South Florida Water Management District (SFWMD)

Canals in the SFWMD system are operated to accomplish flood control, water supply, water quality and ecosystem restoration objectives. Coastal canals discharge directly to tide through gated spillways, designed by the US Army Corps of Engineers (USACE) using traditional static conditions back in 1930’s and 1960’s. Coastal spillways are operated to provide drainage, maintaining stages within pre-determined water levels for operations, while at the same time preventing salt water intrusion. The primary SFWMD Control Area receives management from secondary canals (drainage districts and municipalities), which collect from tertiary canals (HOAs/Private Interests).

Level of Service (LOS)

The purpose of Flood Protection LOS program is to identify and prioritize long-term SFWMD infrastructure needs. Level of Service projects provide a process to establish flood protection thresholds for each basin. These thresholds will help initiate retrofits and other adaptation efforts. More specifically, LOS describes the amount of flood control protection provided by water management facilities within a watershed. Flood control LOS for needs to be evaluated under highly dynamic (transient) conditions:

- Rainfall-runoff (different frequencies)
- Storm surge (different frequencies)
- Tidal and wind surge effects
- Tidal and wind surge (different frequencies)
- One level rise (SLR) different with tidal conditions.

Loss determination requires the use transient hydrologic and hydraulic simulation models.

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<th>Methods and Materials</th>
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HEC-RAS (USACE-HEC) was the transient hydraulic model selected to simulate the system. Flood control LOS was computed using both the SFWMD customized equations and intrinsic HEC-RAS equations for spillways. The HEC-RAS output high resolution stage and flow hydrographs throughout the modeling domain, including all water control structures.

Method of Measures to Evaluate LOS

The 12-hour moving average (12-hr MA) is used to filter the effect of regular tidal cycles on results.

Methods of Processing and Interpretation

For the PM3 analysis, five sea-level scenarios were investigated. For the 1963 (USACE Design), current (2015), and future (2055 Low, Mid, High) sea-level rise scenarios, the peak flow capacity of the structure was computed using both the SFWMD customized equations and intrinsic HEC-RAS equations for spillways. The HEC-RAS output high resolution stage and flow hydrographs throughout the modeling domain, including all water control structures.

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<th>Method of Measures to Evaluate LOS</th>
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The shape of the discharge hydrograph at the structure generated by PM4 simulations will determine on the arrival time of the runoff and the arrival of the storm surge at the structure. If the storm surge arrives earlier or later than the storm event the shape of the hydrograph will be affected by run off.

A sensitivity analysis was performed in which the TW boundary condition was shifted to arrive after the peak rainfall and the runoff event. Offsets from 0 to 18 hours were generated. As shown by the PM4 analysis, the offset is one that tends to produce similar bidirectional peak volumes. A value of 0 hours was selected as the best compromise for all the simulations required for PM4.

This analysis indicated that the offset between the peak rainfall and peak storm surge at the coastal structure is an important parameter to consider during design, maybe as important as selecting the magnitude of the rainfall or the peak tidal surge stage.

For the PM4 analysis four sea-level scenarios were modeled: Current (2015), and future (2055 Low, Mid, High). For each scenario, a range of four design storms were examined (5, 10, 25, and 100-year). Results of each simulation are further analyzed to determine the maximum 12-hour MA flow through the system.

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<th>PM4 Results</th>
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For PM4, the “Effects of sea level rise only” zone (12-hr MA flow prior to the storm surge) characterizes the suppression of flows caused by increases in SLR. Flow capacities in the “Effects of Storm Surge” region are further decreased by the intensity of the storm surge.

For PM3, the highlighted value in the 1963 Sea Level curve is the equivalent to USACE design.

Due to canal capacity limitations 600 cfs never exceed 400 cfs.

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According to PM3, the S22 structure is the most strongly impacted by sea level rise. For mid SLR sea levels, the capacity of the S25B structure drops to the 600 cfs forward pump capacity for any storm surge with a return period equal to or greater than 100 years. In very few cases the structures have some capacity to deal with 100-year events.

For PM4, maximum structure flow increases with design storm because both runoff and storm surge increase with the design storm. S25B exhibits the larger drop in capacity from the existing conditions to the Low and Mid SLR scenarios. There are no significant differences in capacity between the different flow equations being used for PM3 and PM4.

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Cross comparison of results is not possible.

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