COASTAL STORM SURGE INFLUENCE ON NUISANCE FLOODING IN BROWARD COUNTY, FLORIDA

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INTRODUTION

The Hollywood Lakes area in Hollywood, Florida, and Las Olas Boulevard area of Fort Lauderdale, Florida experience nuisance flooding, or "sunny day" flooding, during extreme high tides. This flooding causes damage to residential and commercial properties and to critical municipal infrastructure. The influences of rising sea levels, extreme rainfall events, and coastal storm surge compound these flooding events,

Hollywood and Fort Lauderdale form part of eastern Broward County, a densely populated area in South Florida bordered on the east by the Atlantic Ocean and on the west by the Everglades. Numerous drainage canals connect the Everglades wetlands and the coastal urban area, with typical elevations of 5-10 ft-NAVD. Porous limestone groundwater substrate further contributes to complex local hydrology.

APPROACH

The U.S. Army Corps of Engineers, Jacksonville District (USACE-SAJ) in partnership with the County of Broward, Florida, is conducting the Broward County Flood Risk Management (FRM) Study for the tidally influenced, but not oceanfront, areas of Hollywood Lakes and Las Olas Boulevard to address local flooding issues. As part of the FRM Study, Taylor Engineering, Inc. is conducting 2D hydrodynamic and wave modeling to evaluate the contributions of storm surge and seawall elevations on the nuisance flooding.

Specific objectives for the FRM Study include determining inundation patterns and water depths produced by four synthetic tropical storm events. Modeled conditions include a "No Action" or existing conditions mesh configuration as well as two alternative seawall configurations: one with all seawalls in the Hollywood Lakes and Las Olas Boulevard regions raised to a minimum of +4 ft-NAVD, and one with the same seawalls raised to a minimum of +6 ft-NAVD.

The FRM Study applies the SWAN+ADCIRC tightly-coupled hydrodynamic and wave model on an unstructured finite element mesh. The ongoing South Florida Coastal Flood Insurance Study conducted by the Federal Emergency Management Agency (FEMA) Region IV provided its validated model mesh for the FRM Study. The mesh features approximately 100-ft nodal spacing throughout the area of interest but resolves narrower canals in select locations. The FRM Study further resolved the mesh to include seawalls and additional finger canals. The FRM Study updated nodal elevations with recent LIDAR and updated corresponding bottom friction parameterization.

Note that some aspects of nuisance flooding associated with extreme high tides involve stormwater effects and infrastructure, which the SWAN+ADCIRC model does not simulate. The FRM Study focuses on the contributions of hydrodynamic flooding.

RESULTS

Figures 1 and 2 show the existing conditions model mesh elevations in the Hollywood Lakes and Las Olas Boulevard areas. The FRM Study selected four tropical storm events from the FEMA Region IV study suite to produce a range of storm characteristics and inundation patterns. All storms' landfalls approximately coincide with fall high tide. All model runs applied an updated local mean sea level as the starting water level condition and directly simulated astronomical tidal forcing with 15-day ramp period before applying meteorological forcing.

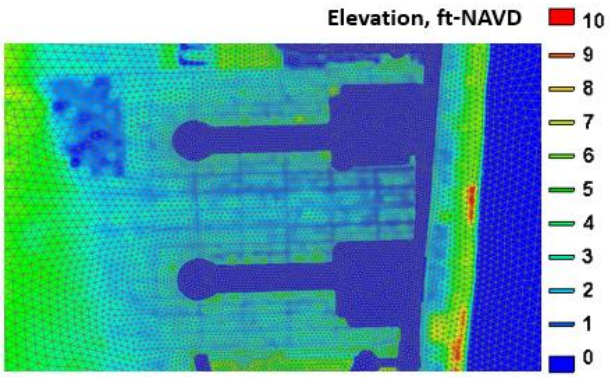

Figure 1 - SWAN+ADCIRC Existing Conditions Model Mesh Elevations in Hollywood, FL

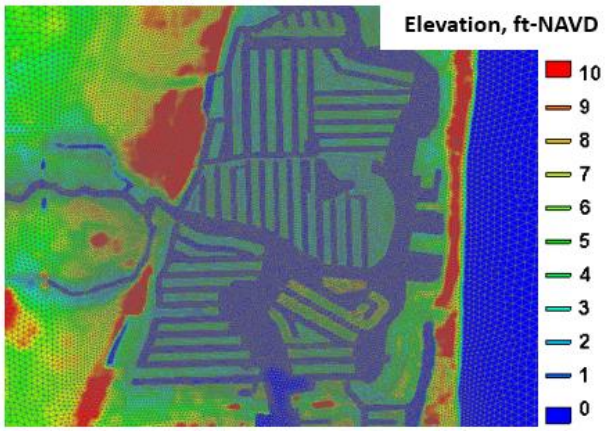

Figure 2 - SWAN+ADCIRC Existing Conditions Model Mesh Elevations in Downtown Fort Lauderdale, FL

The four selected storms produced overland flooding in both areas of interest under existing conditions. Seawalls of +4 ft-NAVD completely prevented the flooding during the first storm (Broward Storm 1) in both areas of interest (Figure 3, Las Olas). Seawalls of +6 ft-NAVD eliminated overland flooding in both areas of interest when compared to existing conditions for Broward Storm 2 (Figure 5, Hollywood Lakes). Additional model

simulations of the final two storms are ongoing.

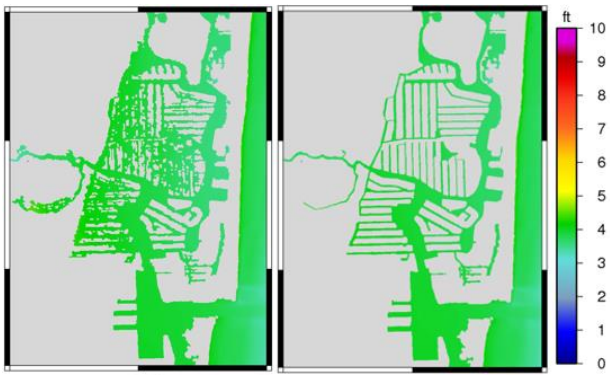

Figure 3 – Maximum Water Levels (ft-NAVD), Existing Conditions vs. Seawalls at +4 ft-NAVD, Las Olas Boulevard area – Broward Storm 1

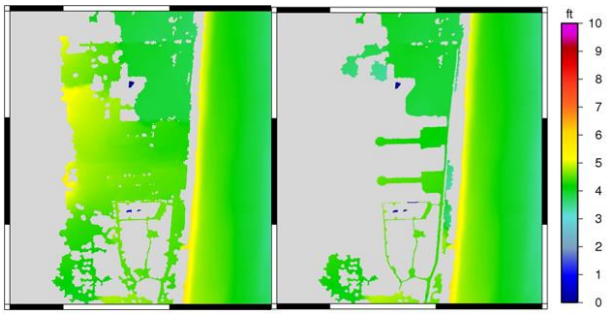

Figure 4 – Maximum Water Levels (ft-NAVD), Existing Conditions vs. Seawalls at +6 ft-NAVD, Hollywood Lakes area – Broward Storm 2

SUMMARY

The Broward County Flood Risk Management Study is conducting hydrodynamic and wave modeling to assess the influence of potential future seawall elevations and coastal storm surge on nuisance flooding that currently occurs in the Hollywood Lakes area of Hollywood, Florida and in the Las Olas Boulevard area of Fort Lauderdale, Florida. Inundation patterns from storm events may influence new requirements for seawall heights in Broward County. The study and results should prove relevant to those conference attendees interested in coastal storm surge and nuisance flooding in the greater Miami area.

REFERENCES

Federal Emergency Management Agency (FEMA)/ (2016): South Florida Storm Surge Project Deliverable 2: Validation Report. Prepared for FEMA Region IV. BakerAECOM, LLC.