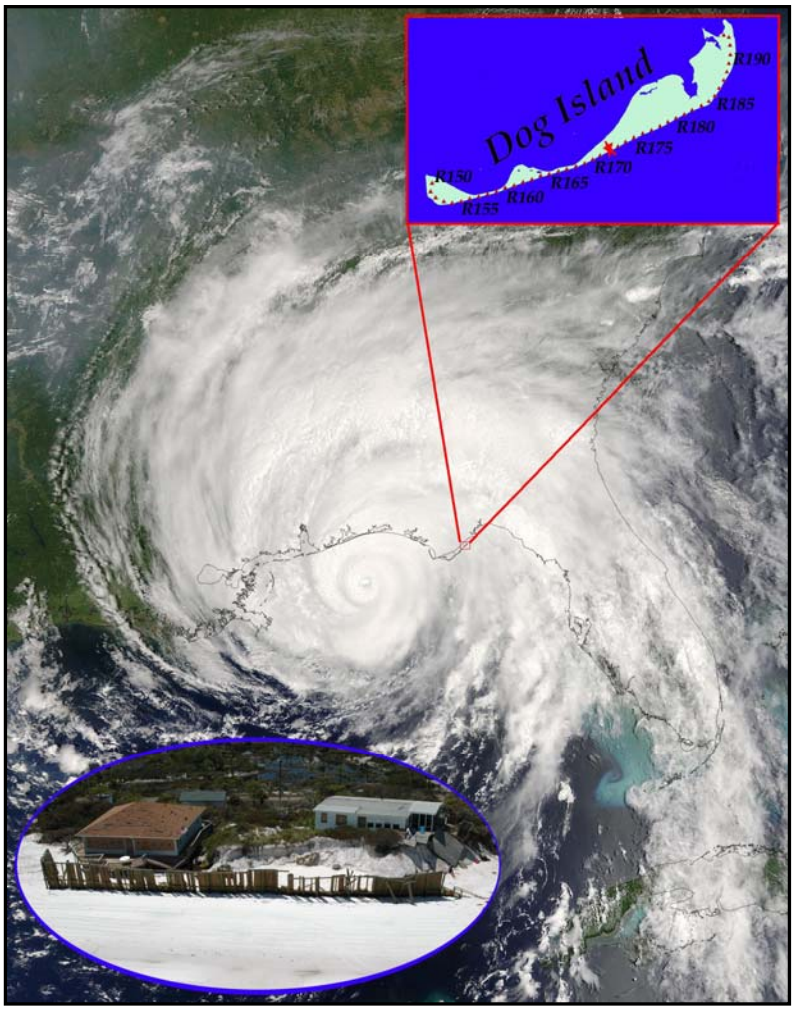
HURRICANE DENNIS

SUPPLEMENTAL DAMAGE ASSESSMENT REPORT

Impact of Hurricane Dennis on Dog Island
And
Discussion of Post-Storm Recovery Responses



Ralph R. Clark
Florida Department of Environmental Protection
Division of Water Resource Management
Bureau of Beaches and Coastal Systems
August 2005

Introduction

On Sunday afternoon, July 10, 2005, Hurricane Dennis made landfall on the northwest coast of Florida with the eye crossing Santa Rosa Island near Big Sabine Point (Figure 1). Dog Island in Franklin County, Florida, lies between 184 and 190 miles east of the point of landfall of the eye of Hurricane Dennis (Figure 1). Dennis made landfall as a category three hurricane on the Saffir-Simpson hurricane intensity scale having winds of 115 to 120 mph near its eye.

Figure 1. Hurricane Dennis Track Map.

On Dog Island, winds were below hurricane strength and likely in the 40 to 65 mph range. However, storm tides of around ten feet were observed in this area and conveyed damaging storm waves. The National Oceanic and Atmospheric Administration (NOAA) weather buoy offshore from Panama City measured wave heights to 34.8 feet. Major beach and dune erosion (condition IV) was sustained along most of the island. The western "Narrows" (R156-R160) and eastern "Narrows" (R163-R168) were inundated by the storm tide and all dunes in these areas were leveled with overwash into St. George Sound.

Storm Impact

On Friday, July 29, 2005, the beaches of Dog Island were inspected between R165 and R188 (Figure 2). Major beach and dune erosion (condition IV) was sustained throughout this area. Overwash with inland flooding was extensive where the dunes had breached or no longer existed.

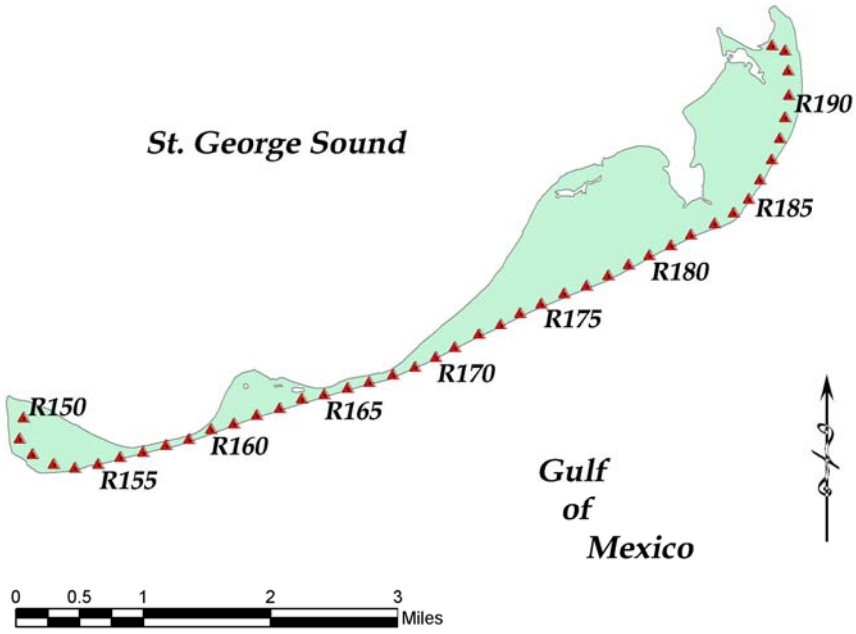


Figure 2. DEP range monuments on Dog Island, Franklin County.

Single-family dwellings were destroyed, structurally damaged, or imminently threatened throughout this coastal reach. Dwellings effectively destroyed were located on or adjacent to the beach at the following locations relative to the nearest DEP reference monument. All these structures were seaward of the coastal construction control line.

1. R163+50 (pile foundation)
2. R167+350 (pile foundation)
3. R169+700 (Photo 1)
4. R171+50 (soil bearing foundation behind wood bulkhead)
5. R173 (wind damage to superstructure; pile foundation okay)
6. R186+450 (dwelling totally destroyed)
7. R186+550 (dwelling totally destroyed)

Dwellings that had significant structural damage, generally to the foundation were located on or adjacent to the beach at the following locations. All these structures were seaward of the coastal construction control line.

1. R168+150 (pile damage)
2. R168+350 (dwelling damaged)
3. R170+250 (pile damage)

4. R172+550 (dwelling damaged)
5. R173+750 (1st floor damaged)
6. R176+200 (soil bearing foundation undermined; slab damaged) (Photo 2)
7. R180+350 (foundation piles suspended and damaged)
8. R180+550 (foundation piles suspended and damaged; wood bulkhead damaged)

In addition to the dwellings damaged or destroyed, a number of dwellings are now in imminent danger of damage by a high frequency storm event and numerous others are threatened by another hurricane (Photos 3 & 4). In general, all structures that extend seaward of the established coastal construction control line are currently threatened. Approximately 43 single-family dwellings and one motel are currently threatened from another major storm.

Photo 1. Dwelling destroyed (R169.7)

Photo 2. Dwelling undermined and damaged (R176.2)

Photo 3. Imminently endangered dwelling (R172.5)

Photo 4. Imminently endangered pile-supported dwelling (R175)

Problem Identification and Discussion

The beach and dune system along the majority of Dog Island is at its most eroded state since monitoring commenced in the 1970's. Since landfall of Hurricane Dennis on July 10, 2005, nearly three weeks of minor recovery of the beach was observed on July 29. This minor beach recovery may be expected to continue until the next major storm event, however, it is important to recognize the areas where beach and dune sediment has been lost and may not be expected to return. This sediment loss will substantially reduce the amount of recovery experienced in coming months.

The major sinks for sediment eroded from the beach and dunes are:

1. offshore transport
2. longshore transport to the island's east and west ends
3. overwash deposits on inland areas of Dog Island
4. overwash deposits into St. George Sound

A significant quantity of material in major storms is often transported offshore to deeper water and does not return to the beach system during normal littoral processes. This is often difficult to quantify even with precise hydrographic surveys immediately following storm events. Offshore transport is thought to be a major factor in the loss of Dog Island's sediments. In shallower waters, the nearshore distribution of sand between the beach and the offshore bar is affected by the normal wave conditions that transport some sediment landward back to the beach in a post-storm recovery cycle. This will be further discussed with the concept of beach scraping.

Longshore transport is another major sink for sediment from much of Dog Island. This loss continues during most wave conditions, not only during storms. The east and west ends of the island are areas of continued growth. Much of the erosion loss seen from R180 eastward, and particularly east of R183 at the Pelican Inn, is due to eastward transport towards the island's east end. The beaches between R188 and R193 are stable to accretional. The island's west end is likewise accreting. And these processes continue regardless of storm events.

Only during storms, however, are overwash losses sustained. In many cases the dunes have been breached or no longer exist and beach and dune sediment has been transported inland and deposited throughout the island. Except for sand that might be removed from roads, driveways, and understructures, and then returned to the beach, overwash sand is substantially lost to the upland. Overwash sand will quite often fill in former lagoonal depressions and interdunal ponds like Bream Pond (between R183 and R184) or Mallard Pond (between R184 and R185).

At the two "Narrows" of Dog Island, overwash sand is also being transported into St. George Sound (Photo 5). The loss of material into the sound at the eastern narrows specifically effectuates a major loss of beach from the reach between R165 and R175. Coupled with westward longshore transport conditions, storm surge conditions like that experienced during Hurricane Dennis will convey large quantities of sediment across the island and deposit the material into the sound. The exposed tree stumps in the foreshore slope of the beach found along the narrows and the connecting island land mass known as

Cannonball Acres reveals the long-term erosion process, northward island migration and rollover growth of the sound shoreline (Photo 6).

Photo 5. Eastern Narrows (R163-R168)

Photo 6. Exposed tree stumps (R165)

In summary, the developed reach of Dog Island between R166 and R188 can be expected to continue to experience severe erosion stress. Between major storm events, partial recovery of the beach may be expected; however, the long-term trend of shoreline and dune line retreat may be expected. Dune recovery will be very slow and subject to the cumulative impact of subsequent storms.

Discussion of Solutions

Typically, coastal engineering solutions to beach erosion and coastal protection include the broad categories of (1) beach and dune restoration/nourishment (with or without shore protection structures), (2) coastal protection structures, and (3) strategic retreat. All of these solutions have their limitations when applied to the erosion problems at Dog Island.

Given the significant problem is the loss of the protective beach and dune, were it not for the high cost, the obvious solution would be a major beach and dune restoration project with sand dredged from an offshore borrow source. The initial cost of such a project for this area could easily exceed $8-10 million and public funding is not likely given the lack of public interest or access. Nearshore thin layer excavation continues to be investigated as a potential innovative technology but equipment has not yet been tested on the open Florida coast.

Shore-protection structures (i.e. groins, breakwaters, etc.) are usually not recommended on the open coast except near inlets or unless part of a beach restoration project. These structures are also expensive when built to be effective and typically have significant adverse impacts to adjoining areas.

Coastal protection structures are usually not recommended where there is continued erosion stress because the beach will ultimately disappear. Employed to protect individual dwellings, these structures are designed for different levels of protection. Coastal protection structures designed for the extreme storm event are costly and typically have a significant impact to the adjoining coast along barrier beaches. Three wood bulkheads were constructed on Dog Island after Hurricane Ivan (2004) to protect four threatened dwellings. Their performance was questionable because all were damaged by Hurricane Dennis (Photo 7). One of the four dwellings was destroyed, one sustained major damage to its foundation, and one other is in imminent danger of collapse. Hurricane Dennis destroyed or substantially damaged 12,270 feet (2.32 miles) of walls and revetments along the gulf beaches of Florida between Navarre Beach and Alligator Point. The construction of wood, vinyl, and concrete walls, as well as, low profile rock revetments rarely provides adequate protection to upland structures during major storm impacts. As may be seen in the post-storm report on Hurricane Frances and Hurricane Jeanne (2004) even massive steel sheet-pile seawalls did not provide adequate protection. Behind a massive steel seawall in the community of Summerplace (Indian River County), 17 homes were substantially damaged including eight that were destroyed.

A less popular but increasingly more effective solution to the severe erosion in Gulf and Franklin Counties is strategic retreat. The relocation of structures to safer inland

locations is likely the most cost-effective solution to protecting structures on Dog Island. Relocating a threatened structure from a soil bearing foundation inland to a pile foundation provides additional time and protection from future storm flooding. For many of the threatened dwellings on Dog Island, relocation is the most recommended long-term solution. However, in some cases, properties have insufficient space to facilitate relocation. Also, individual structures may not be designed or constructed to be moved.

Photo 7. Wood bulkhead destroyed (R171)

Beach Scraping

A short-term post-storm response often considered when other long-term solutions are not currently feasible is beach scraping. As a viable concept, beach scraping is the process of mechanically removing a layer of sand from the foreshore and transferring it to the backshore. Beach scraping is not the mining of material from the beach or nearshore to nourish the backshore to the detriment of the beach system and adjoining properties. Where such activity may be reasonably conducted, the Department of Environmental Protection has developed guidelines for beach scraping that define limits on the depth and location of scraped material from the beach in order to minimize any potential adverse impact that may occur from excessive sand removal activities.

The benefit to be obtained from a beach scraping project meeting the agency's guidelines is only short-term protection from seasonal high tides and very high frequency storm conditions. A beach scraping project is not expected to provide protection to Dog Island properties during conditions comparable to that experienced during Hurricane Dennis. Beach scraping has been conducted successfully in other areas of the state. A scraping

project in Ambersand Beach (Indian River County, Florida) following Hurricane Floyd (1999) provided sufficient albeit temporary protection from a later storm, Hurricane Irene (1999). Ambersand Beach was subsequently restored with a beach fill project that protected all the upland structures from the storm surges and wave damage inflicted by Hurricanes Frances and Jeanne last year.

On Dog Island there exists sufficient sediment along the recovering foreshore of the beach to facilitate a beach scraping project. Continuous segments of shoreline are preferred to be scraped than individualized, isolated properties. Typically, if properties are sufficiently protected from high frequency storm conditions by existing coastal protection structures, they would not be eligible for beach scraping. The three wood bulkheads on Dog Island have shown themselves to be insufficient to provide this protection, so these properties should not be excluded from an otherwise continuous scraping project.

The segment of beach where beach scraping may be reasonably conducted, subject to appropriate terms and conditions of a Coastal Construction Control Line Permit, extends from R168 to R181.2 (less than 2.5 miles)(Figure 3). While numerous properties within this reach do not have threatened structures, their exclusion does not warrant the segmentation of an effective project that can benefit properties that do have threatened structures. ***Another short segment is located between R186.7 and R187.2*** (Photo 8). Generally, a short 500-foot segment would not be recommended; however, there are mitigating features at this location, which is immediately adjacent to a downdrift stable to accretional shoreline.

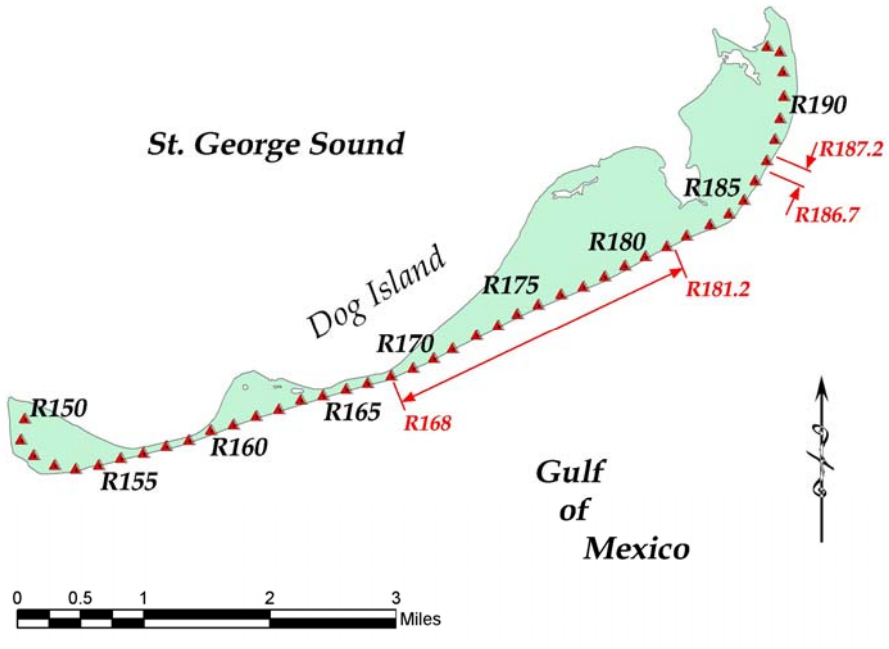


Figure 3. Potential areas for a controlled beach scrape.

Beach scraping should not be viewed as a panacea for long-term protection of the upland properties. It can provide short-term benefits to include assisting barrier dune recovery. Because the cyclical natural beach recovery process proceeds quickly for the beach system, material becomes readily available soon after a storm. The natural transfer of this material landward to the emerging barrier dune system will proceed much slower and a portion of available material can be lost to longshore transport or to offshore transport during continued high frequency storm conditions. Performed correctly, beach scraping can speed up this landward sediment transport and accelerate the dune recovery process and provide short-term protection from seasonal high tides and minor storms. Scraping should not, however, be viewed as a long-term management solution for a shoreline subjected to erosional stress.

Photo 8. Potential area for beach scraping (R186.7-187.2)

Acknowledgements

This report was made possible through the efforts of various staff of the Bureau of Beaches and Coastal Systems. Particular credit goes to the hard work of Jim Lagrone, coastal engineer, in putting together all the graphics for this report as well as participating in the field investigation and obtaining the four ground photos presented. Credit also goes to Bill Fokes, the Department's area field engineer, who also participated in the field investigation, and routinely assists Dog Island property owners with their post-storm recovery activities. The four aerial photos were obtained by Stacey Roberts, PBS&J Associates, who flew aerial photography and aerial videography for the Bureau immediately following Hurricane Dennis for the entire Florida Panhandle. In addition, Bob Brantly and Mike Barnett provided their usual support and expert coastal engineering review of the draft document. Lastly, the aquatic transportation assistance of the Florida Fish & Wildlife Conservation Commission office in Carrabelle is gratefully acknowledged.