



What if a Surge Similar to "Sandy" Affected Washington DC?



Jason Elliott

Senior Service Hydrologist

National Weather Service Baltimore/Washington

Introduction

- The impact of "Sandy" in October 2012 raised awareness in all coastal areas about the potential for extreme storm surge events. In the Washington, DC area, it brought to the forefront the question "What if this happened here?"
- This study attempts to provide a basic answer to this question, not by modeling any particular storm into the Washington, DC area, but instead by taking the direct level of tidal anomaly generated by Sandy and overlaying it onto a typical tide in Washington.

Methodology

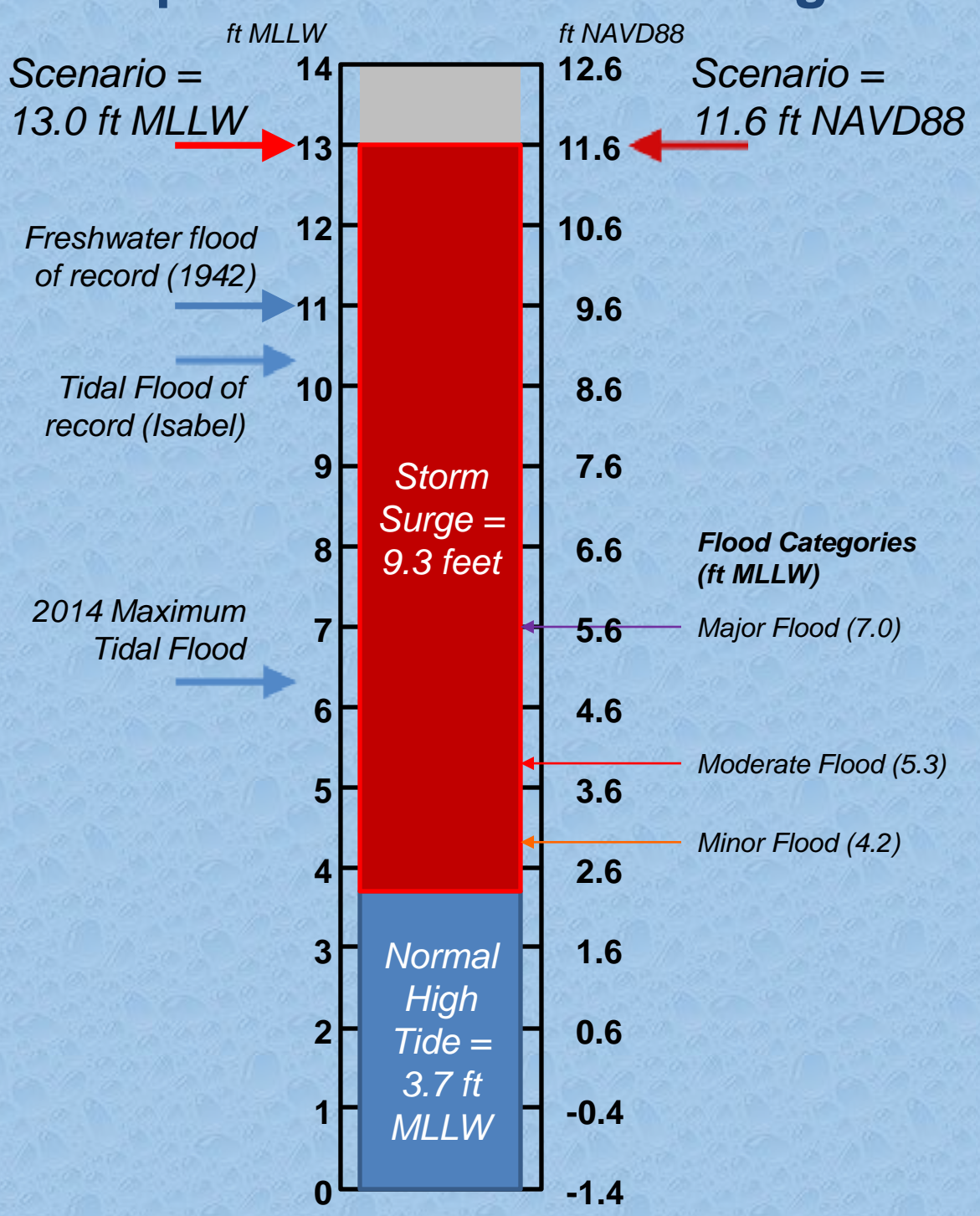
- Observed maximum water level and maximum tidal anomaly during Sandy for three National Ocean Service gauges is contained in the table below. Also listed is the tidal flood of record from 2003 at the National Ocean Service tide gauge in Washington, DC.

Location	Max Level	Max Anomaly
The Battery, NYC	14.04 ft MLLW (11.27 ft NAVD88)	9.34 feet
Bergen Point	14.56 ft MLLW (11.64 ft NAVD88)	9.56 feet
Kings Point	14.30 ft MLLW	12.64 feet
DC Record Tidal Flood (Isabel, 2003)	10.28 ft MLLW (8.88 ft NAVD88)	8.10 feet

- The total storm tide from Sandy in the New York City area is around four feet higher than the value observed in DC during Isabel, yielding a resultant NAVD88 elevation 2.5-3.0 feet higher.
- The maximum anomaly observed at Bergen Point and The Battery during Sandy was around 1.5 foot higher than the value observed in DC during Isabel, while the anomaly at Kings Point was more than 4.5 feet higher. However, it is important to note that the maximum anomaly/surge occurred nearly coincident with high tide at The Battery and Bergen Point (and during Isabel in DC), but occurred coincident with low tide at Kings Point.
- Another factor to consider is normal astronomical tide. Tidal ranges are higher near New York City than in Washington DC; therefore, a comparable surge will yield a lesser storm tide and corresponding elevation in DC.

Scenario Used

- The maximum tidal anomaly observed during Sandy at The Battery was combined with the highest-possible astronomical high tide during the tropical season at Washington DC to determine the scenario for this case.



Floodwaters cover areas near Washington Harbour during Isabel in 2003. Photo courtesy FEMA/Liz Roll.

	Isabel (2003)	This Scenario
Peak Water Level	10.28 ft MLLW	13.00 ft MLLW
Maximum Surge	8.1 ft (max surge was after high tide)	9.3 ft
Normal High Tide	2.9 ft MLLW	3.7 ft MLLW

Mitigation

- In the Washington, DC area, there are numerous methods used to mitigate potential flooding, including but not limited to, earthen levees, permanent floodwalls, and manmade floodwalls that must be installed at the time of a potential flood. Sandbagging is also utilized in some areas.
- The maps shown in this presentation are derived from 1/9 arc-second LiDAR data. As such, they do include some earthen levees, which the LiDAR is able to detect. However, they do not include structures like the 17th Street Closure or the Washington Harbour flood walls, which would be manually installed in advance of a potential flood. It is generally expected that the actual flood extent would be less than depicted here due to these mitigation efforts.



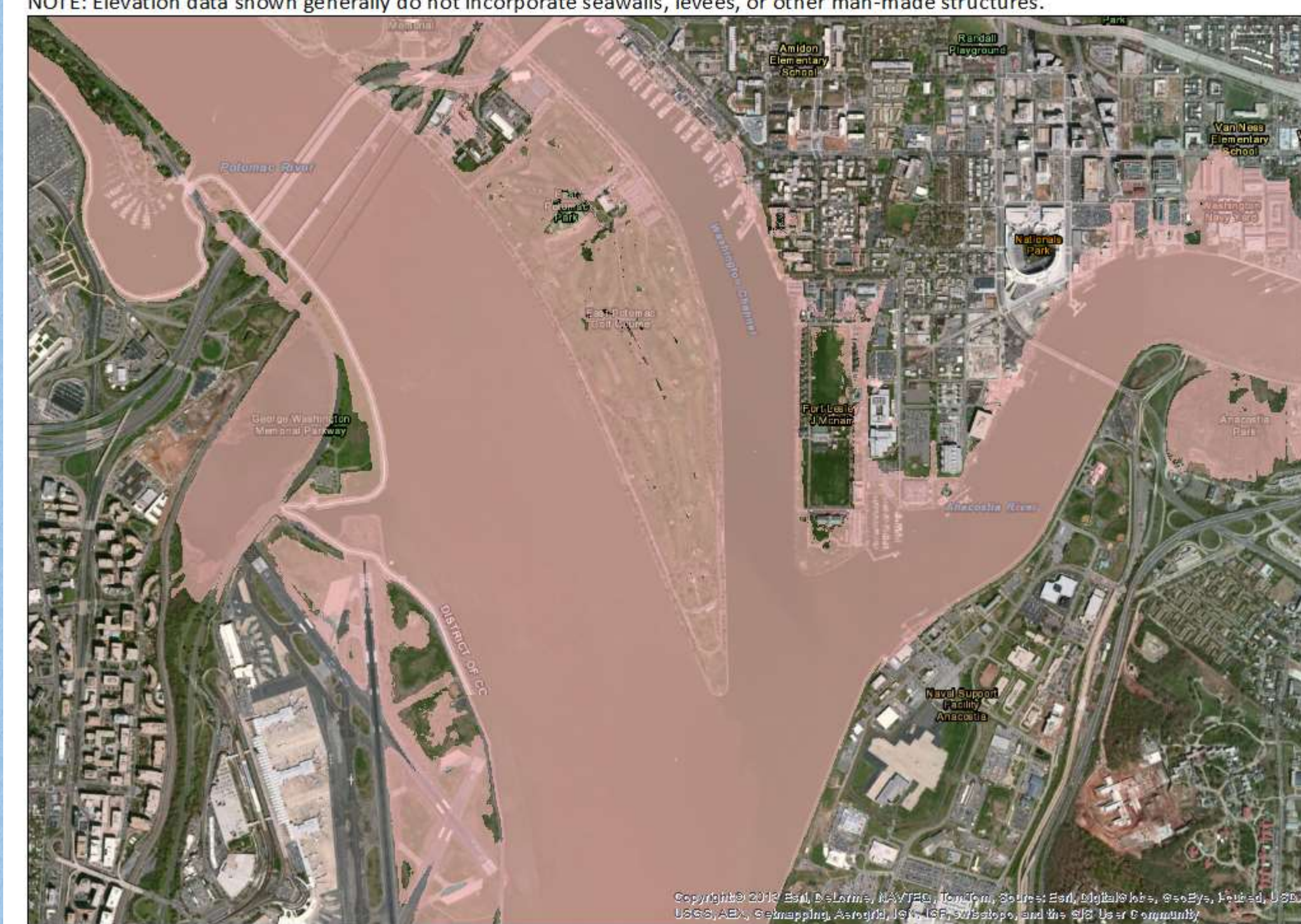
Test Installation of 17th Street Closure, Washington, DC, on October 31st 2014. Photo courtesy U.S. Army Corps of Engineers.

Results

11.6 ft NAVD88 Inundation Area. Elevations are in feet NAVD88. Data shown is 1/9 arc-second. NOTE: Elevation data shown generally do not incorporate seawalls, levees, or other man-made structures.

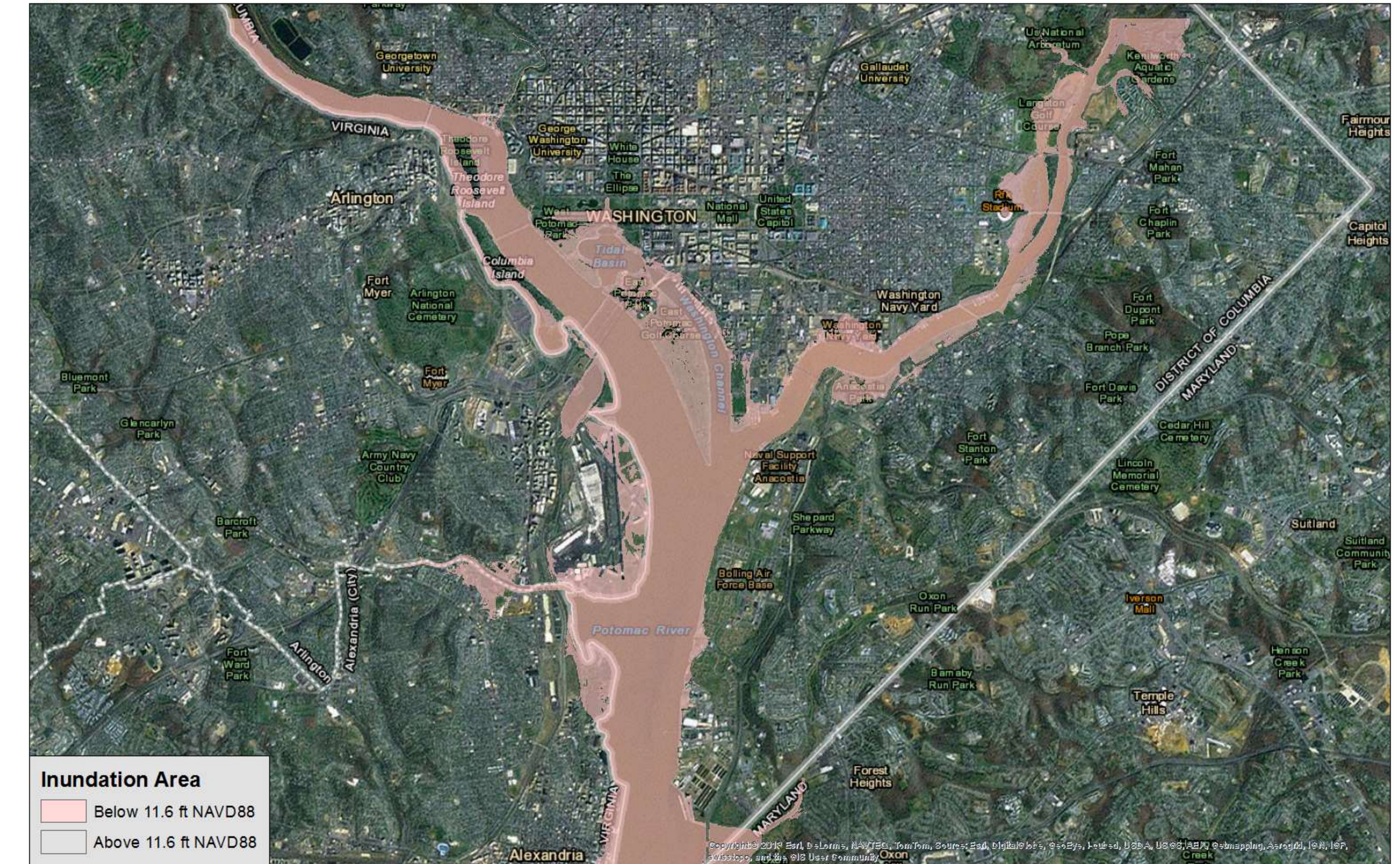


11.6 ft NAVD88 Inundation Area. Elevations are in feet NAVD88. Data shown is 1/9 arc-second. NOTE: Elevation data shown generally do not incorporate seawalls, levees, or other man-made structures.



Approximate Extent of Inundation

Data shown is 1/9 arc-second



NOTE: Elevation data shown generally do not include seawalls, levees, or other man-made structures.

Tidal Basin Area

- Floodwaters surround the Jefferson Memorial and cover virtually all of the FDR Memorial and Martin Luther King, Jr. Memorial.
- The World War II Memorial and areas surrounding the Reflecting Pool are also flooded. However, an earthen levee keeps the water from going north of the Reflecting Pool.
- Floodwaters move up 17th Street almost to Constitution Avenue. The high point at 17th & Constitution is 12 feet NAVD88, so it would not be breached in this scenario. If it was, water would flow into the core of the city, inundating a much larger area.

Elsewhere

- DC's SW Waterfront is flooded, along with virtually all of East Potomac Park. Water also inundates areas outside of levee protection along the banks of the Anacostia River.
- Floodwaters may also cover portions of the runways at Reagan National Airport, creating a disruption to air travel.
- WMATA's Waterfront station is affected by flooding.

Conclusions

- It has now been more than a decade since the last significant surge event on the Potomac River. Although it would be a major undertaking to develop a scenario in which Sandy specifically impacted the region, making use of the surge values as a plausible scenario gives decision makers and planners the ability to see which areas would be impacted if a similar-level surge event happened in the DC area.
- This magnitude of surge would become the flood of record by more than two feet over the current tidal flood of record (Isabel, 2003) and be nearly two feet higher than the current freshwater flood of record at the National Ocean Service tide gauge in Washington, DC.
- However, further upstream near the tidal interface, freshwater events have caused more significant floods in the Georgetown area than this scenario would cause. As a result, a record freshwater flood still poses a greater threat to much of Washington, DC than a record tidal flood.

Future Work

- The DC Silver Jackets interagency flood risk management team is actively working on a pilot project to develop a full suite of inundation maps for Washington, DC and neighboring areas. Target completion is August 2015.
- These inundation maps will allow better visualization of both tidal flood inundation areas and freshwater flood inundation areas, including these extreme scenarios.

Acknowledgments

DC Silver Jackets Flood Emergency Task Group
Suzanna Sterling-Dyer, WMATA
U.S. Army Corps of Engineers, Baltimore District