RANSOM
Consulting, Inc.

Memo

400 Commercial Street, Suite 404, Portland, Maine 04101, Tel (207) 772-2891, Fax (207) 772-3248
Byfield, Massachusetts □ Portsmouth, New Hampshire □ Hamilton, New Jersey □ East Providence, Rhode Island
www.ransomenv.com

Date: 6 Feb. 2014
To: Chris DiMatteo, Assistant Town Planner, Town of Kittery
From: Robert Gerber, PE
Subject: Preliminary review of FEMA Preliminary Coastal Flood Maps

Summary of Issues found that may warrant Follow-up

1. Kittery was one of the first towns calculated by FEMA in 2007 and frankly, it was not done well at all. FEMA only did its STWAVE model recently so it was not available back in 2007. Although FEMA made some recent adjustments to increase the offshore wave heights for the purpose of calculating wave setup, a common sense application of FEMA's Guidelines and Specifications was not made. Therefore, we suggest that all transects should be completely re-calculated after the STWAVE model is re-tooled to put the shoreline in the correct position and the surge elevation is adjusted to 9.2' NAVD88.

2. STWAVE model improvement and better incident wave selection for WHAFIS and TAW. The wave model does not properly reflect the topography of the study area above surge elevation as shown in **Attachment 2**. Putting in the actual topography on land above the surge elevation would result in improved wave modeling. LiDAR and 2-ft contours for that area are available on the MEGIS website. Although FEMA insists on using the deepwater wave characteristics to calculate wave setup, smaller near-shore waves should be used as inputs to WHAFIS, TAW and SPM. The surge elevation of 9.2' should be used in the STWAVE model, not 9.5'. The nearshore wave heights vary depending on the transect and in some cases both the fetch-derived wave characteristics and the STWAVE results should both be used for WHAFIS and TAW, to see which controls.

   We note that FEMA used the full deepwater (e.g., ≥300' water depth) wave heights in both WHAFIS and wave runup calculations. As noted in Section D.2.7.1 of the February 2007 Guidelines and Specifications for Flood Hazard Mapping Partners (Atlantic Ocean and Gulf of Mexico Coastal Guidelines

Update) (**Attachment 12**) WHAFIS is not intended to use a wave characteristic derived from 10 miles offshore if the wave is transformed by "refraction, diffraction, or bottom dissipation effects." The section goes on to state that "the Mapping Partner should perform separate wave transformation calculations if these effects will cause the incident wave height to depart markedly from the value generated (WHAFIS originally generated the wave characteristics by simulating a wind of constant velocity blowing across a fetch of defined length) by WHAFIS." This is a benefit of using the STWAVE model to create a distribution of significant wave heights and periods across the coastal area being mapped. It does take into account refraction and bottom dissipation effects and, to a mild degree, diffraction.

Similarly, FEMA used the deepwater wave height for its TAW runup calculations. See **Attachment 13,** Page 2 of the "Technical Report, Wave Run-Up and Wave Overtopping at Dikes" published by the Technical Committee on Flood Defence at Delft in May 2002 (which documents the TAW methodology), "the wave height that is always used in wave run-up and wave overtopping calculations is the incident wave height that should be expected at the end of the foreshore (and thus at the toe of the dike)." This is definitely *not* the deepwater wave of 29.9'.

3. The choice of wave height for the calculation of wave setup should be provided with backup from historical storm records if possible. If wave setup controls (instead of wave runup) in a critical area, it may be worthwhile to try to simulate the February 1978 storm conditions and compare the single measured Total Water Level with a value predicted by reconstructing the wave conditions from the February 1978 storm (data point 101) and then calculating the wave setup at the wave transect of interest. The point on Chauncey Creek from 1978 had a measured elevation of 9.01' NAVD88.

   This could then be used to argue that the classic DIM calculations over-predicted the wave setup. The problem remains of how to translate this to the theoretical 100-year storm. It may be possible to develop a defensible way of scaling up the results of measured storm TWL measurements to the theoretical 100 year storm, but we have not thought through that process in enough detail yet to determine what would be required.

Estimated Cost to fix STWAVE model and re-run all transects and produce new map of the study area is $20,000.

Attachments: 1-13