

## NOTES TO USERS OF HURRICANE IVAN SURGE INUNDATION MAPS

**Coastal High Water Marks (HWMs)** – Identified and surveyed in October and November 2004 using global positioning systems (GPS) methods with accuracy of  $\pm 0.25$  feet vertically and  $\pm 10$  feet horizontally. Coastal HWMs included mud lines, water stains, debris, and eye witness testimony. Based upon the location and type, each HWM was classified as either “indoor” (I), “outdoor” (O), or “debris” (D). The field crews identifying the coastal HWMs attempted to identify storm surge elevations only, but in some cases, particularly for “outdoor” and “debris” HWMs, wave heights and runup may have been captured.

**Limit of Surge Inundation** – Created by mapping surveyed coastal HWMs to digital, pre-storm topographic contour data. In areas where coastal HWMs were close together and elevations differed significantly (more than 2-3 feet), engineering judgment was used to interpolate the inundation limits. In areas where the preliminary debris line was landward of the initial mapped inundation limit, it was assumed that the debris line represented the limit of inundation and the inundation limit was adjusted landward to match the debris line. Wave effects were not considered in mapping the limit of surge inundation. Where the coastal HWMs description included indications that a point contained the affects of wave heights, the coastal HWM was not used directly.

**Preliminary Debris Line** – Based upon interpretation of digital, color aerial photography flown by the U.S. Army Corps of Engineers a few days after the storm. At the time of this project, the aerial photographs had been georeferenced, but not orthorectified. The inland debris limits are therefore accurate to  $\pm 75$  feet in any direction.

**Preliminary Storm Surge Elevation Contours** – Created based upon an interpretation of the surveyed coastal HWMs, as well as general knowledge of storm surge characteristics. Because of the inherent uncertainty and the random and irregular spacing of coastal HWMs, the surge contours required professional judgment in their creation, and represent a generalized picture of the maximum storm surge elevations. Therefore, there may be coastal HWMs that are higher or lower than the contour elevations if they did not fit the overall pattern assessed from the coastal HWMs, or if there were indications that they may include wave effects or were outliers.

### Using Hurricane Ivan Surge Levels to Estimate Coastal Flood Elevations (with Waves)

***Hurricane Ivan surge elevations cannot be compared directly to Base Flood Elevations (BFEs) from the FEMA flood maps, since BFEs in coastal areas include both wave effects and storm surge.*** Flood elevations including wave heights can be estimated in areas where there are no major obstructions (such as seawalls or dense zones of vegetation) located directly between the site of interest and the coastal flooding source. To estimate a wave crest elevation from a HWM or an estimated surge elevation contour, take the water depth at the site and multiply times 1.55. See the sample calculation below.

Example: For a site where the ground elevation is known

Ground elevation: **6.5 feet** (NAVD88)

Surge elevation (read from surge contours or HWM elevation on the Ivan map): **9.0 feet** (NAVD88)

Water depth: 9.0 feet – 6.5 feet = **2.5 feet**

Estimated wave crest height: 2.5 feet x 1.55 = **3.9 feet** (above the ground)

Estimated wave crest elevation: (2.5 feet x 1.55) + 6.5 feet = **10.4 feet** (NAVD88)

For a more detailed discussion of the methods used to prepare the Hurricane Ivan Surge Inundation Maps, please see the report titled, “Hurricane Ivan Surge Inundation Maps, Summary of Methods,” available at <http://www.fema.gov/ivanmaps/methods.shtm>.