress on the banks. To some extent this effect is offset by increases in brackish marsh areas which have significant ecological value. But that is a change in the ecology of the Cape Fear River estuary.

- **Loss of Habitat.** This project involves extensive dredging and vessel traffic in heretofore undisturbed areas. These are intertidal and shallow soft bottom and shell bottom habitats, which function as primary nursery areas, secondary nursery areas, or special secondary nursery areas. Hundreds of acres of underwater habitat would be lost.

- **Dredging Operations.** Dredging has two impacts on aquatic life. The first is “entrainment,” which means the fish, shellfish, crabs, larvae and other life at and near the bottom get sucked into the dredge and discharged somewhere else. The other is less drastic—turbidity and suspended sediments, which can be lethal to both marine creatures and submerged aquatic vegetation in sufficiently long exposures. Dredging would be continuous, from the start of construction through maintenance forevermore.

- **Change in Water Depth.** Increasing the depth of the river by ten feet changes the light penetration to the bottom and reduces the concentration of dissolved oxygen at the lower depths. Both have an adverse effect on submerged aquatic vegetation and marine life.
• **Spoil disposal.** The proposed channel improvements would involve removal of approximately 43 million cubic yards of material, including 10 million cubic yards of rock, which would have to be deposited somewhere. Some of the material would be beach-quality sand, which could be used for nourishment of nearby beaches.

Disposal of spoil on islands created for the purpose and at disposal sites out to sea both involve complex problems, mainly involving loss of habitat, exacerbated here by the large amount of material involved.

• **Blasting.** Consultants to the State Ports Authority have determined that rock would be encountered at depths of 36 to 45 feet and below along the route of the channel from the terminal site to approximately 6000 feet beyond the mouth of the river. Approximately ten million cubic yards of rock would have to be removed, a very substantial amount. Blasting would be required for excavation of rock not removable by dredging alone.

Underwater explosions injure and kill fish, marine mammals, sea turtles and other marine life.

• **Altered circulation.** The proposed channel would substantially alter the current patterns in the lower Cape Fear River and in the ocean immediately south of the mouth of the river. The effects on aquatic life are unknown, but likely to be significant.

• **Spill potential.** The lowest 10 to 20 feet of the channel, from the terminal site to approximately 6000 feet beyond the mouth of the river, would be cut through rock. This would present a hard bottom to vessels and raise the issue of hull damage in case of grounding. In addition, there is the normal hazard of collision. Only a single incident, such as that of the *Cosco Busan* in San Francisco Bay, can cause substantial environmental damage from spill of fuel from container shops, or liquid cargoes from tankships using the same channel. Area beaches and the wetlands along the shore of the Cape Fear River are very vulnerable.

*Spread of oil from Cosco Busan in San Francisco Bay*
• **Hazardous cargo loss.** The Cape Fear River is not a deep water harbor. Deep draft vessels would be confined to the channel, and would not have a sheltered anchorage when not actually loading and unloading at the terminal. Waiting vessels would be obliged to remain at least fifteen miles out in the ocean.

  This increases the risk of loss of deck cargo containers, some of which may contain toxic and hazardous substances, in rough weather conditions. Incidents such as the loss of several containers of arsenic trioxide by the *M/V Santa Clara* off the New Jersey coast can cause substantial damage to the ocean ecology and require closing of fisheries for extended periods.

• **Ship strikes.** Aquatic creatures, particularly mammals and reptiles, would be at increased risk from strikes by vessels.

  The last remaining population of right whales moves along the coast past the Cape Fear in the annual migration between calving grounds near Georgia and Florida and feeding grounds in the North Atlantic. Ship strikes are a primary cause of right whale mortality. Five species of sea turtles, four endangered or threatened, nest on area beaches and inhabit coastal waters.

• **Sand placement.** Sand from dredging placed on beaches can adversely affect sea turtles, intertidal microfauna, seabeach amaranthus, shore birds and other organisms. This issue has been addressed in earlier projects, with limited success, and must be addressed here with the benefit of the experience of such projects.

• **Erosion.** Erosion of beaches and other shoreline areas can result from dredging, alteration of current patterns by reshaping the river and seabed, and wakes and propwash from very large vessels. North Carolina beaches adjoining inlets have required constant renourishment where dredging has created “sediment sinks,” deep trenches that capture sand and prevent the normal and natural regeneration of beaches.

  Historical records show that the natural depth at the mouth of the Cape Fear River in Colonial times was about ten feet. Beginning in the nineteenth century, a succession of dredging projects has created a channel 44 feet deep and 500 feet wide. The result is an extreme example of disturbing the natural state of equilibrium of beaches and inlet, creating an artificial situation that can only be sustained by constant dredging and beach nourishment.
The loggerhead sea turtle and green sea turtle, both Federally threatened, nest on the beaches at Bald Head Island and Caswell Beach, on either side of the mouth of the Cape Fear River with its shipping channel. The Federally-threatened piping plover winters in the project area, and the seabeach amaranth, also Federally-threatened, grows on Bald Head Island beaches. The dredging of the channel between those beaches has disrupted the normal movement of sand and sediment along the shore which maintains the beaches, by trapping the material in the dredged trench. The habitat of the threatened species is routinely diminished as the beaches erode into the sea, and then disturbed by the placement of sand dredged from the channel in the course of maintenance dredging. The wider, deeper channel contemplated by the project will exacerbate that problem.

Particularly sensitive is the passage along the west side of Bald Head Island, where the shipping channel has been located to avoid rock formations. Maintenance dredging of that channel in 2009 produced an environmental and public relations calamity when large parts of the beach fell in the dredged trench.

Public Safety

- **Blasting.** The reactors and the above-ground spent fuel storage area of the Brunswick Nuclear Plant are approximately 8000 feet from the location of the berthing area and turning basin for the proposed terminal. Dredging of both would require the removal of extensive rock formations at the lower depths planned, which may require blasting, with unknown but ominous effects on those elements of the plant.

- **Storm surge.** Increasing the channel cross-section would increase the volume and velocity of a storm surge in the Cape Fear River. The Cape Fear is part of “hurricane alley,” subject to category two and three hurricanes at frequent intervals. The Cape Fear River opens to the southeast, the typical direction from which wind and water approach the area in a storm. This would put structures along the river at more risk of damage.
than they now face, which is considerable. The container terminal itself would be at the end of the channel directing the path of the surge, and the Brunswick Nuclear Plant and the entrance to its cooling water canal are there, too.

Cultural and Historic Resources

- **Damage to archeological sites.** An enlarged channel between Southport and Battery Island would extend about 150 feet on both sides of the existing channel, taking in the sites of four shipwrecks of archeological interest: the *Kate*, the *CSS North Carolina*, the *Belfast*, and the *Fayetteville*. Widening of the channel at the junction with the new channel to the terminal site may also affect the site of the quarantine station constructed in the river in 1895.

  In addition, dredging operations often involve heavy ground tackle set well outside the area to be dredged. In 1995, a 15,000 pound anchor was dropped on the bow of the *CSS North Carolina* to serve as a mooring for barges supporting dredging operations. It was later pulled out through the hull, resulting in the damage shown in this illustration.

![Plan of the bow of the ironclad CSS North Carolina illustrating the damage done by anchoring in the wreck (Image courtesy of Tidewater Atlantic Research, Inc.).](image)

**FIGURE 8.** Plan of the bow of the ironclad *CSS North Carolina* illustrating the damage done by anchoring in the wreck (Image courtesy of Tidewater Atlantic Research, Inc.).

Erosion of the shoreline from ship passage and underwater erosion from dredging has the potential to expose buried archeological sites to damage.
• **Blasting.** The channel passes close by the Price’s Creek lighthouse and the Bald Head light, both of historical interest. Both may be affected by seismic energy from channel blasting.

**Recreational Resources**

• **Incompatible water use.** Just as the container terminal would represent an incompatible land use for the nearby residential areas, the passage of container ships larger than any other vessel afloat through waters frequented by recreational craft is an incompatible water use. The lower Cape Fear River is a link in the Intracoastal Waterway and popular destination, well used by local and transient mariners, some more skilled than others. The September 2009 issue of *Sail* magazine reported: “There are currently 28 marinas and 2500 slips within a 25-mile radius of the proposed port and increased traffic could have a negative effect on recreational boating.”

• **Erosion of beaches.** The same erosion of beaches that affects sea turtles and other marine and terrestrial life would erode the recreational and scenic value of those beaches. At the beginning of the project, the beach quality sand generated by the dredging could be used to enhance the beaches, and indeed the preliminary plans prepared by CH2M Hill, Inc., contemplate such beach nourishment over a wide area. But the project has a very long life, and the permanent effects of the inevitable changes in ocean and river currents are unknown. Experience has shown that sand placed on beaches eventually finds its way back into the trenches dredged in the ocean floor, and must be removed and restored to the beaches in an endless cycle.
Alternative B: The CH2M Hill, Inc., Proposal

This plan would involve use of the existing channel only from the mouth of the Cape Fear River seaward. From the berthing area at the proposed terminal site and turning basin, a new channel would be constructed to the mouth of the river. This would pass east of Battery Island, by-passing the sharp turns in the existing alignment. That portion of the existing channel would be partially filled with dredging spoil and retained only as part of the Intracoastal Waterway. From the mouth of the river, the existing channel would widened and deepened along its existing alignment, and then extended the additional length necessary to reach deep water. To reach water of 55-foot depth, a ten-mile extension would be required.

This alternative includes consideration of various depths from the existing depth of 42 feet to the depth embodied in the State Ports Authority proposal, 52.5 feet.

This alternative includes the container terminal and its land-side infrastructure.

Monetary Effects–Benefits

Just as Alternative A, the primary benefits of this channel alternative are derived from the container terminal, and the aggregate benefits (and costs) of this alternative must include the benefits and costs of the container terminal. This Alternative does not have the disbenefit of the need for tugboat assistance for larger vessels to navigate the channel turns, although tugboat assistance would be required at the berthing area. It does have an independent benefit—the shortening of the route for all vessels calling at upriver points.

Route shortening–all vessels

The channel from the mouth of the Cape Fear River to the Wilmington harbor would be shortened by about one mile by the proposed new channel by eliminating the curve at Southport. All vessels calling at the harbor would benefit.

To estimate the benefit, we use these assumptions:

Speed: six knots
Average operating cost: $2000 per hour
Annual vessel calls: 1000

This would provide an annual savings of approximately $333,000, which for fifty years would have a present value of $6,450,000.
Monetary Effects—Cost

CH2M Hill, Inc., consultants to the State Ports Authority, estimated that the channel recommendation that emerged from their analysis (which we use herein as Alternative B) would require the removal and disposal of 68.3 million cubic yards of material.

CH2M Hill, Inc., determined that the most recent cost of dredging for new construction (as opposed to maintenance) in the Cape Fear River was about $10 per cubic yard. This does not include extra costs of rock removal, engineering cost, environmental mitigation, post-project monitoring and review, or contingency. By reference to the cost of the current project to deepen the Cape Fear River to Wilmington harbor, with an estimated $533 million final cost for 27.3 million cubic yards, we use for the purpose of this analysis a total cost of $20 per cubic yard.

This disregards most of the cost of rock removal, which can be many times the cost of removal of softer material. Rock will be encountered at the terminal site and site of the turning basin, and at the mouth of the river for a distance of about 6000 feet. This alternative would not require the removal and preservation of four wrecks of archeological interest along the existing channel alignment, but may require investigation of the site of the quarantine station, which is located at approximately the point at which the new channel “cut-thru” proposed by CH2M Hill, Inc. leaves the existing channel.

As in the case of Alternative A, another cost not included is whatever measures are necessary to isolate the channel and berthing area at the terminal site from the entrance to the cooling water intake canal for the Brunswick Nuclear Plant.

This is a summary of cost for various depths:

<table>
<thead>
<tr>
<th>Depth</th>
<th>Dredged Material</th>
<th>Total Cost</th>
<th>Annual Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>52.5 feet</td>
<td>68,300,000 cubic yards</td>
<td>$1,366,000,000</td>
<td>$70,500,000</td>
</tr>
<tr>
<td>50</td>
<td>61,200,000</td>
<td>1,224,000,000</td>
<td>63,200,000</td>
</tr>
<tr>
<td>48</td>
<td>55,600,000</td>
<td>1,112,000,000</td>
<td>57,400,000</td>
</tr>
<tr>
<td>46</td>
<td>49,900,000</td>
<td>998,000,000</td>
<td>51,500,000</td>
</tr>
<tr>
<td>44</td>
<td>44,300,000</td>
<td>886,000,000</td>
<td>45,800,000</td>
</tr>
</tbody>
</table>

Maintenance cost should be the same for all depths. Maintenance costs for the existing channel have been estimated by the Corps of Engineers (prior to construction) at approximately one million dollars annually. Over 50 years, that has a present value of $19,400,000.

To these costs must be added the cost of the terminal and land side infrastructure: $1,866,604,000 total, or $96,382,000 annually over 50 years.
Non-Monetary Effects

Natural Resources

The effects on natural resources for Alternative B would be the same as Alternative A in most respects, with these differences:

- **Salt water intrusion upstream.** This alternative creates a shorter path for tidal movements to the upper parts of the river, with the result that, by comparison to Alternative A, tidal amplitudes upstream would be higher, and water of high salt content would reach farther up the Cape Fear River and tidal tributaries.

- **Loss of Habitat.** This alternative, in addition to extensive dredging and vessel traffic in the heretofore undisturbed areas near the terminal site, would involve a new channel approximately 2.3 miles long through undisturbed areas east of Battery Island with an existing depth of one foot or less. Some areas are completely exposed at low tide.

  In order to achieve a channel width of 600 feet, recommended by CH2M Hill, Inc., the necessary slope at the channel sides would take an additional 275 feet on each side, for a total width of 1050 feet. Approximately 140 acres of tidal and subtidal habitat would be lost.

  This new channel alignment would pass through areas reserved in the John H. Chaffee Coastal Barrier Resource System. The Coastal Barrier Resources Act, at 16 USC 3504, prohibits Federal expenditures for construction within such system. This area is also part of a State reservation, the Bald Head Island Natural Area.

- **Storm surge.** By comparison to Alternative A, the channel alignment of Alternative B presents a straight path for storm surge directly to the terminal site and the cooling water canal for the Brunswick Nuclear Plant. The experience with the Mississippi River Gulf Outlet suggests that this can be a major problem.

- **Damage to archeological sites.** The alternative avoids the area of the Civil War era shipwrecks along the existing channel at Southport, but does appear to pass directly through the site of the quarantine station constructed in the river in 1895. According to old charts, the route of the CH2M Hill, Inc.,"cut-thru" was never a navigation channel, and should not be the location unknown wrecks. However, it would have to be investigated.
**Alternative C: New Inlet**

This plan would involve reopening the inlet to the Cape Fear River from Onslow Bay to the east, in the location of the inlet that had been opened by a storm in 1761, and later closed by the Corps of Engineers by construction of a rock barrier in the period 1870-1891.

A variation of this would be enlarging of the existing inlet about a mile to the south, now called “New Inlet.” While that remains open at high tide, it is not and has never been used for navigation.

This alternative includes consideration of various depths from the existing depth of 42 feet to the depth embodied in the State Ports Authority proposal, 52.5 feet.

This alternative includes the container terminal and its land-side infrastructure.

**Monetary Effects–Benefits**

Just as Alternatives A and B, the primary benefits of this channel alternative are derived from the container terminal, and the aggregate benefits (and costs) of this alternative must include the benefits and costs of the container terminal. This alternative does not have the disbenefit of Alternative A, the need for tugboat assistance for larger vessels to navigate the channel turns, although tugboat assistance would be required at the berthing area.

This alternative would have an independent benefit—the shortening of the route for some vessels calling at upriver points. For vessels from the south, however, which would include the coastwise trade from Gulf ports, the route would be longer than Alternative A and perhaps Alternative B. For the purpose of this analysis, we shall use the route-shortening benefit ascribed to Alternative B, an annual savings of approximately $333,000, which for fifty years would have a present value of $6,450,000.
**Monetary Effects—Cost**

As in the case of Alternatives A and B, we start with the estimates of CH2M Hill, Inc., consultants to the State Ports Authority. The consultants determined that 22,700,000 cubic yards of material must be removed for the berthing areas, access channel and turning basin. That estimate would be applicable to Alternatives A, B and C. To that we must add an estimate of dredging volumes to deep water 12 miles offshore. We note that the old channel has long since filled and an entirely new channel would have to be created.

Also as in the case of Alternatives A and B, we use for the purpose of this analysis a total cost of $20 per cubic yard, which includes some rock removal, engineering cost, environmental mitigation, post-project monitoring and review, and contingency.

This disregards most of the cost of rock removal, which can be many times the cost of removal of softer material. Rock will be encountered at the terminal site and site of the turning basin, and perhaps at other locations along the route.

This alternative would involve the removal and preservation of many wrecks of archeological interest along the path of the former “New Inlet,” which was the site of many encounters between Union and Confederate vessels. That cost is not included.

As in the case of Alternatives A and B, another cost not included is whatever measures are necessary to isolate the channel and berthing area at the terminal site from the entrance to the cooling water intake canal for the Brunswick Nuclear Plant.

This is a summary of costs for various depths:

<table>
<thead>
<tr>
<th>Depth</th>
<th>Dredged Material</th>
<th>Total Cost</th>
<th>Annual Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>52.5 feet</td>
<td>130,000,000 cubic yards</td>
<td>$2,600,000,000</td>
<td>$134,300,000</td>
</tr>
<tr>
<td>50</td>
<td>116,500,000</td>
<td>2,330,000,000</td>
<td>120,300,000</td>
</tr>
<tr>
<td>48</td>
<td>105,800,000</td>
<td>2,116,000,000</td>
<td>109,300,000</td>
</tr>
<tr>
<td>46</td>
<td>95,000,000</td>
<td>1,900,000,000</td>
<td>98,100,000</td>
</tr>
<tr>
<td>44</td>
<td>84,300,000</td>
<td>1,686,000,000</td>
<td>87,000,000</td>
</tr>
</tbody>
</table>

Maintenance cost should be the same for all depths. Maintenance costs for the existing channel have been estimated by the Corps of Engineers (prior to construction) at approximately one million dollars annually. Although the channel would be shorter than the existing channel, eventually it would be necessary to maintain most of the existing channel as a part of the Intracoastal Waterway. Over 50 years, one million dollars has a present value of $19,400,000.

To these costs must be added the cost of the terminal and land side infrastructure: $1,866,604,000 total, or $96,382,000 annually over 50 years.
Non-Monetary Effects

Natural Resources

The effects on natural resources for Alternative C would be the same as Alternatives A and B in most respects, with these differences:

- **Salt water intrusion upstream.** This alternative creates a shorter path for tidal movements to the upper parts of the river, with the result that, by comparison to Alternatives A and B, tidal amplitudes upstream would be higher, and water of high salt content would reach farther up the Cape Fear River and tidal tributaries.

- **Loss of habitat.** This alternative involves dredging through about two miles of areas that have not been disturbed for over a century, and twelve miles that have never been disturbed. Coastal habitat of every kind would be lost. However, there eventually may be offsetting gains in return of the existing channel through the river mouth to its natural state.

  This new channel alignment would pass through areas reserved in the John H. Chaffee Coastal Barrier Resource System. The Coastal Barrier Resources Act, at 16 USC §3504, prohibits Federal expenditures for construction within such system. This area is also part of a State reservation, the Bald Head Island Natural Area.

- **Beach erosion.** The problem of beach erosion at the mouth of the river may be attenuated or even eliminated as the existing channel fills. However, a new and similar problem would be created at the new inlet.

- **Storm surge.** By comparison to Alternatives A and B, the new channel alignment of Alternative C presents a considerably shorter path for storm surge directly to the Military Ocean Terminal at Sunny Point, as well as the terminal site and the cooling water canal for the Brunswick Nuclear Plant. The experience with the Mississippi River Gulf Outlet suggests that this can be a major problem.

- **Damage to archeological sites.** The area around the location of the old “New Inlet” is littered with Civil War era shipwrecks of both Union and Confederate vessels, including the **CSS Raleigh**, the ironclad sister ship of the **CSS North Carolina**. This issue can be avoided by using the existing inlet (designated “New Inlet” on current charts), but that inlet has never been open to navigation and the loss of habitat would be more extensive.

- **Recreational Use.** Diversion of large vessel traffic from the lower Cape Fear River would enhance the recreational potential of that part of the river. Sailing events would not conflict with the occasional passage of container ships.
Alternative D: No Action

In this plan, no new dredging would be done and the proposed North Carolina International Terminal would not be built. The terminal site, now unmolested marsh and woodland, would be dedicated to other uses, perhaps reserved as park or natural area.

As the base case, both monetary benefits and monetary costs would be assigned a value of zero. As for non-monetary effects, this alternative leaves unsolved the problems of the hazardous channel turn and beach erosion at the river mouth attributable to the depth of the existing channel.

Alternative E: Restoration

In this plan, no new dredging would be done and the proposed North Carolina International Terminal would not be built. The existing channel would be left to fill from natural sedimentation until it reached the selected lesser depth. The terminal site would be dedicated to other uses, perhaps reserved as park or natural area.

We note that the channel along the wharf areas of the Military Ocean Terminal at Sunny Point is shown on current charts with a depth of 32 to 34 feet. We use 34 feet as the minimum depth to be considered, in order to maintain access to that wharf. Depths between that depth and the existing depth of 42 feet should be considered in this alternative.

Monetary Effects

The alternative does not have direct costs associated with it. As for benefits, we find two positive monetary benefits and one disbenefit.

Maintenance dredging

This alternative would be effected by suspending maintenance dredging for a sufficient period to permit natural sedimentation to occur. The period of such suspension is unknown. Resumption of maintenance dredging would likely occur by degrees, as some areas will shoal sooner than others.

Beach nourishment

Reduction in channel depth at the mouth of the river would reduce its effect as a sediment sink, restoring, to some extent the natural replenishment process. This would reduce the need for and expense of beach nourishment. Whether the need for beach nourishment can be eliminated altogether would depend on experience.
Marine transportation costs

The rationale for the recent channel deepening process (from 38 to 42 feet) was the reduction in transportation cost made possible by admitting deeper draft vessels to the river. Such vessels offer economies of scale. To some extent, however, vessels of design draft close to or exceeding the available channel depth can navigate the river when loaded to less than capacity (“light-loaded”) or by timing calls for favorable tides.

The recent channel deepening, effective in 2004, has not been reexamined to determine whether the anticipated benefits actually occurred.

This graph shows vessel calls and drafts in 2007, the last year for which such data are available (but which other information suggests is the peak year).

Data from this and previous years shows that vessel drafts do not exceed three feet less than the channel depth. Thus a 38-foot channel would accommodate vessels of 35 foot draft and less, and a 34-foot channel would accommodate vessels of 31 foot draft or less.

The data suggest that vessels of 35-foot and deeper draft constitute a substantial proportion of vessel traffic in the Cape Fear River, and that restricting navigation of the river to shallower-draft vessels would result in a significant disbenefit. The amount of such disbenefit would require analysis of cargo types, origins and destinations. Container traffic intended for inland destinations can be diverted to container terminals in other states, with some penalty of increased costs of land transportation, but traffic in the Cape Fear River includes bulk cargoes that are not so readily diverted.
Non-Monetary Effects

Non-monetary effects of partial restoration of the Cape Fear River by letting the channel fill to lesser depth would be derived from the lesser depth and smaller channel cross-section, and from reduced traffic of large vessels.

Air pollution

Fewer diesel-powered vessels means less air pollution from main propulsion engines and auxiliary engines.

Tidal amplitude

Reduced channel cross-section would restrict tidal flows, moving the interface between salt and fresh water in tidal inlets down to a level approaching that prevailing before deepening. Although the damage from previous salinity increases in tidal creeks may already have been done, restriction of tidal flows may offset to some extent the rise in sea level.

Beach erosion

Reducing the depth of the navigation channel at the river mouth would reduce its propensity to capture migrating sand, restoring to some extent the ability of the beaches to be replenished by natural forces instead of mechanical nourishment. This would be less disruptive of the function of the beaches for sea turtle nesting.

Spill hazards

Fewer vessels mean fewer opportunities for fuel and cargo spills from operating mishaps. Reduction in channel depth would tend to discourage calls by the larger vessels that have difficulty with the channel turns, reducing the occasions of groundings.

Recreational uses

Reduced traffic of large vessels would reduce the conflict with recreational uses of the river.
Step J. Compare and Screen Alternatives

Alternatives with the North Carolina International Terminal

Alternatives A, B and C are channel alternatives for the North Carolina International Terminal, as that is defined in the plans and reports of the consultants of the North Carolina State Ports Authority. The benefits and costs of those alternatives include the benefits and costs of the terminal, any separate benefits of the channel alternative, and the costs of the channel alternative.

**Alternative A**

Alternative A is the North Carolina International Terminal with the existing channel alignment, with an access channel for the terminal and extension to deep water.

Set forth below are the annual benefits, costs, and benefit/cost ratio at various channel depths:

<table>
<thead>
<tr>
<th>Benefits</th>
<th>Channel Depth (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>52.5</td>
</tr>
<tr>
<td>Inland transportation</td>
<td>$3,250,000</td>
</tr>
<tr>
<td>Sailing time savings</td>
<td>4,070,000</td>
</tr>
<tr>
<td>Added land distance</td>
<td>(5,340,000)</td>
</tr>
<tr>
<td>Tugboat assistance</td>
<td>(1,680,000)</td>
</tr>
<tr>
<td>Total benefit</td>
<td>300,000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Costs</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Terminal</td>
<td>96,380,000</td>
</tr>
<tr>
<td>Channel construction</td>
<td>44,300,000</td>
</tr>
<tr>
<td>Maintenance</td>
<td>1,000,000</td>
</tr>
<tr>
<td>Total cost</td>
<td>141,680,000</td>
</tr>
</tbody>
</table>

Benefit/cost ratio: 0.002 0.002 0.002 (negative)

The non-monetary effects of Alternative A are all negative. The problems of the non-conforming channel turn and beach instability at the mouth of the river would not be solved, but would be exacerbated.

This alternative does not deserve further consideration. Benefits are only a small fraction of the costs.
Alternative B

Alternative B is the North Carolina International Terminal with the CH2M, Inc., recommended channel alignment.

Set forth below are the annual benefits, costs, and benefit/cost ratio at various channel depths:

<table>
<thead>
<tr>
<th>Benefits</th>
<th>Channel Depth (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inland transportation</td>
<td>52.5</td>
</tr>
<tr>
<td>Sailing time savings</td>
<td>$3,250,000</td>
</tr>
<tr>
<td>Added land distance</td>
<td>(5,340,000)</td>
</tr>
<tr>
<td>Route shortening</td>
<td>330,000</td>
</tr>
<tr>
<td>Total benefit</td>
<td>2,310,000</td>
</tr>
</tbody>
</table>

| Costs                                 |       |       |       |       |
| Terminal                              | 96,380,000 | 96,380,000 | 96,380,000 | 96,380,000 | 96,380,000 |
| Channel construction                  | 70,500,000 | 63,200,000 | 57,400,000 | 51,500,000 | 45,800,000 |
| Maintenance                           | 1,000,000 | 1,000,000 | 1,000,000 | 1,000,000 | 1,000,000 |
| Total cost                            | 167,880,000 | 160,580,000 | 154,780,000 | 148,880,000 | 143,180,000 |
| Benefit/cost ratio                    | 0.014 | 0.014 | 0.014 | 0.011 | 0.007 |

The non-monetary effects of Alternative B are all negative. In many respects, the non-monetary effects are substantially worse than with Alternative A. However, this does solve the problem of the non-conforming channel turn at Southport. It would increase the severity of the problem of beach instability at the mouth of the river.

Although offering a slightly better benefit/cost ratio than Alternative A, this alternative does not deserve further consideration.
**Alternative C**

Alternative C is the North Carolina International Terminal with a new channel to the east through the location of the former “New Inlet.”

Set forth below are the annual benefits, costs, and benefit/cost ratio at various channel depths:

<table>
<thead>
<tr>
<th>Channel Depth (feet)</th>
<th>Benefits</th>
<th>Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>52.5</td>
<td>$3,250,000</td>
<td>96,380,000</td>
</tr>
<tr>
<td>50</td>
<td>$3,250,000</td>
<td>96,380,000</td>
</tr>
<tr>
<td>48</td>
<td>$3,200,000</td>
<td>96,380,000</td>
</tr>
<tr>
<td>46</td>
<td>$2,600,000</td>
<td>96,380,000</td>
</tr>
<tr>
<td>44</td>
<td>$1,950,000</td>
<td>96,380,000</td>
</tr>
</tbody>
</table>

**Benefits**

- Inland transportation: $3,250,000, $3,250,000, $3,200,000, $2,600,000, $1,950,000
- Sailing time savings: 4,070,000, 4,070,000, 4,070,000, 4,070,000, 4,070,000
- Added land distance: (5,340,000), (5,340,000), (5,340,000), (5,340,000), (5,340,000)
- Route shortening: 330,000, 330,000, 330,000, 330,000, 330,000
- Total benefit: 2,310,000, 2,310,000, 2,260,000, 1,660,000, 1,010,000

**Costs**

- Terminal: 96,380,000, 96,380,000, 96,380,000, 96,380,000, 96,380,000
- Channel construction: 134,300,000, 120,300,000, 109,300,000, 98,100,000, 87,000,000
- Maintenance: 1,000,000, 1,000,000, 1,000,000, 1,000,000, 1,000,000
- Total cost: 231,680,000, 217,680,000, 206,380,000, 195,480,000, 184,380,000

**Benefit/cost ratio**

- 0.010, 0.011, 0.011, 0.009, 0.005

The non-monetary effects of Alternative C are all negative, and in many respects worse than Alternative A. The problem of the non-conforming channel turn at Southport would be solved. The problem of beach instability at the river mouth would likely be solved, but a new, similar problem would be created at the reopened New Inlet.

This offers a slightly better benefit/cost ratio than Alternative A, but is worse than Alternative B. This alternative does not deserve further consideration.
Alternatives Without the Terminal

Alternative D–No Action

In this alternative, the channel in the Cape Fear River would be maintained at its present depth of 42 feet, and container traffic would continue to be handled at the Port of Wilmington. There would be some economic penalty after the Panama Canal is opened to larger vessels after 2014, in that those larger vessels could not enter the Cape Fear River when fully loaded, and any container traffic carried in such vessels would move through Hampton Roads or Charleston. For the markets in the Raleigh area and eastern North Carolina, longer movements on land would be necessary, incurring a cost of approximately $3,250,000 annually. Other markets would be served equally well by ports other than Wilmington.

This alternative does not address the problem of the non-conforming channel turn at Southport, and the instability of the beaches at the mouth of the river would continue to require mechanical nourishment in perpetuity, if they are to be preserved.

Alternative E–Restoration

In this alternative, the channel in the Cape Fear River would be permitted to shoal until the depth returned to some depth between 42 and 34 feet. That depth, to the extent it would not be kept naturally by river currents, would be maintained by dredging.

This is the only alternative that addresses the non-monetary issues of the non-conforming channel turn and the beach instability at the mouth of the river. The hazard of the channel turn would be diminished by discouraging navigation of the river by the larger vessels, which typically are deeper draft and require channel depths in the order of 42 feet.

The stability of the beaches would be improved by lessening the tendency of the channel to capture the natural movement of sand along the shore, which is the mechanism that naturally replenishes beaches. That issue can only be completely resolved by allowing the mouth of the river to shoal to its natural depth of ten to twelve feet, which is impractical because of the need for access to the Military Ocean Terminal at Sunny Point. The extent to which shoaling to depths of 34 to 38 feet would improve the situation can only be learned by experience.

This alternative involves an economic penalty. As (and if) container ships of larger size and deeper draft are placed in East Coast service, some container traffic would be diverted to ports in other states. This would necessitate a longer overland trip for some markets.

Bulk and break-bulk commodities moving through Wilmington harbor would also be affected. Determination of the economic penalty involves examination of trends for such
commodities; the most recent trends are downward, but whether that is a long-term trend or is due to the current economic situation is not known.

Offsetting economic gains result from the reduction is the frequency and extent of maintenance dredging and nourishment of beaches.

Step K. Recommend a Plan

To recommend a plan, we revisit the National Objectives for Water Resources Planning, proposed by the White House Council on Environmental Quality in response to a Congressional mandate:

(1) protecting and restoring natural ecosystems and the environment while encouraging sustainable economic development;

(2) avoiding adverse impacts to natural ecosystems wherever possible and fully mitigating any unavoidable impacts; and

(3) avoiding the unwise use of flood plains, flood-prone areas and other ecologically valuable areas

None of the three alternative plans involving further dredging and construction of the proposed North Carolina International Terminal respond to these objectives. None of the three alternatives protect and restore natural ecosystems and all have adverse impacts on such systems. As for sustainable economic development, none have a shred of economic worth. The best benefit/cost ratio, found in Alternative B, the plan developed by the consultants to the North Carolina State Ports Authority, is 0.014. This is quite awful, relative to the traditional break-even level of a ratio of 1.0. These alternatives represent the “unwise use …. of ecologically valuable areas” that the National Objectives urge us to avoid.

The no-action plan, Alternative D, avoids the negative impacts, but it does not solve the problems of the negative impacts of previous projects, the problems of the non-conforming channel turns and the beach instability.

The only alternative plan responsive to the proposed National Objectives is Alternative E, restoration. It would protect and restore natural ecosystems in the Cape Fear estuary. It would avoid adverse impacts. It would avoid unwise use of ecologically valuable areas. Natural reduction on the depth of the river channel may not fully solve the problems of the channel-turn hazard and beach erosion, but it would attenuate both problems.

As for “encouraging sustainable economic development,” investigation of the restoration alternative should include application of new techniques of valuing ecosystem services to
determine whether the positive monetary effects offset any economic penalties from moving commercial traffic to other ports. As for measuring such economic penalties, a regional approach should be used, considering whether the use of nearby ports with naturally deep harbors and facilities in place offer advantages over continued imposition of heavy commercial traffic on an environment unsuited by physical characteristics and location.

Alternative E, restoration of the river channel to a previous shallower depth, should be investigated.
Sources


California Air Resources Board, *Health Effects of Diesel Particulate Matter*


Holland Consulting Planners, Inc., *Brunswick County CAMA Core Land Use Plan* (2007)


http://www.scorecard.org


