Life Cycle Cost Assessment: A Win-Win for Virginia Wetlands

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NATURE, VIRGINIA'S ECONOMY, AND THE CLIMATE THREAT

Abstract

Virginia shorelines are facing some of the highest rates of sea level rise seen over the last 5 millennia and are among the most vulnerable coastlines in the country to the effects of sea level rise such as flooding and storm surge (Down et al. 1994). In the face of these rising sea levels, coastal wetland habitats will be forced to migrate inland to avoid inundation (Akumu et al. 2011). However, increased development on the Virginia coast threatens these critical wetland habitats by blocking their inland movement as the try to avoid rapidly rising sea levels. Without a clear migratory path, wetland's ecosystem services and biodiversity will be lost to saltwater inundation. To prevent the loss of wetland's migratory paths from development, this paper proposes that any new development behind coastal wetlands must undergo a Life Cycle Cost Assessment (LCCA). Completion of the LCCA will expose developers to both the future costs they will incur from rising sea levels, flood mitigation, and the costs associated with possible wetlands destruction. Exposing developers to the future costs they will incur has the potential to save a developer future property loss while also maintaining wetland's inward migration path by deterring development. Cost of the LCCA will fall on the developer of the coastal property.

Wetlands are trapped behind coastal development

Virginia's coasts are facing some of the highest rates of sea level rise over the last 5 millennia and is second only to New Orleans as the most vulnerable coastline in the United States to flooding and storm surges from sea rise (Downs et al. 1994). Water levels on the Virginia coast are expected to rise 2.3- 5.2 feet over the next century, with low lying areas such as Virginia Beach and Hampton Roads experiencing the worst effects of this elevated sea level (Governors Commission on Climate Change 2008). Rising sea levels are the direct result of climate change. As global temperatures increase, water in the oceans is increases as the result of melting land ice and the thermal expansion of water molecules (Meier and Wahr 2002).

Rising sea levels will negatively affect coastal habitats, most notably coastal wetlands. Typically, wetlands are able to adjust to changing sea levels by raising themselves through vertical accretion (Akumu et al. 2011). However, the rate of sea level rise will surpass the rate of vertical accretion (Akumu et al. 2011). Wetlands contingency plan in this scenario is to migrate landwards to avoid inundation. However, coastal development behind wetlands is blocking their migratory path landwards. Without a clear path inwards, wetlands ecosystem services and their abundant biodiversity will be lost to saltwater inundation.

Trapping wetlands between development and the rising tides will not only result in losing the physical wetlands, but also the value of their important ecosystem service and ecological functions. Coastal wetlands are habitats that provide extremely important ecological functions and services such as critical habitat for large amounts of Virginia's biodiversity, flood control, storm buffering, and water purification (Woodward and Wui 2000).

Many of these ecological functions can be quantified through the Hedonic Pricing method, which estimates the economic value for ecosystem services that directly affect market prices (Mahan et al. 2000). Using the Hedonic Pricing method illustrates how wetlands directly influence residential property value. Decreasing a properties distance to a wetland by 1,000 feet increase the value of the property by $436.17 (Mahan et al. 2000). Wetlands, in terms of housing prices, can be assigned an economic value in this way. Also, because proximity to the nearest wetland have a positive effect on property value, keeping wetlands healthy is a good thing for housing prices. Destroying wetlands, on the other hand, will negatively contribute to coastal property values.

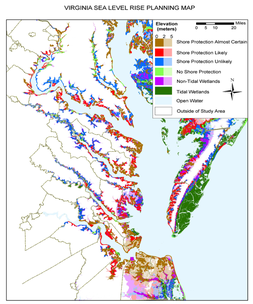

Figure 1. Map of Virginia's coastline vulnerability to future effects of sea level rise (Virginia Institute of Marine Science)

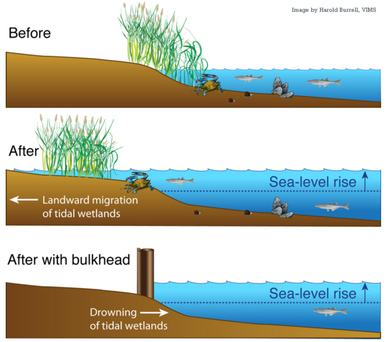

Figure 2. Animated and real life examples of wetlands migratory path blocked by development

Life Cycle Cost Assessment; Saving Wetlands and Money

To protect wetlands from perishing under saltwater inundation, Virginia should require that any new development behind coastal wetlands must undergo a Life Cycle Cost Assessment (LCCA). This cost assessment has the potential to save wetlands inward migration by saving developers money.

Cost Assessments

The LCCA will look 50 years into the future with benchmarks at 10, 20, and 50 years. It will require developers to face all the cost they will incur over the next 50 years due to sea level rise. These costs include:

•Costs of building some type of sea level rise mitigation (Sea walls, dykes, jetties, etc.)

•Costs of property damages that will occur without flood mitigation

•Costs of wetlands loss if developers decide to build behind wetlands

Enforcement and Completion

The LCCA will be a mandatory assessment for any parties that wish to develop in the migratory path behind wetlands. Enforcement, payment, and completion of the LCCA will fall on different parties in order to minimize any conflicts of interest.

•Enforcement: Local municipalities will be in charge of requiring parties complete an LCCA before deciding to develop.

•Completion: Privatized third parties will complete the LCCA for the developer.

•Payment: Parties the are financing the development will be charged with paying the LCCA completion.

Full Disclosure

Following completion of the LCCA, the assessment must be given back to the local municipality. The LCCA must be disclosed to the municipality for three reasons:

•Municipality can verify that the LCCA is completed and can give permission for parties to build if they still wish to develop.

•Municipality will archive the LCCA and make available to the public

•Municipality cannot allow or disallow the developer to build based on the results of the LCCA

Similar Life Cycle Assessments

While there is no direct example of a Life Cycle Cost Assessment, there are analyses in practice that are generally similar. One such analysis is the Life Cycle Cost Analysis created by the National Institute of Standards and Technology. This analysis helps developers minimize costs by analyzing operating and maintenance costs, building costs, and personnel costs over a 30-year period (Fuller 2010). Understanding these costs early in the design process allows developers to consider alternate building designs and ensures a reduction in total life-cycle costs (Fuller 2010). A Life Cycle Cost Assessment can be understood in the same way. However, instead of analyzing the costs associated with building and operation, the LCCA will analyze a properties future costs associated with sea level rise over 50 years. This will allow developers to consider alternate building locations or different courses of action to avoid these future costs.

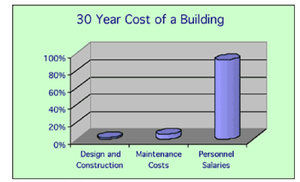

Figure 3. 30-year costs that are considered for abuilding under the Life Cycle Cost Analysis (National Institute of Technology)

A Win-Win Solution for Wetlands

The strength of the Life Cycle Cost Assessment is that it saves wetlands migratory paths by targeting people's self-interests. Generally, those who are going to develop behind a coastal wetland do not have extensive knowledge of or interest in wetlands migratory paths. Thus, it is less effective to show developers the importance of wetland habitats than to show developers how and why they will lose money. Instead of convincing a potential developer of the importance of the wetlands that they may be harming, the LCCA targets their economic self-interest by showing them that this development will be a bad long-term investment of their money. By forcing developers to understand facts about future of sea level rise, it has the potential to both save wetlands and save developers money. In this way, the LCCA is a win-win solution for saving coastal wetlands.

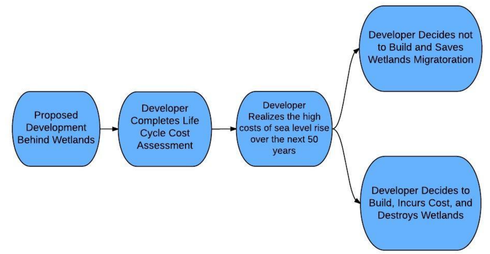

Figure 4. Process of completing the Life Cycle Cost Assessment and the available options to the developer after completion

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