

Thesis Project Portfolio

Hydrologic Modeling and System Optimization for IoT Flood Management

(Technical Report)

Impacts of Sea Level Rise and Flooding on Low-Income Communities in Hampton Roads, Virginia

(STS Research Paper)

An Undergraduate Thesis

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Sociotechnical Synthesis

The city of Charlottesville, Virginia has a significant amount of land area that is at risk of severe flooding over the next 30 years. As heavy precipitation events become more frequent due to climate change, the University of Virginia will become more susceptible to damaging flooding. Internet of Things (IoT) water sensors connected to The Things Network (TTN) allow for real-time monitoring of flood-related data. By deploying these water sensors on the grounds of University of Virginia, emergency officials will have access to an early-warning system for flooding. Hampton Roads, Virginia is facing the highest rate of sea level rise (SLR) along the Atlantic coast, with recent estimates projecting a 1.7 foot rise by 2050. This level of SLR will be especially damaging to low-income neighborhoods and residents of affordable housing, which do not have the same resources or political voice as middle- and upper-class residents. Langdon Winner's theory of technopolitics is used to analyze the dynamics and power structure of local governments in Hampton Roads. A content analysis of comprehensive plans from five cities in Hampton Roads was conducted to discover the correlation between housing, affordable housing, and flooding. Furthermore, the plans were analyzed to discover if there are differences in flood mitigation plans for high- and low-income neighborhoods. It was found that there are few mentions of affordable housing in the policy documents, and even less mentions of flooding and housing. In fact, three of the comprehensive plans did not mention flooding with relation to housing at all. Furthermore, there is little being done to combat the projected increase in flooding in low-income neighborhoods. The findings support the fact that localities in Hampton Roads are not doing enough to protect low-income residents from flooding. Flood adaptation technologies like early warning systems using IoT water sensors can be deployed to mitigate the impacts of SLR. However, it is necessary that these technologies are deployed equitably, as history has suggested that flood adaptation efforts have been concentrated in largely white, upper-class neighborhoods.