The Costs of Doing Nothing: A Sea Level Rise Synopsis for the Hampton Roads Region

October of 2016 brought Hurricane Matthew to coastal Virginia, providing once again an illustration of the vulnerability of the Hampton Roads region and economy to the threats and impacts of flooding and the role of sea level rise in those impacts. The hurricane prompted Virginia Governor Terry McAuliffe to state, "Climate change is real. Sea-level rise is happening. We've got to get into the game."[1] Indeed, sea level rise, combined with 14 to 17 inches of rain that fell in the region during the hurricane,[2] damaged over 2,000 homes (many that were outside the flood zone and not covered by flood insurance), displaced around 620 individuals, and caused over $13.2 million in estimated damages of public facilities and structures.[3]

Increased recognition of this vulnerability is taking place at all levels of government,[4] but the true costs of inaction have yet to be quantified. This study conducted by the Research Triangle Institute (RTI), entitled the *Costs of Doing Nothing: Economic Consequences of Not Adapting to Sea Level Rise in the Hampton Roads Region*, is a first step to understanding the costs of failing to act. The study, produced for the Virginia Coastal Policy Center at William & Mary Law School (VCPC), through funding from the blue moon fund, models the effects of *not* implementing any specific measures to mitigate the negative impacts of sea level rise for Virginia's Hampton Roads coastal communities.

The study concludes that sea level rise in the range of .5 meters to .75 meters (the levels predicted by the Virginia Institute of Marine Science (VIMS) by the years 2040 and 2060, respectively)[5] could increase the costs and economic damages from coastal flooding events by up to $100 million annually.

Among the study's key findings are:

- Sea level rise will substantially increase damages to residential properties in the Hampton Roads region. Whereas without sea level rise the expected damages in any given year are estimated to be roughly $12 million, these expected damages would increase to roughly $50 million annually with a sea level rise of .5 meters and to over $100 million annually with a sea level rise of .75 meters.

- Sea level rise will significantly increase the regional economic impacts of large storm events. The decline in Gross Regional Product (GRP)[6] of the Hampton Roads economy as a result of a 100-year

[1] Adrienne Marie Mayfield, *McAuliffe to request FEMA aid for Hurricane Matthew damages next week*, SOUTHSIDE DAILY (Oct. 13, 2016), http://southsidedaily.com/2016/10/13/mcauliffe-to-request-fema-aid-for-hurricane-matthew-damages-next-week/.
[2] *Id.*
[3] Office of the Governor, *Governor McAuliffe Requests Federal Disaster Declaration Following Hurricane Matthew* (Oct. 21, 2016), http://governor.virginia.gov/newsroom/newsarticle?articleId=18135.
[4] For example, in 2015, the Virginia General Assembly passed the bipartisan Senate Bill 1443. http://law.lis.virginia.gov/vacode/title15.2/chapter22/section15.2-2223.3/. The bill requires Hampton Roads Planning District localities to include strategies to combat current flooding and future sea level rise in their comprehensive plans. Further, in 2016, the General Assembly passed House Bill 903 to create the Commonwealth Center for Recurrent Flooding Resiliency. http://law.lis.virginia.gov/uncodifiedacts/2016/session1/chapter440/. The Center will help provide scientific and technical support for state agencies, localities, and other entities.
[5] VA. INST. OF MARINE SCI. (VIMS), RECURRENT FLOODING STUDY FOR TIDEWATER VIRGINIA (SJR 76, 2012), S. DOC. NO. 3 (2013).
[6] "GRP" is the value of all final goods and services in the region over a year, measuring the "size" of the economy.

storm event would go from $611 million without sea level rise (in the year of the storm) to over $1 billion with sea level rise of .5 meters and over $2 billion with a sea level rise of .75 meters.

Why Should Hampton Roads Care About Sea Level Rise? The Hampton Roads region contains more than $100 billion worth of buildings, not including the region's defense industry and ports.[7] The region represents about 20 percent of Virginia's total economy, income, and population.[8] However, the region and economy are particularly vulnerable to the effects of sea level rise – one study ranked the Norfolk-Virginia Beach Metropolitan area as 10th in the world in value of assets exposed to sea level rise.[9] Unfortunately, the coming decades are not projected to provide any relief due to the expected and accelerated pace of rising sea levels. VIMS estimates an increase of 1 to 2 meters by the end of the century.[10] In short, sea level rise will make damages from flooding more likely and those damages will be costly.

How Were the Estimates Made? The study assesses the potential impacts of sea-level rise on residential properties in the region through a "risk-based approach." RTI considered historical data such as tidal patterns, coastal storm surges, and sea level rise, and calculated the likelihood of different-sized storm events in order to estimate the expected storm damages and costs in any given year. RTI also estimated the impact that sea level rise would have on a large 100-year storm event and its effects upon the state and regional economy through a "multi-market model." These latter estimates included flood damages for residential, industrial, and commercial structures by taking into account both direct and indirect impacts on the economy resulting from damages to structures and equipment. RTI took a conservative approach in their estimates when accounting for limitations and uncertainties regarding the data. Therefore, the report's findings represent the low-end of the likely costs that will fall upon the Hampton Roads region if no adaptive measures are taken to combat sea level rise.

What Did the Study Find? Applying the VIMS mid-range estimates for sea level rise, the RTI study predicts damages to residential properties for three potential scenarios if no actions were taken to adapt to sea level rise. RTI found that in the Hampton Roads region:

- With no sea level rise, the expected residential property damages in any given year due to coastal flooding events is about $12 million.
- With a sea level rise scenario of 0.5m (predicted by the year 2040), these estimated damages would increase to about $50 million annually.
- With a sea level rise scenario of 0.75m (predicted by the year 2060), estimated damages would significantly increase to over $100 million annually.

Also, in the 0.75m scenario, Virginia Beach, Norfolk, Chesapeake, and Hampton accounted for over 60% of the expected damages to residential structures.

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[7] GEORGE VAN HOUTVEN ET AL., COSTS OF DOING NOTHING: ECONOMIC CONSEQUENCES OF NOT ADAPTING TO SEA LEVEL RISE IN THE HAMPTON ROADS REGION, RTI 1-1 (SEPT. 2016).

[8] *Id.* at 2-1.

[9] *Id.* at ES-1 (citing Nicholls, R. J., Hanson et al., *Ranking port cities with high exposure and vulnerability to climate extremes, exposure estimates, Environmental Working Papers No. 1,* ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT (2008), http://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=ENV/WKP(2007)1&doclanguage=en).

[10] *Id.* at 2-4 (citing Carl Hershner & Molly Mitchell, *Rising tides, sinking coast: How Virginia's coastal communities can adapt to surging sea levels*, VIRGINIA ISSUES & ANSWERS 22–27 (Winter 2012-2013), http://www.via.vt.edu/winter13/Rising-Tides-Sinking-Coast.pdf).

The study also modeled the impacts of sea level rise on the regional and state economy to illustrate the greater economic impact if no actions were taken to combat sea level rise. [11] These estimates considered how damages to residential, industrial, and commercial structures from a 100-year flood event, would result in different direct and indirect costs on the regional economy under different sea level rise scenarios. RTI found that in the Hampton Roads region:

- With no sea level rise, a 100-year flood event would reduce the total annual household income from GRP in the year of the flood event by an estimated $611 million (about $944 per household annually) or the equivalent of losing 5,200 jobs.

- With a sea level rise scenario of 0.5m (predicted by the year 2040), a 100-year flood event would reduce total household income in the year of the event by an estimated $1.14 billion (about $1,760 per household annually) or the equivalent of losing 9,700 jobs.

- With a sea level rise scenario of 0.75m (predicted by the year 2060), a 100-year flood event would reduce the total household income in the year of the event by an estimated $2.18 billion (about $3,366 per household annually) or the equivalent of losing 18,500 jobs.

RTI also evaluated, per sea level rise scenario, the impact that a 100-year flood event would have on tax revenues and on prices of goods and services in the region. RTI found that in the Hampton Roads region:

- With no sea level rise, the fall in GRP due to a 100-year flood event would reduce federal, state and local tax revenues combined by $27 million in the year of the event.

- With a sea level rise scenario of .5m (predicted by the year 2040), the same storm event would reduce these tax collections by $95 million.

- With a sea level rise scenario of .75 m (predicted by the year 2060), the storm event would reduce tax collections by over $300 million.

- In all scenarios, the overall impact of a 100-year storm event on consumer prices in the region would be small, but it would shift from a 0.03% increase without sea level rise to a 0.1% increase under a .75m sea level rise scenario.

These estimates illustrate the stark economic impact of sea level rise upon the Hampton Roads region if no action is taken to develop or implement measures to protect coastal communities against it. As sea levels rise, damages from flood events are expected to increase significantly, placing a large economic burden on the region. The RTI study demonstrates the urgency for the Commonwealth and local communities in the Hampton Roads region and other coastal areas to take action today to protect and equip coastal communities against rising sea levels. Overall, the figures and projections presented in the study can assist decision makers in the region by creating a baseline reference point against which to weigh methods of sea level rise protection.

[11] Although these economic impacts also extend beyond the Hampton Roads region to the rest of Virginia, they would be relatively small compared to the size of the rest of the state's economy (less than 0.1 percent). Within the Hampton Roads region, the impacts will generally be higher for higher earning households because they are the ones who rely more directly on income from the damaged capital stock (i.e., buildings, structures, and equipment).

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