Hurricane Ike devastated the southeastern Texas Gulf Coast area in September of 2008, predominantly by storm surge which destroyed homes on Bolivar Peninsula (Fig. 1A) and floated debris, including dead vegetation, far inland where it was trapped in trees, bushes, and fences (Fig. 1B). The Federal Emergency Management Agency (FEMA) measured high water marks on buildings and bridges in the hardest hit more populated areas, but left out large areas of southeastern Texas due to the lack of structures. To fill in these gaps and refine the previous storm surge maps, additional high water marks were measured in the spring of 2009 (e.g., Fig. 1B). These marks were combined with those measured by FEMA to create a water elevation map (Fig. 2), and ultimately a surge depth map (Fig. 3).

The locations of the 122 high water marks measured in this study are shown in Figure 2 as black circles. Most of the marks were measured at the top of lines of debris (usually grass) that were caught in the branches of trees (Fig. 1B), in bushes, and in fences. The top of this debris marked the highest still water levels of the storm surge. A few marks in Orange and Galveston counties were from water lines made by debris adhering to the walls and windows of buildings. Measurements of the heights of the high water marks were made using a stadia rod (Fig. 1B). The latitude and longitude of each measurement was recorded by a hand-held Garmin global positioning satellite (GPS) unit with accuracies as good as 10 ft (3.0 m). Pictures were taken at each measurement site to visually record the location of the measurement and the marks being measured. After all the marks were recorded, a survey-grade Trimble R8 Global Navigation Satellite System (GNSS) GPS unit was used to record the position and elevation of each mark to the nearest inch (2.5 cm) or better. The height of each mark was then added to its ground elevation to determine the maximum water elevation at that spot. The maximum surge water elevations from this study were combined with the maximum surge elevations determined by FEMA to create a dataset that was gridded at a 98.4 ft (30 m) spacing using an inverse distance weighted algorithm. The grid was colored and contoured at a 1 ft (0.3048 m) interval, and displayed as the map in Figure 2. The high water mark elevations are also posted next to the stations on this map. Note that the gridding process will project high water elevations into areas that were not inundated (Fig. 3) because it does not take into account the ground level elevations. In order to remedy this and create a maximum surge water depth map, 16.4 ft (5 m) digital elevation models (DEMs) of Orange, Jefferson, Chambers, and Galveston counties were combined and resampled to create a 98.4 ft (30 m) DEM of the study area. The ground elevations at each grid cell in this DEM were subtracted from the corresponding high water elevations to create a surge water depth DEM (Fig. 3).