

Preparing McClellanville's Stormwater Management for a Changing Future

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Background

The low elevation and flat topography of South Carolina's Low country mean that many environmental hazards, such as flooding, erosion, hurricanes, tidal surges, and shoreline erosion routinely have negative impacts on its coastal communities. Such events complicate existing management and planning challenges facing coastal communities like McClellanville. Now, science suggests there may be a risk of changes in the historic patterns of environmental hazards. Recent studies find that over the past 30 years rainfall in the southeastern US has become more variable, and sea level continues to rise. Understanding the interactions between the impacts of these environmental changes and other changes facing communities requires bringing together diverse expertise to identify actions that may help prepare coastal populations.

On March 31 and April 1, 2011, six members of McClellanville's management boards and committees met with a research team from the University of South Carolina, the South Carolina Sea Grant Consortium, and the Social and Environmental Research Institute to begin addressing some of these issues in their community. During these two hour meetings, this expert team led the McClellanville representatives through a diagramming process that helped them identify current stormwater management challenges that may be intensified by environmental changes. Using a computer diagramming tool helped organize the discussion and keep a record of what group participants learned. This facilitated process helped the town's representatives identify what strategies and actions McClellanville managers and residents can consider to improve long-term planning efforts. This report summarizes briefly the major points identified in these meetings.

To begin the discussion, Dr. Jessica Whitehead of South Carolina Sea Grant provided scientific input on observed and projected climate conditions. Then, she asked the McClellanville participants what concerns them about routine environmental hazards and how they might be affected by possible future changes in climate. By consensus, the group decided to focus its attention on how more frequent heavy precipitation events and sea level rise could affect McClellanville's drainage issues. Together, the group made a diagram summarizing potential outcomes and consequences of continued drainage system deterioration combined with sea level rise and increased rainfall variability and intensity (Figure 1). Discussions also centered on possible responses by the Town and individual residents, including "no regret" strategies, which offer immediate benefits whether or not projected climate changes occur, and "low regret" strategies, which present tradeoffs between greater future security and some limited current costs and benefits. The group also considered possible consequences associated with such different management approaches.

Stormwater and drainage management

Stormwater management is a significant concern for the residents and the Town of McClellanville, and the way the Town manages stormwater is tied to local climate and sea level. Heavy rainfall events occur regularly in coastal South Carolina, and these events' intensity may increase as a result of climate change. Such events can affect stormwater systems by leading to runoff, which increases flooding, standing water, and pollutant loads in waterways. The amount of standing water depends on the existing moisture in the soil, debris and barriers in drainage networks, tidal stage, and quality of drainage ditch maintenance. Sea level affects soil moisture and the speed at which standing water can drain, but sea levels along the South Carolina coast have been increasing at a rate of approximately 1 foot per century. Climate change scenarios anticipate this rate will accelerate. Participants identified several concerns and management strategies associated with the combination of heavier rainfall and higher sea levels that relate to the economic and social well-being of the community. The following discussion describes the relationships diagrammed in Figure 1.

Flooding and standing water

Minor flooding and standing water can lead to reduced property access. Although a substantial portion of total runoff volume may result from rainfall upstream from McClellanville, there are still actions the Town can take to reduce flooding and therefore limit loss of property use. Planting additional trees can increase the absorption of water from the soil. The Town can mitigate flooding caused by clogged drainage ditches by ensuring that easements are established both within the Town limits and upstream outside the Town limits. Charleston County will clear drainage ditches on private property if easements are in place, but unfortunately they are not always in order for all properties on a street. When that is the case, the County sometimes skips maintenance on the entire street. Three barriers that discourage some private landowners from setting up easements are fears that they may reduce property values, reduced use of the area, and costs to the property owner of surveying the easement. There is also a concern that establishing easements on public land may restrict the use of those lands. The Town can facilitate establishing easements by reducing the costs to property owners, updating Town ordinances, and providing for public easements where appropriate.

Standing water also provides habitat for mosquitoes, which can be nuisances or even transmit diseases. Management strategies that can be used to reduce mosquito populations include public education, spraying that kills either mosquito larvae or adults, and adding mosquito eating fish to water sources. While chemical spraying is the preferred choice of many, it is not without consequences. There are concerns that over the long term spraying might lead to health effects in the community, loss of insect populations (e.g., butterflies and fireflies), impacts to commercially important shrimp and crab populations, and increased costs of abatement programs to cash-strapped counties. These concerns can be addressed via more information and study by DHEC and DNR.

Increased pollutant loads in waterways

Increased rainfall variability may change the amount of pollutants in runoff. Pollutants, including organic wastes, build up during dry periods. When rainfall events occur again, more pollutants are washed into the water in a strong pulse. These loads can impact the water quality of Jeremy Creek and the Cape Romain National Wildlife Refuge, both valued ecological assets. Reduced water quality has economic and health consequences, like shellfish contamination. If pollutant loads exceed standards, shellfish beds may be closed, which would have a direct effect on personal and business incomes in McClellanville. Loss of business income would affect town revenues via reduced collection of property taxes and license fees. Ultimately, reduced town revenues may impact the quality of life and character of the town.

There are a number of management strategies that the Town can adopt to prevent or mitigate such water quality consequences. Contamination can be managed by educating residents to keep drainage ditches clear and their property free of organic (pet) wastes. More "downstream" consequences such as

loss of town revenue can be managed locally by increased economic development, reduction in services, or increasing mil rates. Working with the County offers additional strategies, including sharing costs for services and impact fees among communities to address financial losses more broadly.

Soil saturation

Flooding and sea level rise introduce more water into soils, increasing saturation and raising water table levels, which participants linked with multiple consequences. Elevated water tables can impair the functionality of septic systems, which has the potential to cause unpleasant odors or increase bacterial concentrations in waterways, diminishing the public's ability to use them. Elevated water tables can also affect the ability of homeowners to maintain yards when landscaped plants cannot tolerate saturated soils. A strategy for dealing with this kind of problem is for landowners to plant more water (and salt) tolerant plants. The inability of residents and the Town to maintain properties as desired can limit property access and use or even result in damage, resulting in reduced property values. Strategies for reducing the risk of damage to property are to elevate properties, seek help from the County, and, in an extreme case, build a dike around the Town.

Sea level rise

Climate change scenarios predict sea level rise. Stormwater management will be affected by sea level rise. In addition, another possible outcome is salt-water intrusion into wells due to rising water tables. In McClellanville, private water wells are used exclusively for drinking water and landscaping. Salt water intrusion into wells would be related to the location of the well, well depth, and whether it was property installed (encased). If salt water intrusion does occur landowners may be unable to maintain their landscaping as desired. One possible strategy for dealing with this problem is for landowners to minimize damage and loss of property and landscaping value by planting more saltwater tolerant plants.

Limits of Town capacities

Discussions at the meetings highlighted significant barriers to McClellanville's ability to adapt to environmental hazards that may further stress its stormwater drainage. In some cases, County and State level government agencies hold authorities, responsibilities, and resources in ways that discourage or prevent the Town from taking independent action, as with the easement problem. Thus, the Town must persuade these agencies and organizations to act, which can be especially challenging in a time of budget constraints. Additional research or consultation with County and State agencies is needed to resolve such issues.

Summary

In summary, the meetings identified several environmental planning issues:

- By virtue of its low elevation and proximity to marshland, McClellanville faces a variety of environmental hazards that may be made more serious by projected climate and sea level changes.
- Environmental hazards, coupled with climate change impacts, can result in a variety of impacts to McClellanville, including to public health, property damage, financial costs, and increased nuisance.
- There are opportunities for “no regret” and “low regret” strategies to reduce the consequences of these current environmental hazards that will also be helpful whether or not predictions about climate change impacts are accurate. A primary example is improvement to the drainage network.
- Interactions among hazards and management strategies can be complex. Management strategies can have unintended consequences. Identifying interactions and complexities requires conversations among people with detailed knowledge of the local areas and the potential changes

- There are limits to what the Town can do alone to address environmental hazards. Other state and county agencies, utilities, and other organizations are responsible for maintenance of infrastructure and resources in the Town. There is a need for close coordination.
- Long-term planning requires additional data to assess potential risks.

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Project information: www.seri-us.org/content/coastal-adaptation-planning

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