Washington, D.C. Area Flood Risk Tour Overview

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Duty Location: Baltimore District



US Army Corps of Engineers BUILDING STRONG_®



Agenda

- Washington D.C./National
 Capital Area Flood Risk
- Overview of Tour Stops
 - Washington D.C. Levee

Project

- Huntington Flood Study
- Prince George's County

Levee Project



Photo courtesy of NPS



Washington D.C. Regional Map



Washington D.C. and Vicinity



Regional Flood Risk

- Washington D.C. is susceptible to flooding due to
 - Location at confluence of Potomac and Anacostia Rivers
 - Three waterways piped underground
 - Relatively flat elevations
 - Broad floodplains
 - Built on fill



Regional Flood Risk

- National Capital Area (DC, Northern
 Virginia, part of Maryland) vulnerable to
 four types of flooding:
 - Riverine flooding from Potomac and Anacostia Rivers and tributaries
 - Urban drainage flooding (stormwater)
 - Tidal/storm surge flooding
 - Interior drainage behind levees
- Major flooding occurred in 1889, 1933, 1936, 1942, 1972, 1996, 2003, 2006
- Sea level rise is a major concern





Predicted Hurricane Storm Surges



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Potomac River

- Watershed covers approximately 14,700 square miles (38,070 sq. km.)
- Reach along D.C. is tidal
- Normal tides have a mean range of three feet (0.9 m); can surge as much as 12 feet (3.7 m) during hurricane
 USACE constructed Washington DC Levee Project to reduce flood risk to National Mall area
 There are a few other flood risk mgmt projects along
- the Potomac River and its tributaries





Anacostia River

- Watershed covers approximately 170 square miles (440 sq. km.)
- Small watershed, but one of most urbanized in the country
- Historically, Anacostia River was broad, deep, and meandering with thousands of acres of freshwater tidal marshes
- Sediment from agricultural activities have clogged the river channel and closed it to navigation
- Impervious areas and wetland loss increased flood risk
- Various communities and military installations along the river have levee and flood wall projects, including USACE's Prince George's County Levee Project





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D.C. Urban Drainage

- Inadequate storm sewer capacity makes the D.C. area susceptible to interior flooding
- One-third of D.C. has combined sanitary and sewer systems
- During the June 2006 flood, extensive interior flooding shut down operations at four key federal agencies and several Smithsonian museums
- Interior flooding creates hazard to the security of federal buildings and treasured historic resources
- Agencies are currently investigating ways to help reduce risk, such as improving the stormwater system and flood proofing individual buildings



9th Street Flooding, June 2006 Photo Courtesy of NCPC



National Capital Area Tour Stops



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Washington D.C. & Vicinity Project

- Potomac Park Levee, part of the Washington, D.C. and Vicinity Project, was authorized in 1936, and built in 1939
- Includes a levee and two closures to reduce the flood risk to the National Mall area
- Closures at 23rd Street and 17th Street are temporary
- The National Park Service (NPS) owns the land and is responsible for the O&M of the project



Potomac Park Levee





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Potomac Park Levee

- Attempts to modify the project to alter the temporary closures at 17th and 23rd Streets began in 1946
- In 1999, Congress authorized USACE to build a permanent closure at 23rd Street, and to modify the temporary closure at 17th Street
- In 2007, USACE declared the temporary sandbag/Jersey barrier closure at 17th Street to be unreliable and issued the National Park Service (NPS) an unacceptable inspection rating under its Inspection of Completed Works Program

Figure 1.2 - Existing and Proposed FEMA 100-year Floodplain Boundary





Potomac Park Levee

- Concerned about the risk and potential economic impact of an unacceptable closure at 17th Street, the District of Columbia and its consultants designed a reliable post and panel closure for 17th Street at a cost of \$2.5 million
- In September 2010, the Baltimore District awarded a \$4.6 million contract to construct the closure across 17th Street
- Construction contract was awarded; construction scheduled to begin in January 2011 and completed by the fall of 2011
- The contract award follows an unprecedented collaboration among federal and District agencies, including the U.S. Army Corps of Engineers, the National Park Service, the National Capital Planning Commission, the Commission of Fine Arts, the Federal Emergency Management Agency, and District of Columbia



Temporary Closure @ 17th Street

The Plan is to change from constructed earthen or sandbag levee like this:



To an installable post & panel system like this:



Unreliable





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Huntington Study

- Flooding occurred in the Huntington, Virginia community during the June
 2006 event
- Huntington is adjacent to Cameron Run, a tributary of the Potomac River
- Approximately 160 duplex houses, which were built in 1940's and 1950's were

flooded; houses have basements





Huntington June 2006 Flood



Huntington Study

•The flood elevations were 2 feet (0.6 m) higher than the expected 1% annual chance flood (event had a recurrence interval of 50 to 70 years) •1% annual chance flood elevation was based on a 1976 study; USACE determined the factors contributing to higher flood levels over time were:

Channel sedimentation
Construction of a new bridge downstream
Development within the floodplain



Huntington Study

- At request of Fairfax County, USACE developed and evaluated alternatives for mitigating future flooding
- Measures included:
 - •Levee
 - Channel dredging
 - •Flood proofing individual houses (elevation)
 - Acquisition
- All alternatives were costly and none had a positive benefit-to-cost ratio, which is required to meet guidelines for federal funding
- Fairfax County voluntarily contributed funds to USACE to develop 65% design of the levee plan
- Levee and pump station project cost is approximately \$20.2 million
- County does not have funds; currently pursuing funding options



Huntington Study – Proposed Levee



- Located in urbanized, densely populated suburb of Washington, D.C
- First settled in 1700's, project area was largely developed in the 1920's-1950's
- Combination of commercial, industrial and residential development
- Moderate-income, working class residents



Project History

- Anacostia River watershed
 experienced several major floods:
 - May-June 1889
 - August 1933 (record at time)
 - October 1942
- May 1950 U.S. Congress authorized the construction of the flood project
- Project was constructed 1954 to 1959.
- Geographic coverage = mainstem Anacostia River, Northwest Branch, and Northeast Branch



Levee Description

- Consists of four separate systems (hydraulically independent)
- 14,400 ft (4.4 km) of flood control channels
- 28,100 ft (8.6 km) of levee embankment
- Four pumping stations with connecting storm sewers for interior drainage
- A pressure conduit for interior drainage
- Relocation and reconstruction of 4 highway bridges and 1 railroad bridge



- Design discharges:
 - Northeast Branch = 8,000 cfs (227 m³/s)
 - Northwest Branch = 10,000 cfs (283 m³/s)
 - Mainstem Anacostia = 15,000 cfs (425 m³/s) (80% of combined peaks)
 - Roughly equivalent to 1933 event
 - Estimated to be the 100-year Q at time
- Since construction, the levee project has prevented flood damages without failure or overtopping.
- Example : Northwest Branch (u/s end)
 - Design discharge = 10,000 cfs (283 m³/s)
 - June 1972 = 18,000 cfs (510 m³/s)
 - September 1975 = 14,800 cfs (419 m³/s)
 - June 2006 = 13,900 cfs (394 m³/s)
 - September 1979 = 12,000 cfs (340 m³/s)



June 2006 flooding within levees



- SO, what has happened since 1954?
- EXPLOSIVE growth in the DC suburbs, particularly in the watershed above the project.
- In 1940s, 1950s, and 1960s, Prince George's County experienced population growth rates of 117%, 84%, and 85%, respectively
- Montgomery County had similar growth rates of 96%, 107%, and 53%
- Virtually no stormwater management until 1984



Summary of Levee Hydrology		
	Northeast Branch at Riverdale gage	Northwest Branch at Hyattsville gage
Estimated August 1993 Q, 1954 Design Flow, Q _{1%}	8,000 cfs	10,000 cfs
June 1972 Q _{peak}	12,000 cfs	18,000 cfs
September 1975 Q _{peak}	10,800 cfs	14,800 cfs
September 1979 Q _{peak}	9, <mark>41</mark> 0 cfs	12,000 cfs
June 2006 Q _{peak}	12,000 cfs	13,900 cfs
2008 Update, Q _{1%}	16,700 cfs*	20,700 cfs*

* The updated 2008 value for Northeast Branch was based on watershed modeling and flow-frequency analysis of the existing gage data; the Northwest Branch value was based on flow-frequency analysis alone.



- BOTTOM LINE: Flood peak flows have significantly increased over the life of the project (doubled essentially).
- August 2005 the Federal Emergency Management Agency (FEMA) initiated new levee certification requirements for ALL systems under the National Flood Insurance Program (NFIP)
- Components of FEMA's NFIP Levee System Evaluation (Certification):
 - Risk and uncertainty determination of hydraulic capacity of the levee system's ability to pass the 1% annual chance exceedance flood
 - Analysis of original design structural, geotechnical, electrical, and mechanical engineering systems – to ensure it meets current criteria
 - Assessment of physical condition/maintenance to ensure project is still functional
- Can be performed by any registered professional engineer or Federal agency with responsibility for levee design



- If the system passes, then FEMA will accredit the project and the area behind the levee will be mapped as a low-risk area; flood insurance will be available to residents at a low cost.
- If the system does not pass, then the area behind the levee will be shown on the flood insurance maps as subject to inundation and residents will most likely be required to purchase flood insurance (at a higher cost than if it were a low-risk area).
- With the digitalization of flood insurance maps, the levee accreditation process has moved to the forefront



- 2007 As part of an ongoing cost-shared feasibility study, Prince George's County requested USACE to conduct hydrologic and hydraulic analyses for an evaluation of risk and uncertainty associated with the existing flood risk management project as a precursor to levee certification
- 2009 USACE completed risk and uncertainty analyses
 - Portions of the levee system would need to be rehabilitated between 3 and 24 inches (7.6 cm and 63.5 cm) to meet FEMA requirements for the 1% annual chance exceedance event
 - Average increase = 1 ft (0.3 m)
 - Mainstem Anacostia segments do not require any raising



- 2010 USACE completed analysis of residual interior flooding for each segment, and mapped interior inundation area
- Colmar Manor:
 - 25 structures in inundation area
 - Only 2 have flow-entry points below 100-year elevation of 8.0 ft (2.4 m)



DRAFT - Colmar Manor, Prince George's County, Maryland

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- 2010 USACE completed concept designs for rehabilitating the levee to meet the FEMA requirements
- For short raises, increase height of existing bituminous paving on top of levee
- For larger increases, raise embankment on landside with select impervious fill and riprap where needed for slope protection
- No real estate needed



- Northwest Branch:
 - 300 ft (91.4 m) on left bank
 - 4200 ft (1.3 km) on right bank
- Northeast Branch:
 - 3225 ft (983.0 m) on left bank
 - 2,750 ft (838.2 m) on right bank
- Total = 10,475 ft (3.2 km)
- Estimated cost = \$5M
- Implementation:
 - County A-E currently preparing plans and specs
 - Construction planned for 2011



- Analysis of Original Design:
 - Structural Features completed, acceptable for accreditation
 - Geotechnical Features analysis is ongoing, but no accreditation problems expected
- Analysis of Physical Condition/Maintenance:
 - Electrical Features completed, acceptable for accreditation
 - Mechanical Features completed, repairs required to flapgates
 - Structural Features completed, repairs required
 - Geotechnical Features analysis is ongoing, but no accreditation problems expected



- Summary
 - Extensive watershed development changed hydrology significantly
 - Levee system has performed without failure or overtopping to date
 - Importance of maintenance and inspections to identify concerns early to maintain mechanical and structural features
 - FEMA accreditation:
 - Colmar Manor anticipated in spring 2011
 - Brentwood anticipated in 2012 once rehabilitation and minor repairs are completed
 - Riverdale-Hyattsville (Edmonston pumping station) anticipated in 2012 once rehabilitation and minor repairs are completed
 - Edmonston-Bladensburg repairs required to the Bladensburg pumping station; status uncertain



QUESTIONS?

D.C. flood risk information source: *Report on Flooding and Stormwater in Washington, DC,* National Capital Planning Commission, June 2008



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