Panel Decision & Report

SRP SCCTKI100418 - Town of Kiawah Island, Charleston County, SC

April 22, 2019

National Institute of BUILDING SCIENCES™
Innovative Solutions for the Built Environment

Table of Contents

Summary

Based on the submitted scientific and technical information, and within the limitations of the SRP, the Panel has determined that for the Kiawah Beach Club site, the Community's data does not satisfy NFIP standards, thus FEMA's data is not corrected, contradicted, or negated.

Based on the submitted scientific and technical information, and within the limitations of the SRP, the Panel has determined that for the Cape Charles site, portions of the Community's data satisfy NFIP standards and correct or negate FEMA's data.

Introduction

This report serves as the recommendation to the Federal Emergency Management Agency (FEMA) administrator from the National Institute of Building Sciences (NIBS) Scientific Resolution Panel (SRP). SRP's are independent panels of experts organized, administered and managed by NIBS for the purpose of reviewing and resolving conflicting scientific and technical data submitted by a community challenging FEMA's proposed flood elevations. The SRP is charged with helping to efficiently resolve appeal and protest issues between FEMA and communities by acting as an independent third party in the effort to obtain the best data possible for the community's Flood Insurance Rate Maps (FIRMs).

Panel

Panel ID: SRP SCCTKI100418
Panel Name: Town of Kiawah Island, Charleston County, SC
FEMA Region: IV

Panel members:

- **Elizabeth Sciaudone. Ph.D., P.E.**, Research Assistant Professor, North Carolina State University, Raleigh, NC.

  Dr. Sciaudone has worked at North Carolina State University, in Raleigh, North Carolina, since 2007. Prior to that, she worked in private consulting with Moffatt & Nichol Engineers. She has over 18 years of experience in coastal engineering research and design. Projects include work on beach stabilization, post-hurricane dune construction, Letters of Map Revision (LOMR), sediment budgets, and coastal highway vulnerability analyses. She has published peer reviewed articles on vulnerability of coastal dunes, identification and analysis of coastal erosion hazard areas, remote sensing of barrier island morphology, and topographic analysis of dune volume and position. She has presented at national and international sediment transport and coastal engineering conferences. Dr. Sciaudone served on the North Carolina Science Panel, advising state regulators on coastal issues, 2010-2018. Current research work includes development of highway vulnerability indicators and dune construction guidelines for overtopping considering a constructed beach berm. She has taught introductory coastal engineering and fluid mechanics

courses as well as preparatory courses for the F.E. and P.E. exams. Her educational background includes a B.S.E. from Duke University and M.C.E. and Ph.D. from North Carolina State University. She holds a P.E. in the state of Florida. Dr. Sciaudone chaired this panel.

- **Thomas Ballestero, Ph.D., P.E., P.H., CGWP, P.G.**, Director, UNH Stormwater Center, University of New Hampshire, Durham, NH.

  Dr. Ballestero is a hydrologist and water resources engineer. He has been at the University of New Hampshire since 1983 and spent 4 years in consulting before then. He has taught college and graduate level courses in: open channel flow, stream restoration, engineering hydrology, coastal engineering and groundwater. Examples of projects involving river and coastal hydraulics include: hydraulic analysis of a re-designed covered bridge over the Baker River, NH; floodplain delineation of the Exeter River (Exeter, NH); 100-year flood designs along McQuade and Riddle Brooks (Bedford, NH); analysis of the Foster Pond earthen dam failure (Windham, NH); stream restoration for Quaker Run, Shamokin, PA; analysis of coastal erosion and breakwater failure (Humboldt Bay, CA); sea level rise adaptation strategies for East Boston, MA; coastal flood risk for Seabrook Station, Seabrook, NH; and Little River flooding and erosion (Hampton, NH). Dr. Ballestero has used and taught river and coastal modeling software since 1977: including HEC-1 and HEC-2 the forerunners to the modern software packages HEC-HMS and HEC-RAS, as well as RUNUP and WHAFIS. He has taught these modern programs since their first release. Present research endeavors include: stormwater management with green infrastructure, stream restoration, and living shorelines. Dr. Ballestero holds Bachelor's, Master's, and PhD degrees in Civil Engineering. He holds professional engineering licensure in Colorado, Wyoming, Pennsylvania, and New Hampshire.

- **Michael Giovannozzi, P.E.,** Senior Coastal Engineer, AquaTerra Consulting Intl., West Palm Beach, FL.

  Mr. Giovannozzi has over 19 years of experience in coastal engineering with the US Army Corps of Engineers and with the private sector. His wide-ranging expertise includes dredging and navigation studies, marina planning and design, wave and hydrodynamic studies, beach nourishments, physical and numerical modeling, and the design of traditional and innovative shore protection structures. He has considerable experience in FEMA coastal flood plain mapping and Letter of Map Revision (LOMR) applications. His education includes a Bachelor of Civil Engineering and a Master of Civil Engineering (with coastal engineering specialty) from the University of Delaware. Michael is a working group member of the World Association for Waterborne Transport Infrastructure (PIANC), Vice-Chair of PIANC Young Professionals (YP), and a member of the American Society of Civil Engineers (ASCE) Coasts, Oceans, Ports and Rivers Institute (COPRI). He is a Registered Professional Engineer in nine states.

- **David Kriebel, Ph.D., P.E., D.CE.,** President, Coastal Analytics LLC , Millersville, MD.

  Dr. Kriebel is a consultant in coastal and ocean engineering through his firm Coastal Analytics LLC. He is also a Professor of Ocean Engineering at the U.S. Naval Academy in Annapolis, Maryland, where he has taught coastal engineering and other courses for 31 years. He has authored about 100 papers and reports on coastal and ocean engineering topics, including sea level rise, ocean waves, coastal flooding, coastal erosion, coastal structures, port and harbor structures, dredging, ship-generated waves, and hurricane and tsunami impacts. He has contributed to the Corps of Engineers *Coastal Engineering Manual*, the FEMA *Coastal Construction Manual*, and the American Society of Civil Engineering standard ASCE-7 *Minimum Design Loads for Buildings and Other Structures*. Dr. Kriebel is past-President, of the Coasts, Oceans, Ports, and Rivers Institute (COPRI) of the American Society of Civil Engineers (ASCE), the major professional society serving coastal engineers. He also served as one of three civilian members appointed to the Coastal Engineering Research Board, a federal advisory committee to the U.S. Army Corps of Engineers. Dr. Kriebel received his Ph.D. from the University of Florida in coastal and oceanographic engineering. He is a Registered Professional Engineer in Virginia and Alaska, and is certified as a Diplomate in Coastal Engineering by the Academy of Coast, Ocean, Port, and Navigation Engineers

- **Todd L. Walton, Jr., Ph.D., P.E. (retired), D.CE. (retired),** Consultant, Ocala, FL.

  Dr. Walton is a consultant in coastal and ocean engineering. He is a retired faculty member from Florida State University where he was Director of the Beaches and Shores Resources Center which provided research and engineering storm surge and beach erosion modeling for the State of Florida in establishment of its Coastal Construction Control Line. Past experience includes coastal research and engineering for the Coastal Engineering Research Center [US Army Corps of Engineers (USACE)], Waterways Experiment Station (USACE), Coastal Hydraulics Laboratory (USACE) as well as numerous consulting coastal engineering companies. He is a past faculty member of Florida State University and University of Florida, as well as an Adjunct or Visiting Professor at George Washington University, Texas A&M University, and Mississippi State University. He has been a member of the U.S. Army's prestigious Tidal Hydraulics Committee; a consultant to FEMA on a seawall guidance manual; a reviewer of FEMA Storm Surge Studies for the Gulf Coast of Mississippi; and a member of the National Academy of Engineering Hurricane Study Review team. He has authored over forty technical journal articles in the coastal engineering, coastal erosion, and storm surge modeling area, as well as over one hundred technical reports and book chapters on coastal engineering subjects. Dr. Walton received his Ph.D. from University of Florida, and was a Professional Engineer in the State of Florida for over 40 years.

Basis for Appeal

Two appeals of the preliminary Flood Insurance Rate Map dated September 9, 2016, for the Town of Kiawah Island, SC, were submitted to the Federal Emergency Management Agency (FEMA) in transmittals dated March 22 and April 10, 2018. The appeals were prepared by Applied Technology & Management Inc., (ATM) on behalf of Kiawah Partners. These appeals involved two separate locations on the Atlantic-facing side of Kiawah Island. The first area, designated "Kiawah Beach Club", is a developed area that includes approximately 400 feet of shoreline toward the northeastern side of the island. The second, designated "Cape Charles", includes approximately 6,600 feet of undeveloped shoreline on the Atlantic Ocean at the southwestern end of the island. The bases for these appeals were revised coastal analyses prepared by ATM using updated and more accurate topographic data than was used for the FEMA study.

By letters dated September 7, 2018, FEMA denied the appeals. In the case of the Kiawah Beach Club site, FEMA determined that its designation of the shoreline area between the ocean and the most landward, historic dune heel was at the appropriate macrotopographic scale for delineation of the Coastal High Hazard Area (Zone VE). The appellant's proposed relocation of the VE zone boundary, based on the more shoreward and more recently deposited dune material, was rejected because FEMA considered it to be a microtopographic feature, contrary to FEMA's "Best Practices" guidance of February 2014. In the case of the Cape Charles site, FEMA determined that a mound-type PFD, with multiple ridges, exists in this area and that it is more appropriate to locate the Zone VE boundary at the most landward dune heel in accordance with the Coastal Guidelines Update issued by FEMA in February 2007.

The appellant then provided comments on the appeal resolution in a letter dated October 4, 2018, and further requested that a Scientific Review Panel (SRP) be convened to consider the technical and other scientific information that was the basis for the appeal. Although the ATM study included reanalysis of Base Flood Elevations based on updated wave-height and wave-runup analyses, ATM concluded that results were similar to those on the preliminary FIRM. Thus, the SRP review is being sought to render a determination on whether floodplain zone delineations should be revised based on the appellants proposed re-identification of the Primary Frontal Dune (PFD) location at both the Kiawah Beach Club and Cape Charles sites.

Data Submitted by the Community and FEMA

The following data used to generate the challenged flood elevations and the contesting data submitted by the Town of Kiawah has been provided to the Panel:

For the Kiawah Beach Club site:

- Cover letter from ATM to Hon. Craig Weaver, Mayor, Town of Kiawah Island, transmitting the appeal package, dated April 10, 2018

- FEMA Preliminary Flood Map Appeal Supporting Documentation Report: Kiawah Beach Club Study Area, and Appendices, submitted by ATM on behalf of Kiawah Partners, dated April 2018
- Stamped Topographic Work Map showing proposed revised flood zones and updated topography
- CHAMP input and output files
- GIS files including:
    - SC Department of Health and Environmental Control (DHEC) profiles
    - Post-Matthew LiDAR topographic elevation model
    - Contours derived from post-Matthew topography
    - Preliminary flood zones
    - Proposed deleted flood lines
    - Proposed revised flood lines
    - Beach Club transect
    - WHAFIS run results
- Appeal resolution letter dated September 7, 2018 from FEMA to the Hon. Craig Weaver, Mayor, Town of Kiawah Island
- Letter dated October 4, 2018, with comments on the appeal resolution and request for SRP from ATM to the State NFIP coordinator, Maria Cox Lamm.

For the Cape Charles site:

- Cover letter from ATM to Hon. Craig Weaver, Mayor, Town of Kiawah Island, transmitting the appeal package, dated March 22, 2018.
- FEMA Preliminary Flood Map Appeal Supporting Documentation Report: Cape Charles Study Area, and Appendices, submitted by ATM on behalf of Kiawah Partners, dated March 2018
- Stamped Topographic Work Map showing proposed revised flood zones and updated topography
- CHAMP input and output files
- GIS files including:
    - ATM transects
    - SC Department of Health and Environmental Control (DHEC) profiles
    - Post-Matthew LiDAR topographic elevation model
    - Preliminary flood zones
    - Proposed deleted flood lines
    - Proposed revised flood lines
    - WHAFIS run results
- Appeal resolution letter dated September 7, 2018 from FEMA to the Hon. Craig Weaver, Mayor, Town of Kiawah Island
- Letter dated October 4, 2018, with comments on the appeal resolution and request for SRP from ATM to the State NFIP coordinator, Maria Cox Lamm.
- Document showing dune profiles at Transects 132 and 133 with PFD location in appeal and in the preliminary study.

Applicable to both sites:

- 2014 Primary Frontal Dune Best Practices Examples
- 2007 Atlantic Ocean and Gulf of Mexico Coastal Guidelines Update
- February 2019 FEMA Policy Standards for Flood Risk Analysis and Mapping

Summary of Panel Procedures

The SRP was selected in January 2019 and a kickoff meeting was conducted on February 13, 2019 via web-based teleconference. At this meeting, Ms. Dominique Fernandez, Director of the National Institute of Building Sciences (NIBS), facilitated introductions, detailed the SRP procedures, roles and responsibilities, and outlined a schedule for the SRP process. A chair of the Panel, Dr. Elizabeth Sciaudone, was selected.

The Panel was tasked with review of the technical information and data provided by FEMA and the Community, with the objective to determine which of the two provided analyses was more scientifically and/or technically correct, and which, if any, elements of the appeal satisfy NFIP mapping standards and negate the FEMA data. After reviewing the Community's and FEMA's data, the Panel was to arrive at a majority decision. A written report of the analysis and findings was to be prepared.

Panel members were instructed that they could not request additional information (unless referenced in appeal data), introduce new data, suggest alternative methods, or conduct alternative analyses, nor could the Panel offer any alternative determination as a resolution. Panelists agreed not to disclose the internal deliberations of the Panel to FEMA, the Community, or to the public, nor to disclose the final decisions of the Panel until that decision has been made public by NIBS or the FEMA Administrator.

All subsequent Panel meetings were conducted via web-based teleconferences.

The first panel meeting was held on February 27, 2019. At this meeting, the Panel reviewed the request and potential outcomes. The files provided by the Community and FEMA were discussed including examination of the provided GIS files. A list of questions for the Community and FEMA was developed for the planned oral presentations. Additionally, the Panel requested clarification from FEMA on whether the two appeal reports were to be considered jointly with one result determination or as two separate appeals with two possibly different outcomes. In response, FEMA clarified that:

"they should be evaluated collectively as two elements of the SRP request by community officials, but referenced individually by the panel as to their unique technical components. FEMA recognizes that there may be a possibility that the panel could make a determination that recommends FEMA review/reconsider its appeal resolution in the case of one of the two, rather than both. Therefore, it would be important for FEMA to understand the panel evaluation of each element separately, in the event of such an outcome, to allow for coordination of appropriate next steps."

A second panel meeting was held on March 4, 2019. At this meeting, the Town of Kiawah Island and FEMA Region IV conducted oral presentations detailing the appeal basis as well as the rationale for FEMA's denial of the appeal. Panel members asked questions of the presenters to clarify the information and evaluate the issues.

The oral presentations and appeal documents were fully discussed at the third meeting on March 18, 2019. This meeting was preceded by a non-binding poll via email where panel members provided an initial vote along with comments so that preliminary opinions could guide discussion. FEMA standards and applicable best practices were reviewed, and each of the sites were discussed separately. A preliminary vote was taken, and the Panel unanimously agreed on the resolution of the Kiawah Beach Club Site. However, the Panel chair requested that Panel members continue to think about the best resolution for the Cape Charles site and send a non-binding email vote prior to the next meeting.

At the fourth meeting, on March 25, 2019, the Panel unanimously finalized the resolution of the Cape Charles site after some additional discussion of the alternatives for resolution. An outline for the report was developed.

The fifth meeting was held on April 8, 2019, and the Panel reviewed the first draft of the report initially prepared by the Panel chair and provided comments and revisions.

The sixth and final meeting of the Panel was held on April 22, 2019 to review the second draft of the report. Final revisions were made, and the final report was approved by all of the Panel members and submitted to NIBS on April 22, 2019.

Recommendation

Based on a unanimous vote, the Panel recommends denial of the Community's appeal regarding the PFD and location of the VE Zone boundary at the Kiawah Beach Club site. The Community's data does not satisfy NFIP standards as defined in FEMA's Guidelines and Specifications for Flood Hazard Mapping Partners, thus FEMA's data is not corrected, contradicted, or negated.

Based on a unanimous vote, at the Cape Charles site, the Panel has determined that portions of the Community's data satisfy NFIP standards and correct or negate FEMA's data. However, because only a portion of the Community's data satisfies NFIP standards, the alternative flood zone delineations submitted by the Community cannot be accepted as submitted.

Rationale for Findings

In the Atlantic Ocean and Gulf of Mexico Coastal Guidelines Update (February 2007), Section D.2.1.2.7.1, the VE zone is identified using one or more of the following criteria for the base flood conditions:

1. The wave runup zone occurs where the (eroded) ground profile is 3.0 feet or more below the 2-percent wave runup elevation.

2. The wave overtopping splash zone is the area landward of the crest of an overtopped barrier, in cases where the potential 2-percent wave runup exceeds the barrier crest elevation by 3.0 feet or more.
3. The breaking wave height zone occurs where 3-foot or greater wave heights could occur (this is the area where the wave crest profile is 2.1 feet or more above the total stillwater level).
4. The primary frontal dune zone, as defined in 44 CFR Section 59.1 of the NFIP regulations.

The actual VE zone boundary is then defined as the farthest inland extent of any of the four criteria. The primary issue at hand for the Panel was the delineation of the PFD heel, because this factor controls the landward extent of the VE zone at the two sites on Kiawah Island.

Relevant portions of the NFIP Guidelines and Standards were considered in the determination of technical correctness of the data at both sites.

The PFD is defined in the 2007 Guidelines as follows:

> "*Primary frontal dune* means a continuous or nearly continuous mound or ridge of sand with relatively steep seaward and landward slopes immediately landward and adjacent to the beach and subject to erosion and overtopping from high tides and waves during major coastal storms. The inland limit of the primary frontal dune occurs at the point where there is a distinct change from a relatively steep slope to a relatively mild slope."

The Guidelines further define dunes of "ridge" type and "mound" type with diagrammatic examples.

Additionally, the FEMA Policy Standards for Flood Risk Analysis and Mapping include Standard 619 effective November 30, 2015, which states:

> "When revising the dune feature identified as the Primary Frontal Dune in an effective FIS, the revised feature must be as continuous as, or more continuous than, the effective PFD. This is especially important in areas with multiple ridges throughout a dune field, areas with man-made dunes, and property-specific revisions, including requests that the PFD designation be removed altogether. Community coordination may be required to make this assessment."

The 2014 Primary Frontal Dune Best Practices Examples from FEMA Region IV (Fort Walton Beach, Florida; Brunswick, North Carolina, and Carteret County, North Carolina) were also reviewed. This document includes the definitions of microtopography and macrotopography, which are used to determine if specific points on the dune represent continuity or an aberration to the underlying landform.

> "*Microtopography* – small to medium-scale landform features resulting from either natural disturbance (rills, microrills, beach cusps, pits, or mounds often associated with tufts of grass or shrubs, etc.) or anthropogenic disturbance (sand displacement associated with driveways, paths, patios, excavation for individual houses, landscaping, etc.)."
>
> "*Macrotopography* – large-scale landform features caused by largely natural forces, notably deposition and accretion of sand by wind and wave action."

It is noted that several items were presented to the Panel by both the appellant and FEMA that the Panel determined were not relevant to the mapping of the FEMA flood hazard zones or the PFD heel location at the appeal sites. These include:

- South Carolina's state setback line;
- Presence of habitat of piping plover;
- Existence of a Coastal Barrier Resources Act (CBRA) zone;
- Anecdotal impacts of Hurricane Hugo; and
- Other appeal data in different states.

These items were not considered in evaluation of the technical correctness of FEMA's data or that of the Community.

Findings for Kiawah Beach Club Site

Based on the reviewed information, the Panel concluded that the preliminary FIRM mapping of the PFD at the Kiawah Beach Club site is technically correct and the delineation of the PFD heel in the Community's appeal documents does not meet NFIP standards for the following reasons:

1. The LiDAR topography, provided transects, and photographs submitted show that at this site a mound dune system exists, consisting of multiple ridges.
2. The digital preliminary FIRM lines and Figure 5 of the ATM report provided in the appeal show that FEMA has mapped the PFD heel as a smooth and continuous feature.
3. Per Standard 619 any revision of the PFD must be shown to be as continuous as, or more continuous than, the effective PFD. Figure 5 of the ATM report does not show the PFD heel as mapped by ATM to be as continuous as or more continuous than the PFD mapped by FEMA.
4. The appeal revision of the PFD heel reflects fill at the Beach Club site and fits the description of microtopography in the 2014 Best Practices.

Findings for Cape Charles Site

Based on review of the available appeal data, the Panel concluded that portions of the Community's data satisfy NFIP standards and correct or negate FEMA's data. However, it is noted that because not all of the Community's data satisfies NFIP standards, the alternative flood zone delineations submitted by the Community cannot be accepted in current form.

At the Cape Charles site, the LiDAR data, photographs, and provided transects indicate that there is a mound type dune system with multiple dune ridges at this location. As with the Kiawah Beach Club site, the appeal centers around the mapping of the PFD heel. The most technically correct landward heel of the mound dune system will define the landward extent of the VE zone.

The Panel determined that the Community's data satisfies NFIP standards and corrects or negates FEMA's data specifically at Transect 132 and northeast, as well as for approximately 150 ft to the southwest. The rationale for this finding is as follows:

1. The Community better defines the dune heel at this location based on the provided LiDAR topography and transect plot in Figure 10 of the ATM report. The PFD heel as mapped by ATM at this transect shows a distinct change from a relatively steep slope to a relatively mild slope, as specified in the 2007 Guidelines. The PFD mapped by FEMA at this location follows a historic ridge which is not connected to, or continuous with, the mound system mapped to the southwest of the "isthmus" (narrow area of the barrier island).
2. The PFD heel mapped by the Community to the northeast of this location follows the contours at the landward side of the mound dune system as shown in Figure 12 of the ATM report and in the GIS data provided.
3. To the southwest of this location, for a distance of approximately 150 ft, the PFD heel mapped by the Community follows the contours at the landward side of the mound dune system as shown in Figure 12 of the ATM report and in the GIS data provided.
4. It is noted that at distance of more than 150 ft southwest of Transect 132, the PFD heel as mapped by the Community, shown in Figure 12 of the ATM report and in the GIS data provided, begins to transition across a dune ridge to a location between ridges that is not the landward extent of the mound dune system. Therefore, southwest of this location, the Community's data does not satisfy NFIP standards and does not correct or negate FEMA's data.

The Panel also determined that at Transect 133, the Community's data does not satisfy NFIP mapping standards, thus FEMA's data in that vicinity and to the southwest is not corrected or negated. This finding is based on the following:

1. FEMA better defines the PFD heel at Transect 133 at the landward extent of the mound dune system, where a transition from a relatively steep slope to a relatively mild slope exists. The Community is mapping the PFD heel between the ridges of the mound dune system. This is shown in Figure 11 of the ATM report as well as the supplemental GIS data.
2. The PFD heel mapped from Transect 133 to the southwest terminus of the island follows the contours at the landward extent of the mound dune system as shown in Figure 12 of the ATM report and in the GIS data provided.

Additional transects at the narrow area between Transects 132 and 133 using the updated topography would help inform mapping of the PFD heel and provide a more technically correct transition between Transect 132 and Transect 133.

In resolving the mapping from Transects 132 to 133, the sole issue at hand is a consistent definition of the landward heel of the landward-most ridge in the mound dune system. Other factors including the South Carolina DHEC setback mapping, environmental impacts, and impacts of hurricane Hugo are not relevant to defining the landward heel of the dune system.

###