



FEMA

October 30, 2013

## Operating Guidance No. 15-13

For use by FEMA staff and Flood Hazard Mapping Partners

Title: Revised Guidance for Dune Erosion Analysis for the Atlantic Ocean and Gulf of Mexico Coasts

Effective Date: October 30, 2013

Approval: Luis Rodriguez  
Branch Chief, Engineering Management Branch  
Risk Analysis Division  
Federal Insurance and Mitigation Administration

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*Operating guidance documents provide best practices for the Federal Emergency Management Agency's (FEMA's) Risk MAP program. These guidance documents are intended to support current FEMA standards and facilitate effective and efficient implementation of these standards. However, nothing in Operating Guidance is mandatory, other than program standards that are defined elsewhere and reiterated in the operating guidance document. Alternate approaches that comply with program standards that effectively and efficiently support program objectives are also acceptable.*

**Background:** FEMA's coastal flood study guidelines and methodology recognizes the vulnerability of coastal dunes to erosion during significant flood events. Erosion is caused by prolonged wave attack during strong coastal storms, and may result in recession of the dune or its effective removal, if breached. Procedures to be used in the assessment of dune erosion are presented in Section D.2.9 of the *Atlantic Ocean and Gulf of Mexico Coastal Guidelines Update, Final Draft*, February 2007. These procedures for estimation of storm-induced erosion on the Atlantic Ocean and Gulf of Mexico coastlines are empirical and were developed in two studies based on analyses of a number of pre- and post-storm dune profiles (*Description and Assessment of Coastal Dune Erosion*, 1986, and *Basis of Assessment Procedures for Dune Erosion In Coastal Flood Insurance Studies*, 1989, Dewberry and Davis). The central concept in the treatment is that dune viability is related to the volume of erodible material within the dune, above the flood level and seaward of the dune crest. This volume is regarded as the frontal dune reservoir. If a sufficient reservoir of sand exists, the dune is taken to recede, or scarp, in a prescribed manner. If the requisite volume does not exist, then the dune is assumed to breach and is replaced by a prescribed eroded profile.

**Issues:** Key to the erosion assessment is the dune reservoir volume above the flood level, seaward of the dune crest. The current *Guidelines* identifies the flood level to be used in determining the reservoir volume as the 1-percent-annual-chance still water level, which includes the contributions of storm surge and tidal effects, but not wave setup. This reference flood level was originally selected “primarily for reasons of simplicity” as stated in *Description and Assessment of Coastal Dune Erosion*, prepared by Dewberry & Davis for FEMA and dated September 1986 - the basis for the current procedure. At the time, wave setup was treated as a secondary contribution to the flood level and not always calculated as part of a coastal FIS update. Since the wave setup component was not always available, it was decided to use the SWEL as the reference water level for the dune erosion procedure.

Advances in the state-of-the-art of storm surge modeling and understanding of the physics of coastal flooding have resulted in wave setup being treated not as a secondary component but as a phenomenon fully coupled with storm surge. New modeling techniques result in flood level estimates that include wave setup. Further, physically, wave setup occurs when waves break as they do during coastal flood events that cause dune erosion. Subtracting out the wave setup component would not only be a difficult process given current modeling practices but would also not be representative of the physical conditions affecting erosion. Given this, and that the original decision to omit wave set-up in the flood level datum was due to existing modeling limitations at the time and not because of empirical or scientific data, it has been determined appropriate to modify the erosion methodology to include the wave setup component when determining the flood level datum above which the dune reservoir volume will be calculated.

**Actions Taken:** New standards, dated August 22, 2013, were previously developed and promulgated for the reference flood level datum to be used for the calculation of frontal dune reservoir volume. These standards are identified in the Knowledge Sharing System and reiterated below for clarity and reference. The intent of this Operating Guidance is to provide Mapping Partners with guidance on how to implement the standards reiterated below:

- For Atlantic Ocean and Gulf of Mexico coastal flood risk projects, the 1-percent-annual-chance water level datum, above which the dune reservoir volume will be calculated for erosion analyses, will include storm surge, tidal effects, and wave setup components.
- Letters of Map Revision (LOMRs) for Atlantic Ocean and Gulf of Mexico study areas where wave setup was evaluated for the effective study shall use the effective still water elevations (including wave setup) for the calculation of dune reservoir volume in the dune erosion analysis. LOMRs for study areas where wave setup was not evaluated for the effective study shall use the effective still water elevations (without wave setup) from the FIS Report for calculating dune reservoir volumes, unless the revision request includes new analyses of still water elevations and wave setup, in which case the reference water level shall include the wave setup component.

In situations where this new procedure will have an impact on flood hazard zone designations and BFEs landward of the dune, taking into account Primary Frontal Dune mapping, and an appellant has provided an estimate of wave setup, thus allowing for application of the superseded guidance for estimating dune erosion, and has applied the superseded guidance and shown the resultant change in zone designation and/or BFE, the results of the appellant’s analysis could be acceptable for incorporation into the FIRM.

Once a study is effective, all analysis to support revision to the FIRM should be based on the same methodology used in the effective analysis. This exception to the standard only applies to appeals of new studies; LOMRs must adhere to the above stipulated standard for LOMRs.

Guidance for the use of the Coastal Hazard Analysis Modeling Program (CHAMP)

The Coastal Hazard Analysis Modeling Program (CHAMP) includes a program that facilitates the calculation of the dune reservoir volume and subsequent construction of the eroded dune profile. The dune reservoir volume is determined by inputting the base stillwater elevation (SWEL) as well as the ground profile and selected dune peak, or crest. In the General Information input screen of CHAMP there are fields to enter the 1-percent-annual-chance stillwater elevation “1% chance SWEL (ft)” as well as the stillwater elevation for other return periods. There is also a field to enter the 1-percent-annual-chance wave setup value “1% Wave Setup Magnitude (ft)”. These fields are highlighted in Figure 1 below.

Historically, the values for 1% SWEL and wave setup were calculated separately and entered into CHAMP in their respective fields. For the Erosion Program, CHAMP uses only the value entered into the “1% chance SWEL (ft)” field to calculate the dune reservoir volume. For new studies, the 1-percent-annual-chance water level datum, above which the dune reservoir volume will be calculated, will include wave setup, so users will need to enter this value (SWEL including wave setup) into the “1% chance SWEL(ft)” field and enter a value of zero into the “1% Wave Setup Magnitude” field. This will allow the Erosion Program to use the SWEL inclusive of wave setup and ensure that wave setup is not accounted for twice in the WHAFIS Program. Once the values are entered as specified above, normal operation of the Erosion Program and WHAFIS Program can be followed.

It is important to note, however, that the RUNUP program also uses the “1% chance SWEL (ft)” field, hence the user needs to determine if wave setup is to be included in the input to RUNUP and may need to make a duplicate transect or project to run the RUNUP program with alternative inputs.

Figure 1. CHAMP General Information Input Screen

**Supersedes/Amends:**

Section D.2.9 of the *Atlantic Ocean and Gulf of Mexico Coastal Guidelines Update, Final Draft*, February 2007.

CHAMP—Coastal Hazard Analysis Modeling Program, Version 2.0 User Manual, August 2007.

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