WORKING WATERFRONTS: ECONOMIC IMPACTS OF SEA LEVEL RISE ON GEORGIA'S COAST

Port of Savannah: Garden City Terminal

City of Darien

FALL 2013

A project of the Georgia Conservancy

BLUEPRINTS
for successful communities

WORKING WATERFRONTS:

Economic Impacts of Sea Level Rise on Georgia's Coast

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Our mission is to protect Georgia's natural resources for present and future generations by advocating sound environmental policies, advancing sustainable growth practices and facilitating common-ground solutions to environmental challenges.

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1.0 INTRODUCTION

Blueprints for Successful Communities (Blueprints) is an 18-year-old sustainable community design program of the Georgia Conservancy. The *Blueprints* process uses a community-based approach to sustainable planning and design. It is unique in that it involves key stakeholders – including citizens, businesses, agency and institutional representatives, and elected and appointed officials – throughout the entire planning process of redeveloping a community to better incorporate and focus on natural resource protection, green space accessibility, sustainable land use, and live-work connectivity. The *Blueprints* process is one of the most highly respected planning processes in our state because of its inclusiveness, transparency and technical quality.

1.1 *BLUEPRINTS* INITIATIVE

Through a research driven process the *Blueprints* team (composed of *Blueprints* staff, instructor Jason Chernock and the Georgia Institute of Technology graduate City and Regional Planning studio) worked to uncover some of the major economic forces in two distinct places on the Georgia Coast, and how these will be impacted by rising seas. The team conducted data collection within the communities to produce maps and outputs; some stakeholder interviews and site visits; and a set of conclusions and draft recommendations for stakeholders' consideration. These recommendations form the basis of this report and will be utilized in the upcoming year to educate stakeholders and advance this knowledge.

BLUEPRINTS PRINCIPLES

Maintain and enhance quality of life for residents of the community	Employ regional strategies for transportation, land use, and economic growth	Consider the effect of the built environment on the natural environment as well as history and culture	Employ efficient land uses

1.2 *BLUEPRINTS* PROCESS

The *Blueprints* process was directed and managed by the Georgia Conservancy. Technical support for the project was provided by Jason Chernock and a studio made up of graduate students in Georgia Tech's City and Regional Planning program. The Working Waterfronts *Blueprints for Successful Communities* began in the summer of 2013 with data collection and project coordination and preparation. From August to December 2013, the research based work occurred, coinciding with the semester calendar of Georgia Tech. From December to February 2013-2014, the Georgia Conservancy compiled, edited and added to the planning studio's work to create this final report.

The *Blueprints for Successful Communities* program adheres to values that protect communities and the environment, and it respects the link between the health of our environment, our economic stability and the way we use land. The *Blueprints for Successful Communities* principles are shown at the top of the page.

By following these principles, we raise public awareness in Georgia about alternative land use and transportation strategies that are good for the environment and good for the economy.

1.3 EXECUTIVE SUMMARY

Coastal Georgia is a diverse region stretching nearly 100 miles and housing more than half a million people in the adjacent six counties. It contains some of Georgia's oldest and most historic cities, some of which have grown into major economic engines, and others of which testify to the region's rich cultural heritage. The Georgia coast is home to beaches, marshes, barrier islands, and working communities, which coexist with major cities, manufacturing sites, tourist hubs, vital highway corridors, and one of the nation's largest ports. As such, the working waterfronts of the Georgia coast live within a rich environmental, cultural, and economic system that interconnects them all. These waterfronts are home to diverse industries at different scales including international container shipping, fishing and shrimping, and tourism that benefits from their natural beauty and heritage.

Scientists have observed sea levels rising along the Georgia coast since the 1930s. The National Oceanic and Atmospheric Administration had documented a sustained trend since 1935 of sea levels rising by 2.98 millimeters per year (National Oceanic and Atmospheric Administration 2013). Other sea level rise projections have forecasted that sea level rise will continue and accelerate, potentially resulting in a sea level rise of one meter above 1999 levels by 2100 (United Nations 2013). Communities should plan for these effects. By

planning now, communities can protect their livelihoods and community treasures with a minimal cost or social disruption compared to acting when disruptions are imminent.

In 2012, the Georgia Conservancy sponsored a studio by graduate students in the School of City and Regional Planning at the Georgia Institute of Technology to investigate the potential impacts of sea level rise in three coastal counties and to detail adaptation opportunities (Georgia Conservancy 2012). The studio found that one meter of sea level rise would inundate nearly one third of the three-county studio area, with a disproportionate impact on parks and conservation land, particularly wetland areas. The team also found significant inundation of residential and waterfront commercial properties, inundation of 13 miles of state and national highways, and the flooding of railroads serving the Port of Savannah, one of the nation's largest container ports. The Georgia Conservancy commissioned the present studio to expand upon the past studio's work on the Georgia coast, particularly addressing sea level rise's economic impacts on the coast and the ripples of this region- and state-wide.

Economic impacts are one of the most understudied but important aspects of sea level rise because the analysis captures relationships that remain hidden from other perspectives. Sea level rise threatens businesses and vital infrastructure in ways that may affect Georgia's economic vitality and potential. Sea level rise threatens large and small businesses, as well as families and individuals along the coast. Small businesses and economically disadvantaged households may have fewer resources with which to respond, creating a disproportionate impact. Moreover, certain industries such as fishing and tourism depend on the coast's natural resources. Finally, an economic analysis reveals relationships between seemingly unconnected locations. These relationships involve employees, exporters, consumers, business operators, and others who are not physically located on vulnerable land but whose life and livelihood is linked with the coast. They are the invisible stakeholders that need to be incorporated into sea level rise discussions.

This *Blueprints* studio describes and quantifies sea level rise's impact on coastal Georgia's economy and the potential repercussions. Sea level rise has the potential to affect communities equally but differently, so the *Blueprints* team focused on two very different sites to capture the diverse impacts. One is the Garden City Terminal at the Port of Savannah, which is one of the country's largest container terminals and the second busiest container exporter by tons (Georgia Ports Authority 2013). The terminal is expected to continue rapid growth facilitated by a multi-million dollar port deepening project.

While the Port of Savannah is a major economic engine for the entire state, the city of Darien — which is the second study site — is a quintessential small, coastal town. Darien has nearly 2,000 residents and a heritage extending back to 1736. Darien's economy is heavily dependent on a few industries, namely fishing, tourism and small business, and residential real estate, which makes it more vulnerable to sea level rise than larger cities. Both the Port of Savannah and the city of Darien have diverse constituents that will be impacted based on what is of value to them. The impacts on one site should not be understood to be greater than the other, but rather attests to fundamental differences in character.

The *Blueprints* team analyzed economic impacts on each site, taking different approaches depending on economic characteristics. Whereas the research team analyzed the Port of Savannah using a traditional economic impact study to measure the effects of a port shutdown, it approached the city of Darien entirely differently, conducting in-depth industry studies to draw connections between sea level rise and local

livelihoods. Each methodology was chosen based on site-specific characteristics, such as industry makeup, economic scale, and available data.

The studio's analysis is intended to inform elected officials, residents, industry, community planners, and others as they prepare for sea level rise on the Georgia coast. Moreover, the analysis reveals that sea level rise is not just a coastal issue, but rather is important at regional, state and even national levels because of the accompanying economic impacts.

1.3.1 GARDEN CITY TERMINAL SUMMARY

The Garden City Terminal at the Port of Savannah is one of the largest and fastest growing container ports in the country, making it an economic engine locally and nationally. The Terminal is an integral economic component on several scales: locally, it supports many households in and around Chatham County; regionally, the port supports wider distribution networks and regional agriculture and manufacturing; and nationally, the port serves as a gateway to access markets across the globe. Therefore rising sea levels projected over the next 100 years make port disruptions an important economic threat on a variety of scales. This report describes the economic threat that sea level rise poses to the port and port-related operations through permanent inundation, worsening storm surge, and other environmental changes at local, regional and statewide scales. The team drew on research from the previous Georgia Conservancy *Blueprints* report (2012) and created new tools for assessing the potential impacts on jobs, property, transportation links and other businesses. The intent is to provide actionable projections for business leaders, policy makers, and individuals in areas that may eventually have to respond to the effects of sea level rise.

A one meter rise in sea level would have a limited impact on Garden City Terminal facilities based on sea level rise calculations conducted by the study team. The team's analysis suggests sea level rise will cause minor flooding along the Terminal's storm drainage canal, which could change maintenance and cargo handling practices at the Terminal and impose costs on the Georgia Ports Authority. In addition to permanent inundation, the study team also conducted an economic impact analysis that calculates the loss of economic activity to the State of Georgia in the event of three hurricane scenarios to determine the economic impact of sea level rise from reduced operations at the

port. Storm surge threatens to magnify the potential effects of sea level rise since higher sea levels provide a higher base for hurricane-driven storm surge. Below are some of the report's major findings regarding storm surge.

- The Garden City Terminal's location on the Savannah River makes it vulnerable to storm surge, and sea level rise is likely to increase the port's vulnerability by reducing its height above the water. Moreover, Chatham County's warehouses are more vulnerable to storm surge than to permanent inundation, which sea level rise will also worsen.

- Large portions of the Garden City Terminal are expected to flood under a category 1 hurricane storm surge. Sea level rise is like to increase the flood depth and extent, worsening disruptions to port operations. Category 5 storms could cause devastating flooding more than 25 feet above terminal ground, which sea level rise would make even more destructive.

- Warehouses around the Port are very vulnerable to high storm surges. Sea level rise could increase the number of warehouse parcels affected by storm surge in a Category 1 hurricane by 50%. Almost all warehouses would be affected by high level storms, and sea level rise would worsen inundation.

To determine the economic impact of a hurricane and storm surge at the Terminal, the team used economic input data from the University of Georgia's 2012 report, "Economic Impact of Georgia's Deepwater Ports" and reports on post-hurricane recovery periods at other ports. Using this information, the *Blueprints* team quantified the impact of sea level rise on the Garden City Terminal in terms of overall output and gross domestic product for the State of Georgia.

- The total economic impact of a Category 1 hurricane on Georgia's economy in terms of output is $1,099,371,223, and in terms of State GDP is $537,021,699. This includes direct, indirect and induced impacts.

- The total economic impact of a Category 3 hurricane on Georgia's economy in terms of output is $1,539,119,712, and in terms of State GDP is $751,830,379. This includes direct, indirect and induced impacts.
- The total economic impact of a Category 5 hurricane on Georgia's economy in terms of output is $13,500,278,613, and in terms of State GDP is $6,594,626,469. This includes direct, indirect and induced impacts.

On a broader geographic scale, the team also looked at sea level rise's impact on warehouses in Chatham County, commute patterns, and road and rail networks.

Chatham County has 437 warehouses, of which a large number are near the port. The I-95 corridor processes large amounts of port-related traffic. Analysis revealed that warehouses have minimal direct vulnerability to permanent inundation. One meter of sea level rise floods 1.5% of warehouse property area. Warehouse buildings in all of Chatham County have an estimated value of $896 million, of which approximately $16 million, or 1.8%, may be affected by permanent inundation.

The results of the commuter analysis show that two areas contain the most vulnerable terminal employees: unincorporated Chatham County and unincorporated Liberty County. Unincorporated Chatham County is home to 37 terminal employees and is expected to have 83.9% of its land inundated. Unincorporated Liberty County houses 30 terminal employees and will likely experience a 45.7% inundation of land.

The *Blueprints* team overlaid one meter sea level rise inundation maps over the coastal Georgia road and

railroad network to determine the extent to which sea level rise will affect the transportation network. Using this data along with roadway bridge construction cost estimates, the study team then determined the cost of rebuilding inundated roadway segments as bridges. This analysis revealed that 22.59 miles of major coastal Georgia roadways will likely be inundated under one meter of sea level rise. In order to restore these roadways, the community would have to build 336 total bridges at a construction cost ranging from $350-922 million in current value. Additionally, 84 segments, totaling 14.04 miles, of railroad would be inundated under one meter of sea level rise.

1.3.2 CITY OF DARIEN SUMMARY

In Section 3.0 on the city of Darien, the analysis focused on three main industries, commercial fishing, tourism and small business, and residential real estate, as well as local commuting patterns, to assess the economic impacts of Sea Level Rise (SLR) over the next 100 years.

In assessing the impacts to commercial fishing, the report focused on the relationship between SLR and the city's unique coastal ecosystem over the next 100 years. Within the commercial fishing industry, shrimping, crabbing and jellyfish processing were looked at in the most detail, as they are the largest industry catches. The coastal wetlands are essential to this industry. They provide a food source, shelter and habitat to these commercial species. Salinity is the most important measurement when determining the future growth of coastal wetland ecosystems, and therefore salinity levels have a direct impact on the health of each species, the stability of their habitat, and their vulnerability to diseases and parasites that can crash the population. To better understand habitat and salinity level changes over the next 100 years, the studio team ran a SLAMM (Sea Level Affecting Marshes Model) assessment using data from the South Atlantic Migratory Bird Initiative. The model demonstrates that there will be a 50-percent reduction in the amount of salt marsh on the Georgia coast, a habitat that is extremely important to shrimp and crab species.

Tourism may suffer if sea level rise degrades wetlands and other natural attractions around Darien. Nature and heritage based tourism are an important economic driver for the City of Darien. Of particular importance to Darien's tourism are historic sites such as Fort King George, the historic downtown, the Coastal Heritage Trail and the coastal wetland ecosystem. Many of these sites are crucial to the success of the tourism industry and are at risk of being permanently inundated by the rising sea levels over the next 100 years. The community's key historic sites — including Fort King George and the Butler Island Rice Plantation — will likely face permanent inundation. It will be important to the local economy to protect historic and natural tourist attractions as much as possible through protection or relocation. Tourism may also present an opportunity for public outreach on sea level rise through education about its effects on Darien.

Small businesses are often severely affected in the face of flooding and Darien has a number of coastal businesses that would be adversely affected by SLR. Fortunately Darien in located on a 30 foot bluff, and

the direct impact to the community's small business industry is expected to be minimal.

In total, 75 residential buildings in Darien are predicted to be damaged by SLR. While many of the residential properties in Darien will not be affected directly by SLR, increased storm surge due to higher sea level will likely impact a larger percentage of properties. One of the implications here is for the National Flood Insurance Program, which is currently phasing out subsidized policy rates. Also, secondary residences and properties that have experienced severe or repeated flooding will see a 25% annual increase in their rates. Greater flood insurance rates will put an increased financial strain on homeowners and small business owners. Of particular concern in Darien is the effect these costs will have on seasonal home owners that represent 7.5% of all of the housing stock in Darien.

The report also looked at the commuting patterns of workers who live in Darien in order to determine if SLR will affect their places of work. This was done using the Census Bureau's online mapping program, "On the Map". Overall, out of 511 workers, 33 commute to a place that will be inundated by SLR. This represents 6.5% of Darien's workforce. Furthermore, the majority of workers travel outside the city to work. If this trend continues, more people may start to commute to affected areas.

In examining adaptation strategies, the report identified strategies for these three main industries. Traditional adaptation strategies include armoring of the shoreline, retreating from the shoreline, or considering measures that accommodate SLR. The report highlights the importance of using tools and practices that encourage community involvement. For example, three communities in coastal New Hampshire have used an innovative program called COAST for a community-driven SLR planning process. It is important for the City of Darien and other local communities to communicate with stakeholders, educate at-risk populations, and involve community members in a manner such that they can decide the adaptation strategies that are most appropriate for their local area.

In conclusion, key findings suggest that flexibility is needed in order to adapt to changing species populations in the commercial fishing industry. Also efforts need to be made to produce policies that will preserve the existing wetlands and coastal habitats. Land use controls should be used to protect existing wetlands and adjacent parcels to allow possible wetland migration. Important tourism sites should be protected or relocated, and public education opportunities through the tourism industry leveraged. Many small businesses may face disruption of their operation or long-term relocation. Lastly, the residential real estate industry will be increasingly impacted by flooding, and flood insurance costs. These increases may make home ownership too expensive for some residents.

1.4 PARTNERSHIPS

Partner organizations and decision-makers are instrumental in the dissemination of the research and recommendations found in this *Blueprints* report in their respective communities. Though sea level rise seems to be on the long-term horizon, action must be pursued now to better position Georgia's coastal communities to a changed landscape. The Georgia Conservancy is working with the Georgia Port Authority as well as elected officials in the City of Darien to convey report findings and work through some impending issues related to sea level rise. While the research and recommendations in this report are specifically based off two working waterfronts, the communities are of varied sizes, with differing advantages and disadvantages. Therefore, these studies can be modified to address other coastal communities, as all of our coastal towns

have an economic reliance on the water surrounding them in one way or another. The Georgia Conservancy will continue to share this information with thought-leaders on the coast and work to make the policy and planning changes to better our community adaptability.