

Flood Mitigation and Sea Level Rise Adaptation for Kiawah Island: A Report

Story and photographs by Jack Kotz

Sunny day or nuisance flooding is a relatively new term for most of us. As we described in the Winter/Spring 2018 issue of *Naturally Kiawah*, it refers to temporary flooding of low-lying areas in the absence of any precipitation or storm impacts, usually occurring during new or full moons. The higher than usual tides during these lunar periods are called “spring tides.” Several times a year, when the new or full moon is closest to the Earth (at its perigee), the gravitational force is even greater. This causes a “king tide” or a “perigean spring tide” that often results in nuisance flooding.





The problem for Charleston and other coastal cities, as well as Kiawah Island, is that the number of nuisance floods is increasing. In the 1970s there were only about two days each year with nuisance floods in Charleston, whereas in 2015 Charleston had 38 days of tidal flooding, and in 2016 there were 50 days of flooding. It is predicted there could be as many as 180 days of flooding per year in the 2040s.

The source of this increasing problem is the rise in sea level due to an increase in global temperatures, which leads to the expansion of ocean water and melting of land-based glaciers. (Land subsidence is also a factor in some locations.) The increase in sea level also means that if a tropical storm or hurricane arrives at high tide, an increase in water level that in previous years might have caused little or no damage, is now imposed on a higher sea level, and flooding occurs.

Sea level is rising around the globe and has risen by roughly a foot along the southeast coast of the U.S. in the last 100 years. The pace of increase in sea level is accelerating, and the City of Charleston has projected that it may rise 1.5–2.5 feet by 2050 and four feet or more by the end of the century. Professor Norm Levine, director of the Lowcountry Hazards Center at the College of Charleston, is quoted in a recent *Washington Post* article on flooding in Charleston saying that about one percent of the buildings in the Charleston area will now see

annual flooding. He estimates that in the next 50 years flooding will be experienced by 15 percent of the buildings in the area.

On Kiawah, we experienced 16–20 inches of rainfall over a four-day period in the 2015 rain event, and at least 42 percent of the land area of the Island was flooded. During Hurricane Matthew in 2016, the storm tide was 3.5 feet above MHHW (mean higher high water) in Charleston, the highest since Hurricane Hugo. (Fortunately, the storm surge did not occur at high tide.) About 65 percent of Kiawah was covered with some water, and considerable erosion of the beachfront dunes occurred. More recently, in 2017 we experienced some beach erosion because Tropical Storm Irma arrived at high tide. Kiawah's rainfall was approximately six inches over a two-day event, and flooding covered at least 73 percent of the island.

These events, together with reports from organizations such as NASA (National Aeronautics and Space Administration), NOAA (National Oceanic and Atmospheric Administration), the South Carolina Sea Grant Consortium, the City of Charleston, and articles in the *Post & Courier*, led in 2017 to the formation of a subcommittee of the Environmental Committee of the Town of Kiawah Island. Our charge was to study the effects of sea level rise on the island and recommend possible steps to mitigate or adapt to this slow-moving change. The committee was chaired



by John Leffler and included a number of island residents, among them people with advanced degrees in various areas of science. There were also representatives from the Kiawah Island Community Association (KICA) and the Architectural Review Board (ARB). The final report from the Committee was sent to the Town Environmental Committee in August 2018. It was endorsed by the Environmental Committee and then presented to the Town Council in September 2018. The full report is available on the Town's website (www.kiawahisland.org/wp-content/uploads/2018/08/FINAL-Flood-Sea-Level-Rise-Report-clickable-links-1.pdf).

John Leffler said that “One of the take-home messages of our report is that Kiawah has the opportunity to fully embrace the challenges ahead and work actively and transparently to become the most resilient barrier island community on the East coast. While academic studies and popular articles [on sea level rise or “SLR”] will continue to emerge ever more frequently, Kiawah's best strategy to preserve property values is to work on [this] report's recommendations, and others not yet identified, and become an ‘SLR-Ready’ community.” We want to be proactive; not stuck in a “wait-and-see strategy.”

The title of the study, “Flood Mitigation and Sea Level Rise Adaptation for Kiawah Island,” conveys the thrust of the report. The Committee met with officials from the City of Charleston, Beaufort County, Folly Beach, and Seabrook as well as those in charge of the Kiawah Island Utility. In addition, we met with, among others, personnel from Berkeley Electric, the South Carolina Department of Natural Resources, the Coastal Services Division of the SC Department of Health and Environmental Control, NOAA, an engineering firm leading resiliency efforts in other cities, the Union of Concerned Scientists, local architects, and several professors of environmental sciences from the College of Charleston.

Among the issues we examined relating to Kiawah Island

were stormwater and nuisance flooding management, the island roads, emergency management, potable water and wastewater management, electricity service, flooding adaptations for residential structures, and landscaping adaptation. We also looked at the beach and salt marsh environments that protect our boundaries and the impacts on our terrestrial ecosystems. In each section of the report, we explored that issue's significance to the Island's quality of life, its current status, our concerns about potential vulnerabilities, recommendations for improvements and adaptation strategies, and the Island entities responsible for improvement. Finally, we included a list of studies, books, and websites the Committee found most useful and informative for that area.

We state in the report that we “do not attempt to sugar-coat the challenges being faced by all southeastern coastal communities. The good news is that there are many practical and useful actions Kiawah property owners and governing bodies can take to preserve our fully functioning and beautiful Island. Compared to perhaps all other barrier island communities, Kiawah is in an enviable position to address these challenges. It is a small, relatively homogeneous community, and that gives it the flexibility to act. Kiawah's financial resources and its broad base of experience and expertise give it the ability to solve tough problems. Although its governing structure is a bit more complicated than most communities, that is also an asset. KICA can undertake actions that are difficult for a municipal jurisdiction like the Town to accomplish. Similarly, the Town has responsibilities and authorities that a private HOA does not.”

Our subcommittee has made recommendations in the following seven major categories:

- A well planned and executed stormwater management system is critical to handling flooding events on the Island. Kiawah is fortunate to have an extensive network of interconnected ponds that can accommodate the equivalent of a 100-year rainfall event. Stormwater moves

through the ponds and leaves the Island through outfalls into the marsh and river. In the future, higher tides will decrease the effectiveness of the pond system by slowing the flow of water from the ponds into the outfalls. Among other improvements, repairs to clogged and deteriorating pipes are underway and will improve the flow of water into ponds and the drainage system. In addition, outflow valves that can be remotely controlled are being installed.

- Kiawah needs to evaluate its entire road system and take actions to ensure main arteries remain passable as long as possible for emergency vehicles to access people on the Island who need help and to assist property owners, guests, and workers in evacuating the Island and returning after storm damage is minimized. Planning needs to look several decades into the future, not just at immediate flooding problems. Fortunately, we have access to high-resolution Geographic Information System (GIS) analyses developed by Professor Levine that can assist in the planning process.
- Essential services on the Island include potable and waste water services, and electrical services. The former are provided by the Kiawah Island Utility, and electrical service is provided by Berkeley Electric Cooperative. We were gratified to learn that all appear to be well managed and relatively prepared to withstand most expected flooding events.
- There are steps homeowners can take to adapt their residences and landscapes to more frequent flooding, and we met with local architects to discuss these issues. The Town Environmental committee and the Kiawah Conservancy are committed to helping in this regard.
- We are fortunate to have a beach that is accreting, and we have had the foresight not to allow building close to the ocean. The beach is evaluated annually by experts, and they recommend allowing the Kiawah beach and dune system to recover from storm erosion naturally rather than using artificial means such as sand fencing, which can create other problems. Challenges may arise as the dune system moves landward with higher sea levels and encroaches on residences and public buildings. Such an anthropogenic barrier to beach movement may, in the future, lead to beach loss and require renourishment. Therefore, the Town should plan well in advance for access to beach-compatible sand that might come from the uplands, nearshore, or offshore sources.
- We want to stress the preservation and, where necessary, the restoration of Kiawah's salt marshes. Much of the flooding in recent storms occurred on the marsh side of the Island, so these areas are crucial to our adaptation strategy. Recommendations include working with neighborhoods to develop policies to protect landward migration routes

for marshes and possibly supplying supplemental sediment for vertical growth of the marshes. Living shoreline construction may be appropriate in some locations to protect marshes from sea level rise induced erosion.

- Finally, we are concerned about the groundwater reservoir that is vital to the health of our terrestrial ecosystems. This water is the freshwater lens that floats on salt water underlying the Island. Drought can reduce the recharge of this freshwater lens, reducing its volume and ability to hold back seawater. Sea level rise will also contract this lens by creating more pressure for saltwater infiltration, which could lead to changes in the Island's vegetation.

In addition to these areas, we believe it is essential that the Town, KICA, and the other decision-making entities work cooperatively and coordinate their efforts. Because the rate of sea level rise and its impacts on Kiawah are uncertain, the Committee recommends that these entities adopt an "adaptive management pathways" approach to addressing the issues that will confront the Island. This approach identifies trigger points for when action needs to be taken and provides time to spread out implementation, allowing for capital development, community support, and new options to be developed. Planning for flooding and sea level rise should be recognized as essential issues to incorporate into such documents as the Town's Comprehensive Plan and KICA's Strategic Plan.

The Town and KICA, and perhaps other entities, should develop collaborative structures to ensure that these challenges are appropriately addressed over time. This may entail the creation of such things as a Resilience Specialist position, a Resilience Committee, ad hoc groups to establish trigger points and to periodically review progress, and collaboration by Kiawah representatives with Charleston County, the College of Charleston, a variety of state agencies, and public-private organizations like the Charleston Resilience Network. Sea level rise will affect everyone associated with Kiawah, and success in dealing with it will require a broad cooperative and coordinated effort.

The Committee is grateful for the opportunity to work on this important project, which has long-term implications for the health of this beautiful Island we call our home. We learned so much about our local and regional environment and hope that residents and visitors will come to appreciate even more its uniqueness. Finally, we thank the Town and other Island organizations and personnel, as well as residents, who participated in this project and shared valuable insights. The implications of sea level rise will unfold in the years ahead and will require the vigilance and cooperation of all of us on a continuing basis. 🌊