# Inundation flood mapping for the city of Boston, USA

The possible effects of forecasted precipitation, sea level rise, storm surge and river dynamics, in and around the Boston Water and Sewer Commission's service area, were mapped. This was carried out for the present and future years within a risk management framework. Due to its versatility and rapid computing time, when compared to other 2D mapping tools available on the market, Flood Modeller's 2D FAST solver was used to identify areas that may be prone to flooding at future year milestones in the years 2035, 2060 and 2100.

The 2D FAST solver in Flood Modeller, which is designed to allow quick assessment of flooding using simplified hydraulics, was used as it was able to rapidly provide results when compared to traditional 2D approaches.

The forecasted effects of changes in precipitation, sea level rise, storm surge and river dynamics were calculated for two greenhouse gas emission scenarios based on Intergovernmental Panel on Climate Change (IPCC) calculations at the selected future years to bound medium and high climate-related risks.

Flooded and inundated land areas were mapped using a combination of the Commission's sewer system and storm system models integrated with the 2D FAST solver. The solver was used to identify assets at risk and evaluate the benefits of regional solutions.

## Model development and flood mapping

The initial phase of the project consisted of calculating sewer system and storm system responses to design storm conditions using the Commission's calibrated hydrologic and hydraulic SWMM (Storm Water Management Model) model for a baseline design storm event.

### Key facts

- Forecasted precipitation, sea level rise, storm surge and river dynamics were mapped
- Flood Modeller's 2D FAST solver was used to identify areas that may be prone to flooding at future year milestones
- The validity of the model was tested by simulating inundation for the Federal Emergency Management Agency's (FEMA) 100-year Base Flood Elevation (BFE) zones and Hurricane Sandy
- Simulations of the two climate change scenarios were conducted without and with rainfall

The models were then used to calculate responses to design storms modified with increased rainfall and boundary conditions for river and harbour water elevations at outfalls accounting for sea level rise, storm surge and river stage due to climate change.

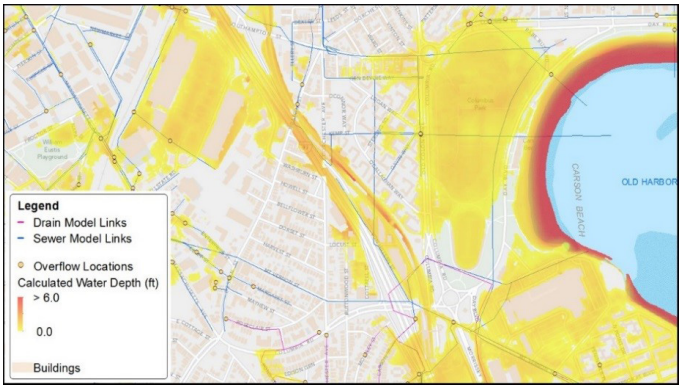
The second phase involved the development of the 2D FAST model of Boston Harbour, three major tributaries and the Commission's entire service area.

Model topography used available LiDAR data (with rectangular grid cells with 6.25 feet of horizontal resolution and with vertical resolution of about 6 inches) and aerial imagery.

Other topographic features such as existing fences and surrounding river dams were overlaid upon the

base topography. Building footprints were removed from the original LiDAR terrain model. The 2D FAST solver interprets the blanked areas as impermeable infinitely high walls. Model boundary conditions consisted of forecasted sea level and river water levels using feature shapefiles developed with our software and ArcGIS.

The final stage consisted of linking node overflows from the SWMM models as point sources within the 2D FAST model's inland area. The validity of the model was tested by simulating inundation for FEMA's 100-year BFE zones and Hurricane Sandy.




Mapped outputs calculating the inundated areas in the City of Boston

Although Flood Modeller and the Storm Water Management Model can be integrated, the models were treated separately for this particular project.

Simulations of the two climate change scenarios were conducted for the years 2035, 2060 and 2100 without and with rainfall. Model runs were divided into two major categories: with and without FEMA's 100-year storm surge of about 5.1 feet. Results were integrated with the Commission's GIS for asset risk evaluations. Regional solutions including sea wall barriers were simulated to identify risk reduction under feasible mitigation cases.


Source: Jacobs

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