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December 8, 2017

Ms Linda Tucker, City Administrator
City of Isle of Palms
PO Box 508
Isle of Palms, SC 29451

RE: Hurricane *Irma* Beach Damage Assessment [CSE 2453-*IRMA*]

Dear Linda,

Following Hurricane *Irma*, CSE completed an emergency beach survey and assessment of the Isle of Palms shoreline to document beach volume changes, escarpment formation, dune erosion, and debris. The survey also was completed to document beach volume changes in the 2008 project area so that eligible losses can be demonstrated to FEMA. The survey was completed between 14 and 15 September 2017.

Hurricane *Irma* impacted the island on 11 September 2017 with winds over 30 knots and a surge of nearly 5 feet (ft) above the predicted tide (in Charleston Harbor). The storm resulted in significant damage to the beach including scarping of the dune, damage to beach access paths and walkovers, and in some areas, overwash into streets. Debris scattered the beach, especially at the south end and along portions of Wild Dunes, where walkovers were destroyed and remnants littered the beach. Photos of storm damage are provided at the end of this letter.

Impacts along the island were variable with some stations gaining volume during the storm and others eroding (see profiles and volume changes in Attachment 1). Generally, most stations lost sand in the upper beach profile (dune and dry-sand beach). Most stations showed a corresponding growth of an underwater sandbar, which compensated for losses higher in the profile. The exception was the area between 54th Avenue and Shipwatch (stations 226–296), which mostly lost sand along the entire profile. Along the south end of the island, all of the emergency berm which was constructed following Hurricane *Matthew* (2016) was eroded, and additional upland area was also lost. CSE considered the area between Breach Inlet and 10th Avenue to be eminently threatened should another storm event occur. CSE recommended the City conduct a beach-scraping project to construct an emergency berm to prevent further damage in this area (west limit 32°46’32.89”, 79°48’38.64”; east limit 32°47’01.50”, 79°47’24.90”).

CSE also recommended emergency berm construction along portions of Wild Dunes, including the area fronting the Grand Pavilion and Beachwood East (west limit 32°48’05.00”, 79°44’18.93”; east limit 32°48’14.44”,79°43’49.70”). These areas suffered structural damage to walkovers or sand overwashing onto streets and had no dune or dry-sand beach following Hurricane *Irma*. Properties here are likely to suffer additional damage with future minor storm events or significant high tides.

Sand scraping was completed between 13 September and 24 October 2017 via an emergency contract issued to Robert Collins Company. The contract was for scraping an emergency berm ~6 ft high and ~20 ft wide using sand from the low-tide beach in accordance with State Emergency Order 17-EO-HI 3, State Permit 2016-00803, and USACE Authorizations SAC-2014-00299, SAC 2017-01418, and SAC 2017-01419. The total cost of the scraping work was $246,200.

Volume Change in the 2008 Engineered Beach Area

Following Hurricane *Matthew* in 2016, CSE and FEMA reviewed FEMA requirements for determining volume losses along an engineered beach. FEMA suggested establishing a volume calculation boundary that encompassed the project area out to a depth of −15 ft NAVD with the eastern boundary generally following the centerline of the Dewees Inlet channel. This would eliminate shoal and delta sand on the Dewees Island side of the Dewees Inlet channel from the volume calculations. The boundary is the black outline on Figure 1, which shows elevation models of the project area bathymetry. This boundary is essentially the same as that of Hurricane *Matthew*, except the landward limit was adjusted to match the data availability in the pre and post Irma surveys.

CSE compared the total volume of sand above the −15 ft NAVD contour within the volume calculation boundary for the pre- and post-storm surveys (Table 1). **The eligible storm-induced volume change for Hurricane *Irma* within the boundary suggested by FEMA was a loss of 281,518 cubic yards (cy).**

Table 1. Beach volumes for the pre-storm and post-storm beach condition.

Hurricane *Irma* Pre- and Post-Storm Beach Volumes	
	Volume (cy) Above −15 ft NAVD
May 2017 (Pre-storm)	11,698,886
September 2017 (Post-storm)	11,417,368
Storm-Induced Change	**-281,518**

The City of Isle of Palms has contracted for a large-scale beach restoration project using offshore sand deposits and hydraulic dredging. This work was planned as part of ongoing maintenance of the 2008 project. It also includes volume to account for losses that occurred during Hurricane *Matthew*. The scope of the project, as presently contracted, includes mobilization and demobilization ($3,415,000), a base quantity of 1,000,000 cy ($6.00/cy), and an alternate quantity of an additional 400,000 cy at $6.15/cy). The total cost for the planned project is $11,875,000.

CSE believes that if FEMA determines the losses presented herein are eligible for reimbursement, then the most cost-effective, timely, and environmentally friendly alternative for restoring the losses occurring from *Irma* would be to increase the volume of the upcoming nourishment project. State and federal permits have already been acquired, and environmental and archaeological studies have been completed. With the project anticipated to be constructed between January and March 2018, the sand could be restored in a very timely manner. The City would need to obtain a modification to the existing permits, which would allow for the increased volume and a time extension. The time extension would be requested for up to an additional month, which would still allow the project to be completed prior to sea-turtle nesting season.

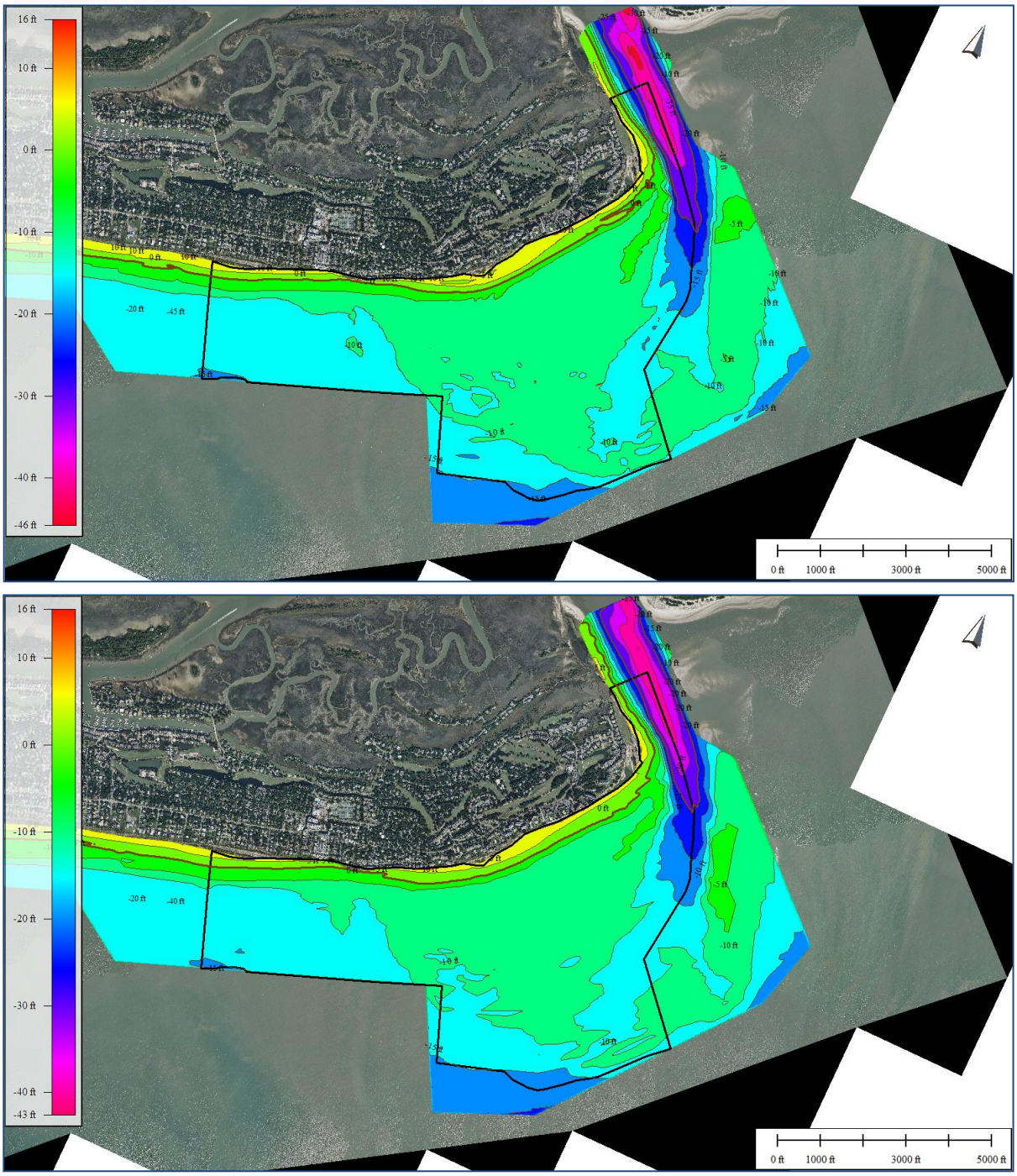

FIGURE 1. Pre- and post-Hurricane *Irma* elevation models of the eastern end of Isle of Palms. The "engineered" beach area to closure depth is within the black outline. The May 2017 condition is shown in the upper image while the September 2017 (post-*Irma*) is given in the lower image.

The contract for the upcoming project was bid competitively and in accordance with IOP procurement policies. In addition, several requirements were included to ensure the procurement followed FEMA and federal procurement guidelines. The contract package is included as Attachment 2. The awarded contractor was Great Lakes Dredge & Dock Company (GLDD), and a copy of the bid and agreement is included in Attachment 2. CSE has communicated with GLDD regarding the feasibility and cost of increasing the scope of the project. GLDD has indicated that the work could be accomplished at the same alternate price rate of $6.15 per cubic yard. This price yields a net total of $1,731,335.70 for placement of the additional material.

In addition to these costs, the City would incur additional expenses for permitting and construction management. CSE estimates these expenses to total $30,000 and assumes that the *Irma*-related work would take ~20 days to construct. Additional costs may be incurred by the City for administration in relation to the extended constructed period.

By combining the *Irma*-related restoration work with the planned project, CSE estimates that the cost of restoration may be reduced as much as $4,000,000 compared to a stand-alone project. This is mainly due to the cost of mobilization of an ocean-going dredge. These costs are already included in the planned project and would not be increased for the additional work.

CSE is providing the following documents in support of the City's request for FEMA reimbursement.

Attachment 1 – Pre-storm and post-storm profiles (previously emailed to Tom Fallon)
Attachment 2 – Nourishment contract package (previously supplied by City)
Attachment 3 – Permits for sand scraping
Attachment 4 – 2008 nourishment project final report (available for download in Dropbox folder)

In addition to these documents, the City has annual monitoring reports documenting beach changes along the entire island (including the 2008 project area), which can be provided to FEMA upon request.

Please let me know if you have any questions or need additional information.

Sincerely,

Coastal Science & Engineering (CSE)

Steven B Traynum
Coastal Scientist / Project Manager

Enclosures

Photos from Isle of Palms following Hurricane *Irma*. These photos show the general beach condition along the southern end of the island.

Photos from Isle of Palms following Hurricane *Irma*. These photos show the beach condition near the Wild Dunes Grand Pavilion (upper) and along Beachwood East (lower).