Restoring the Role of Tiber Creek: Flood Adaptation for the Federal Triangle

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Tiber Creek: The Bathers John Quincy Adams takes a deadly chance, 1825

Latrobe’s 1804 Engineering Drawing of Goose Creek showing the Washington City Canal Juxtaposed on current DC Map

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L'Enfant's 1791 Plan for Washington DC

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Washington City Canal at the foot of the Capitol (under construction), 1860

http://www.civilwaralbum.com/misc17/06dc1.htm
Detail of “Panoramic View of Washington City, from the new dome of the Capitol, looking west” by Edward Sachse, 1856

http://www.southernspaces.org/2012/enslaved-labor-and-building-smithsonian-reading-stones
Historic Map of DC Stormwater and Sewage Pipes
Late 1800’s, handles only a 15 year storm

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Current Ponding Area for Storm Water Drainage

- Constitution Avenue is the lowest area in the Federal Triangle and was the site of Goose Creek, later renamed Tiber Creek.
- Later fill made Constitution Avenue the lowest area in the Federal Triangle, trapping runoff from rain events.
Flood Adaptation: Storm Water Flow & Retention Diagram

Green Infrastructure:-
“Makes Way for the Water” by restoring the natural hydrologic pattern in the landscape
-Buys time
-Lessens load on combined sewer system
-Allows filtration and infiltration
-Provides natural habitat
-Improves air quality
-Provides security
-Mitigates urban heat island effect
-Provides greener urban spaces and natural irrigation
-Provides recreation and amenities for visitors during all seasons

-Always working and ready
-Much Cheaper- $110 M vs. $400-500 M

http://www.dcwater.com/education/lowimpact.cfm
http://cfpub.epa.gov/npdes/home.cfm?program_id=6
http://www.dec.ny.gov/lands/58930.html

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Precedents: Cheonggyecheon Stream Restoration Project
Seoul, South Korea

- Provides Flood Protection
- Increases Biodiversity
- Lessens Urban Heat Island Effect
- Provides Recreation- is a major focal point
- Huge success by every metric

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When it rains, the Bentemplein, in the city center of Rotterdam in the Netherlands, collects runoff and releases it back into groundwater.

Image credit: de Urbanisten

http://nextcity.org/daily/entry/a-storm-water-drainage-system-cleverly-disguised-as-a-park
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Precedents- US: Tulsa, Houston and Rock Creek
There are many innovative stormwater management examples of parks used as detention areas and of restoring natural drainage in the US and in DC.
Flood Adaptation: Restoring the Role of the Tiber Creek Bioswale and Retention Area Diagram

Retention area
Bioswale along Constitution Avenue

17th St
Bioswale-outlet for gravity drainage and pumping as necessary

Swale sizing along Constitution Avenue and for the Washington Monument Retention Area is based on the flow calculations for the Federal Triangle Flood Event in 2006 = Historic Canal footprint.

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-The estimated storage volume required for a 200 year storm is about ~ 24 million gallons.

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Possible Section Through Constitution Avenue:
Open Bioswale collects and cleans water and provides drainage from Constitution Avenue

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Possible Section Through Constitution Avenue: Swale Under Existing Sidewalks and Roadways Preserves Access
Water Feature in front of new Museum of African American History and Culture was proposed. 70,000 gallons per day of ground water is pumped from its basement even after repair.

(Davis Brody Bond Rendering)
- Keep existing double sidewalk

- Eliminate curb along Constitution Ave

- Make sidewalks permeable and slope toward bioswale

- Landscaped areas can provide seating and recreation

- Access to Museums preserved and enhanced

Visualization of possible Bioswale along Constitution Avenue: Dry and Draining

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Flooding Design Numbers

**Interior Flooding**
200 year rain = 6” rain in 6 hrs.
500 year rain = 7” rain in 6 hrs.

**Potomac River Flooding (17 Street Levee addresses)**
200 year flood = El. 12.2 feet
500 year flood = El. 16.3 feet (19.9MG of water)

**Interior + River Flooding**
500 year rain + 10 year river flood = 23.8MG of water

*The 24 million gallon capacity of a Washington Monument Detention Area could handle the 500 year flood.*

-Existing 15 year Storm Sewer will stay in place.

-FEMA 100 year flood plain should move to swales + detention area away from buildings (needs to be modeled)

-Provides a backup for 17th Street Levee

-Upstream detention could greatly increase the capacity of this system.


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There are Many Questions to be addressed:

- Hydraulic modeling
- Subsurface and utility information
- Issues of storm water quality need to be acknowledged and evaluated
- Conceptual design and cost analysis (prelim estimate of $110 M)
- There are many agencies involved, no funding
- Big Question: How to leverage avoided damage cost projected to be up to $7.5 BILLION?? PPP?
Water is an Asset- Flood Adaptation could be Part of a Comprehensive Water System

- Saves millions of $ per year in wastewater costs – could pay for itself
- Could divert clean water pumped from basements along Constitution and the Metro from Blue Plains into the Constitution Avenue Swale
- Could filter grey water from adjacent buildings
- Decreases load on Blue Plains
- Swale could provide Mall irrigation and charge the water feature at Constitution Garden

The 2002 DC Combined Sewer Overflow Control Plan

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Cost of 2006 flood- IRS alone= $54 M
Projected cost of Bioswales and Retention Area= $110 Million

- **TREASURY INSPECTOR GENERAL FOR TAX ADMINISTRATION**
  
- The Internal Revenue Service Building Flood Caused No Measurable Impact on Tax Administration
  
  - February 7, 2007
  
  - Reference Number: 2007-30-028

- Damage estimates as of September 2006 show the GSA will spend approximately $36.8 million to respond to the flood and repair the IRS Headquarters building. The IRS is expecting to spend an additional $17.2 million to move personnel to and from temporary rented work space, assist with cleanup efforts, and replace damaged equipment.
View of Proposed Retention Area at the Washington Monument

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View of Proposed Retention Area at the Washington Monument Flooded (Exact Canal Footprint)

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