The Committee of 100
on the Federal City

www.committeeof100.net

Mr. Kevin D. Brandt, Superintendent
Kevin_Brandt@nps.gov
C&O Canal National Historical Park Headquarters
1850 Dual Highway
Suite 100
Hagerstown, MD 21740

January 5, 2017

RE: Comments on the National Park Service Environmental Assessment of the C&O Canal National Historical Park Georgetown Plan

Dear Superintendent:

The Committee of 100 on the Federal City (C100) was founded in 1923 and continues to work toward protecting and enhancing, in our time, Washington's historic distinction, natural beauty and overall livability. The Committee is concerned with respecting the L'Enfant Plan of 1791 and the McMillan Commission Plan of 1901-02, while accommodating the needs of the 21st Century, and with providing responsible oversight in all pertinent aspects of citywide planning. These include parks and conservation, historic preservation, visual planning and architecture, land use regulation and renewal planning, pollution control and environmental protection, and transportation planning.

The Committee is pleased to submit the following comments on the Environmental Assessment under the National Environmental Policy Act (NEPA). A copy of this letter will be sent to parkplanning.nps.gov/Georgetowncanalplan. Our comments under Section 106 of the National Historic Preservation Act will be submitted in a separate letter.

Summary
The concept plan offers excellent ideas, including refilling the canal, restarting canal boat rides, adding a new visitor center, improved signage, and grading the towpath for safety. The canal has endured repeated and severe floods, scouring the canal and damaging its structure. Therefore, for the concept plan to succeed, every alternative selected must be sustainable, able to withstand flooding. For example, flood-vulnerable alternatives such as boardwalks, elevators, new flower beds, and alternatives B and C for the towpath should be re-evaluated.

NPS states that the canal floods approximately every 10 years. An NPS publication, *Historic Resource Study: Chesapeake & Ohio Canal*, documents that the canal flooded

38 times during the 19th century. The canal flooded again in 1902, 1907, 1914, 1924, 1936, 1942, 1972, and 1996. Many of these floods damaged the Georgetown section.[1] The most recent major flood was in 2010.[2] Climate change, rising river levels, and more frequent extreme rain events will combine to make future canal floods more severe.

In 2016, a study was done for the National Park Service (NPS), *C&O Canal Lower Reach Flood Response Plan*. This study appears to be very important for the Environmental Assessment, but is not yet public, and we urge that it be posted on the PEPC website and used in evaluating the environmental impacts of the concept plan.

More detailed information and questions are contained in the attachment to this letter.

Thank you for considering our comments. For additional information or questions please email info@committeeof100.net or call 202.681.0225.

Sincerely,

Stephen A. Hansen, Chair
Committee of 100 on the Federal City

Attachment

cc:
parkplanning.nps.gov/Georgetowncanal plan
Kevin_Brandt@nps.gov
Tammy M. Stidham, National Park Service Tammy_stidham@nps.gov
Kate Johnson, DOEE Climate Change Program analyst Katherine.johnson@ dc.gov
Alison R. Greenberg, Executive Director, Georgetown Heritage
agreenberg@georgetownheritage.org
David Maloney, DC SHPO, OP david.maloney@dc.gov
Thomas Luebke, Secretary, CFA tluebke@cfa.gov
Matthew Flis, Lee Webb, NCPC matthew.flis@ncpc.gov, lee.webb@ncpc.gov
Rob Nieweg, Betsy Merritt, Will Cook, NTHP rnieweg@savingplaces.org
emerritt@savingplaces.org wcook@savingplaces.orgRebecca Miller,
Peter Sefton, DCPL Rebecca@dcpresevation.org
psefton@comcast.net
Charlene Dwin-Vaughn, ACHP cvaughn@achp.gov
Peggy McGlone, Washington Post peggy.mcglone@washpost.com

[1] Harlan D. Unrau, Historic Resource Study: Chesapeake & Ohio Canal (Hagerstown, Md.,: National Park Service, 2007, 277-318, 312).
[2] "Canal Flood Information," www.nps.gov./choh/learn/historyculture/Canalfloods. Internet; accessed 2 Dec. 2017. Donna Childress, "Heavy Flooding Impacts C&O Canal National Historical Park, Great Falls Park, And Other D.C. Area Parks," www.nationalparkstraveler.org , 26 Mar. 2010.

ATTACHMENT

COMMITTEE OF 100 COMMENTS ON THE NATIONAL PARK SERVICE ENVIRONMENTAL ASSESSMENT OF THE C&O CANAL NATIONAL HISTORICAL PARK GEORGETOWN PLAN

Purpose and Need for the Project:, including sustainability in floods

The concept plan states:

> The purpose of the proposed action is to develop a plan to enhance the one-mile portion of the C&O Canal National Historical Park (NHP) in Georgetown, from the Zeromile marker to the Alexandria Aqueduct. The plan will focus on addressing deferred maintenance issues and related safety and accessibility concerns associated with the towpath; improving connections between Georgetown and the C&O Canal towpath; enhancing visitor experience through increased signage and optimizing underutilized areas. The plan will be developed in a matter that addresses the identified needs, while also preserving the historic character and cultural significance of the C&O Canal NHP and the Georgetown Historic District (DC Landmark, National Register of Historic Places, National Historic Landmark).
>
> The plan is needed to provide a coordinated approach to address the following concerns:
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> • Portions of the towpath are uneven, narrow, and poorly lit, creating potential safety hazards;
> • Visitors with limited mobility can only access the towpath from Grace Street, NW (south of the canal). All other access points are not compliant with the Architectural Barriers Act Accessibility Standards (ABAAS);
> • Many access points to the towpath are not readily visible or unknown due to lack of signage;
> • The park desires to expand opportunities for interpretation, education, and cultural programming;
> • The park has limited amenities and facilities for visitor comfort such as seating, drinking fountains, and rest rooms; and
> • Several plazas along the canal are underutilized and could be developed to provide additional recreational activities.

Sustainability: C&O Canal flooding

NPS states that the canal floods approximately every 10 years. The most recent major flood was in 2010.[3] As discussed below, major floods are likely to be more frequent and

[3] "Canal Flood Information," www.nps.gov./choh/learn/historyculture/Canalfloods. Internet; accessed 2 Dec. 2017. Donna Childress, "Heavy Flooding Impacts C&O Canal National Historical Park, Great Falls Park, And Other D.C. Area Parks," www.nationalparkstraveler.org , 26 Mar. 2010.

more severe. For these reasons, all planning for the C&O Canal must accept the realization that the canal is in a flood plain, has already flooded many times, and will flood again in the future. Therefore, in order for the concept plan to succeed, every alternative selected must be flood-sustainable.

We understand that HDR, Inc. completed a study for NPS, *C&O Canal Lower Reach Flood Response Plan* (December 2016), and that this study assesses aspects of flooding including Rock Creek, and possible overflow or rupture of a sewer line in the Potomac River leading from Virginia to the Blue Plains Advanced Wastewater Treatment Plant in Southwest Washington, which could cause sewage to flow into the canal.[4] Posting this study on the PEPC website would assist everyone participating in the Environmental Assessment.

An NPS publication, *Historic Resource Study: Chesapeake & Ohio Canal*, documents that the canal flooded 38 times during the 19th century, and many of these floods damaged the Georgetown section.[5] The 1889 flood was particularly destructive, damaging stonework, mills, warehouses, and wharf facilities in the Georgetown section. The mole and towpath were washed badly, and 1,200 cubic yards of material was deposited in the basin. The steam dredge and scows in the Georgetown section were gone. One observer wrote, "From the mouth of the Monocacy to Georgetown, nothing but ruin can be seen."[6]

The canal flooded again in 1902, 1907, 1914, 1924, 1936, 1942, 1972, and 1996. Many floods damaging the Georgetown section resulted from the Potomac River flooding and breaking through to the canal, and flooding the canal downstream. In 1936, the Potomac flooded into the canal near the Old Angler's Inn and the banks at the Georgetown Level were washed and the prism (the shape of the canal in cross-section) was heavily silted.[7] The 1972 flood (Hurricane Agnes) was a "major disaster." Virtually every bridge and 95 percent of the picnic tables were lost.[8] The canal suffered two damaging floods in 1996. The concrete retaining wall built at the Old Angler's Inn after the 1936 flood gave way in January 1996 and, the flood covered "more than 80 percent of the canal, ripping out canal banks and damaging many historic structures," leaving behind deep mud, silt, debris and downed trees." Hurricane Fran, September 1996, wiped out the repairs made after the January flood, and repairs had to begin over again.[9]

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[4] See www.dcwater.com/potomac-interceptor.

[5] Harlan D. Unrau, Historic Resource Study: Chesapeake & Ohio Canal (Hagerstown, Md.,: National Park Service, 2007, 277-318, 312).

[6] "Maryland and the Canal," Washington Star, 10 June 1889, 5.

[7] Historic Resource Study, 319. Karen Grey, "The Canal Prism: Variable and Dangerous," Along The Towpath, June 2013.

[8] Duncan Spencer, "Flood Ruined C&O Canal," Washington Star, 30 June 1972, 23.

[9] Napier Shelton, Potomac Pathway: A Nature Guide to the C & O Canal (Arglen, Penn.: Schiffer Publishing, Ltd. 2011, 100-101).

[9] Duncan Spencer, "Flood Ruined C&O Canal," Washington Star, 30 June 1972, 23. Erik Wemple, "Hate Canal," Washington City Paper, 7 Nov. 1997. The Georgetowner reported floods in 2010 and 2011. Samantha Hungerford, "C&O Canal Makes Emergency Flood Preparations," 9 Sept. 2011. Jim Keary and Arlo Wagner, "River's rise washes out morning rush - "Today may see repeat of slow ride," Washington Times, 10 September 1996, sec. A, p. 1. The Potomac River crested at Georgetown about 5:45 a.m.

Washington Harbour, on the Potomac River, is approximately one mile northwest of the Zeromile marker and one-half mile west of Rock Creek, offers useful data on flooding. The complex was built with flood gates, which needed to be raised during seven floods between 1986 and 2012.[10]

Potomac River Flooding

The flood stage on the Potomac River is 7 feet above average level. Moderate flooding occurs at 8 feet, major damage begins at 10 feet.[11]

Month	Year	Feet above average river level--Georgetown
November	1877	16.5
June	1889	19.5
March	1924	8.0
March	1936	20.25
October	1942	17.72
June	1972	15.4
February	1979	13.1
November	1985	11.75
April	1987	8.0
March	1994	10.3
January	1996	13.8
September	1996	12.1
September	2003	13.75
April	2011	10.00 -12.00
October	2012	9.0

The *Historic Resource Study* concludes: "One of the principal reasons for the collapse of the canal was the recurrence of great floods which repeatedly wrecked the waterway. The forces of nature were continually at work tearing down the physical fabric of the waterway and interfering with its trade."[12] Although flooding has and will damage canal infrastructure, NPS notes that floods provide important environmental benefits.[13]

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yesterday at 13.75 feet, 6.75 feet above flood stage - about a foot less than in January - and dumped about 4 feet of water onto 31st and Water streets in Georgetown. The water covered only about two blocks of Water Street, and businesses were prepared with sandbags in front of their doors."

[10] "Washington Harbour," wikipedia. Internet; accessed 29 Nov. 2017.

[11] Steve Vogel, "Bulk of Flooding Expected in Old Town, Washington Harbour." Washington Post., 28 June 2006. cited in "Washington Harbour," wikipedia. Ivelisse DeJesus, "Flood? What Flood? They Asked Dryly." Washington Post., 10 February 1996. Karlyn Barker and John Ward Anderson, "Destructive Floods Hit D.C., Richmond," Washington Post, 8 Nov. 1985, sec. A, p. 1. Unrau, Historic Resource Study, 312, 318.

[12] Historic Resource Study, 322.

[13] "Flooding, of course, has been part of the Potomac River for millions of years. As a result, flood-adapted habitats such as floodplain forests and scourbars, have been created. These habitats have gained significance in Maryland and nationally due to increasing habitat loss and fragmentation from development and invasion of alien plant species. In fact, many rare plants depend on these unique habitats. ...

Increased flooding risk from climate change

The Potomac River faces increased threats of flooding for three reasons:
(1) Washington, DC, part of the Chesapeake Bay system, is sinking, which is raising river water levels.[14]
(2) Climate change is raising sea levels, and, as a result, raising river levels.
(3) Climate change is predicted to cause more frequent and more extreme rain events.

(1) Chesapeake Bay region land subsidence

The Chesapeake Bay is an inland estuary of the Atlantic Ocean, bordered on the north by Maryland and in the south by Virginia. It was formed by a crater from a meteorite that struck 35 million years ago. The region has been subsiding approximately .05 inches each year for the last thousand years, raising river levels independently from the effects of climate change.[15]

(2) Rising sea and river levels from climate change

DC Department of Energy and Environment (DOEE) released its "Climate Change Adaptation Plan" (2013) describing expected sea level rise. DOEE's 2016 report, "Vulnerability & Risk Assessment: Climate Change Adaptation Plan for the District of Columbia" considers the projected effects of climate change in 2020, 2050, and 2080, such as higher water levels. The Georgetown section of the canal is within the 500-year (2080) flood plain. Figures 1, 2.

- Scientists predict temperature warming by two degrees Centigrade (C) by 2040, causing a global sea rise of 20 cm (7.8 inches), with even higher rises in more

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Periodic inundation of the banks of the Potomac River and bordering C&O Canal NHP benefits the natural system as a whole. Silt, enriched by nutrients and minerals, is deposited by flood waters creating fertile soils which foster biological diversity.

Floodplain forest habitat comprises about 85% of the park and benefits from such soils. Many spring wildflowers that attract the public to the park thrive in this habitat.
Fertile soil can also be scoured away by the swift river, leaving substrates of rock or sand on the river's edge. These dynamic habitats are called floodplain scourbars which support unique floral communities. Floods also carry seeds great distances helping rare and endangered species to establish in new locations. Unfortunately, this also helps alien weeds that may out compete native plants. Some trees, such as silver maple and sycamore, take advantage of the potential for water transport by producing seeds that float. While some plants gain wider distribution, others can disappear entirely from certain locations. Floods also clear debris from the forest floor, but can damage trees by the powerful rush of water.

Although some organic matter and nutrients are lost from the system, disturbances, like floods, make room for new growth and allow sunlight to reach plants and young trees." "Canal Flood Information," www.nps.gov./choh/learn/historyculture/Canalfloods.

[14] Kelsey Robertson, "Resilient History: Protecting Chesapeake Bay Coastal Historic Districts from Rising Seas Through Adaptive Planning," Thesis, Masters of Professional Studies in Urban & Regional Planning, Georgetown University (2016).
National Oceanic and Atmospheric Administration (NOAA), Adapting to Climate Change: A Planning Guide for State Coastal Managers, (Silver Spring, Md.: NOAA Office of Ocean and Coastal Resource Management: 2010), noaa.gov/climate/adaptation.html.

[15] United States Geological Survey (USGS), The Chesapeake Bay: Geologic Product of Rising Sea Level (Reston, Va: USGS, 1998), http://pubs.usgs.gov/fs/fs102-98/.

than 90 percent of coastal areas.[16] If warming exceeds two degrees C, by 2100 the sea level rise is estimated to exceed 1.8 meters (5.94 feet) for 80 percent of coastal areas.

- Other predictions are similar: By 2100, estimates of sea level rise range from three feet (Intergovernmental Panel on Climate Change), to five feet (US Army Corps of Engineers (USACE)), to 6.5 feet (National Oceanic and Atmospheric Administration (NOAA)).[17]

- The Potomac River is tidal, and therefore sea level rise will raise the water level in the river.

- In the last 90 years, the water level in the river has already increased 11 inches, and nuisance flooding has already increased 300%.[18] Nuisance flooding is flooding experienced at high tide (as established by the National Weather Service).

- NOAA has been monitoring sea levels and flooding in DC since 1924, and the mean sea level has been increasing at the rate of 3.21 mm (0.126 inches) per year. Nuisance flood level is 0.31 meters (1.22 feet) above mean high higher water.[19] Flooding is already increasing.

- Several sections in the project appear in Federal Emergency Management Agency's (FEMA) 2010 flood plain. Figure 3.

- By 2080, the water level in the river is expected to rise an additional 3.4 feet.[20]

- Sea levels (and river water levels) may rise higher and faster, if the rates of ice loss accelerate, as reflected in USACE's estimate of a five-foot sea level rise, and NOAA's estimate of a 6.5-foot rise.[21]

As discussed below, boardwalks are proposed at two locations.

(3) <u>More frequent extreme rain events</u>

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[16]Svetlana Jevrejeva et al., "Coastal sea level rise with warming above 2◦ C," Proceedings of the National Academy of Sciences, www.pnas.org/cgi/doi/10.1073/pnas.1605312113. National Aeronautics and Space Administration, "Adapting to a Changing Climate: Federal Agencies in the Washington, DC Metro Area," (2012) www.mwcog.org. Internet; accessed 13 Nov. 2016. Authorities cited in DOEE, "Wildlife Action Plan," 114-117 (2015).

[17]Cited in Elizabeth Kolbert, "The Siege of Miami," The New Yorker, Dec. 21 and 28 (2015), 42-50, 42.

[18]NOAA, William Sweet, et al., "Sea Level Rise and Nuisance Flood Frequency Changes Around the United States." NOAA Technical Report NOS CO-OPS 073, vi (2014).

[19]NOAA, "Sea Level Rise and Nuisance Flood Frequency Changes Around the United States.".

[20] U.S. Army Corps of Engineers estimate, cited in DOEE, Climate-Ready DC," 3.

[21]DOEE, "Climate Ready DC," 2-3. DOEE, "Vulnerability & Risk Assessment," 19. See Elizabeth Kolbert, "A Letter from Greenland: A Song of Ice: What happens when a country starts to melt?" The New Yorker, 24 Oct. 2016, 50-61.

As a result of climate change, a 100-year rain event is projected to occur once in 25 years by 2050 and once in 15 years by 2080. (A 15-year rain event is 5.2 inches of rain during a 24-hour storm.[22] An extreme rain event, eight inches of rain, is a "100 year rain event.")

Annual precipitation is expected to remain approximately the same, but concentrated in fewer events, and coastal storms will be more intense. In the future, fewer, more intense precipitation events, combined with more intense coastal storms, when added to the predicted rise in the river's water level is expected to further increase the risk of flooding in more areas. (For precipitation, the 2080 higher scenario is 14 inches for the 100-year, 24-hour storm, and the lower scenario is five inches for a 15-year, six-hour storm.)[23] Figure 4.

Heavy rains cause flooding and pollution from storm water runoff.[24] DOEE's maps, based on data from the USACE and the FEMA, show areas in 2010, 2020, 2050, and 2080, areas of known flood risk, a proxy for priority risk areas.[25]

Flood sustainability of alternatives

Flood sustainability is necessary to avoid adverse impacts from adopting any of the Alternatives. For this reason, any alternative selected must be able to withstand flooding, be easy and economical to repair or replace, and be least likely to washed away to clog the canal or become debris in the Potomac River, an adverse effect on the river, engineered structures such as bridges, and a danger to navigation.[26] The simpler Alternatives A are generally more sustainable than Alternatives B or C.

More sustainable alternatives

Leveling the towpath (Towpath Alternative A), improving access, adding way finding signs at street level or using mobile apps (e.g., C&O Canal Explorer Mobile App, from www.canaltrust.org) are beneficial improvements that should be sustainable.
The ticket kiosk, boat launch and renovated NPS office are essential for the boat rides, and the pollinator meadow should be economical to restore. A new visitor center could be designed to be sustainable.

The Grove and The Locks show a more restrained and generally better approach, regrading the towpath, and minimal interventions.

Less sustainable alternatives

[22]DOEE, "Vulnerability & Risk Assessment," 38.
[23]DOEE, "Vulnerability & Risk Assessment," 20.
[24]DOEE, "Climate Ready DC," 2-3.
[25]DOEE, "Vulnerability & Risk Assessment," 20.
[26] Ryan N. Tyler, "River Debris: Causes, Impacts, and Mitigation Techniques, "prepared for Ocean Renewable Power Company by the Alaska Center for Energy and Power (2011) www.uaf.edu. Internet; accessed 4 Dec. 2017.

The Towpath Alternative B alters the canal walls, adding a new layer of stone, and Alternative C adds a cantilevered edge over the canal or a vegetated edge.[27] These interventions would be more costly to repair if damaged, than just repairing any damage to the original walls of the canal.

Boardwalks are proposed for the Walls. They compromise this industrial section of the canal, and appear to be susceptible to flood damage, to becoming debris, and create unnecessary infrastructure to be repaired or replaced. Depending on the expected useful life of these boardwalks, they should be evaluated under the flood plains for 2010, 2020, 2050, or 2080.

The Zeromile marker, a wild partially secluded place, is right on the river, and the proposed new plantings, seating, and floating classroom should be re-evaluated for flood sustainability. Depending on its useful life, the boardwalk in Alternative B may be susceptible to damage, and if so may create floating debris, and need repair/replacement. The nearby Washington Harbour boardwalk has been damaged by flooding.[28]

New hardscape (The Markets, The Walls) detracts from the historic experience of the canal and appears susceptible to flood damage.

Three elevators are proposed: The Walls, Market Places, and The Bend (34th Street) . Water-damaged elevators would be expensive to repair or replace. Access for disabled visitors should be reevaluated for different locations, or using more sustainable technology.

New flowerbeds, e.g., at the Bend, detract from the historic industrial landscape. New trees are proposed for the Walls, the Locks, and the Grove. These elements are subject to destruction in a flood, washing away into the canal or the river creating silt and debris in the canal or the river.

The Rock Creek Confluence is subject to flooding both from the canal and from Rock Creek. The sloped lawn/nature classroom, and native riparian planting are in a low elevation and are very vulnerable. For this reason, any new plantings should be able to withstand flooding, and a list of appropriate wetlands-friendly plants should be developed and used in the alternatives.[29] The proposed footbridges need to be designed for flood resilience.

Drinking fountains (see Purpose and Need), lighting, benches (Towpath Alternatives B, C), chaise lounges (The Walls), tables and chairs (The Grove), lounge chairs (The Bend), and hammocks (the Zeromile marker, Alternative B) are vulnerable to being washed away but should not be costly to replace (with the possible exception of the lighting).

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[27] At the November 2, 2017 public meeting, one of the featured speakers mentioned possibly engraving the names of former landowners in the new stone edge. This information can be most easily and economically communicated in a phone app.

[28] "Washington Harbour," wikipedia. Internet; accessed 29 Nov. 2017.

[29] See DOEE Wildlife Action Plan (2016), Ch. 3, Habitats.

Purpose and Needs

We agree that deferred maintenance must be addressed. As noted in the Purpose and Needs statement, an essential goal is "preserving the historic character and cultural significance of the C&O Canal NHP and the Georgetown Historic District (DC Landmark, National Register of Historic Places, National Historic Landmark)." Refilling the canal, bringing back the canal boats and the mules are key to meeting these goals. Other Purpose and Needs of the project can be met:

• *Portions of the towpath are uneven, narrow, and poorly lit, creating potential safety hazards:*

Towpath Alternative A, as noted in that alternative, would create a level, safe path, and is the most flood-sustainable of the Alternatives.

• *Visitors with limited mobility can only access the towpath from Grace Street, NW (south of the canal). All other access points are not compliant with the Architectural Barriers Act Accessibility Standards (ABAAS):*

Please see below re: possible additional ABAAS access from behind the Four Seasons Hotel. Because of the vulnerability of the three proposed elevators to flooding, these elevators should be restudied to see if more flood-sustainable technology could be used, and if all three elevators are in fact needed.

- *Many access points to the towpath are not readily visible or unknown due to lack of signage:*

We agree that additional way finding signs are needed, to direct visitors to and from the canal, the ticket kiosk and boat launch, interpretive center, and to food and rest rooms in Georgetown.

- *The park desires to expand opportunities for interpretation, education, and cultural programming:*

The new interpretive center should be a major benefit. We suggest that phone apps would be a flexible and cost-effective method for interpretation, education. The Aqueduct offers an opportunity for events, and events have been held at the Locks.

- *The park has limited amenities and facilities for visitor comfort such as seating, drinking fountains, and rest rooms:*

The concept plan proposes rest rooms for the restored NPS office, and in a new interpretive center. The park is in an attractive urban area which offers seating, water, plus dining; nearby businesses should be encouraged to provide amenities to canal visitors.

• *Several plazas along the canal are underutilized and could be developed to provide additional recreational activities:*

It would be helpful to know what recreational activities are needed at these locations. NPS plans to resume the boat rides, and the Locks and the Aqueduct can be used for

public events. If the property owners agree, these plazas might be used to host activities, without the need to alter the canal's walls.

Questions

While the plan contains graphics and some text for each section, considerably more information is needed on existing conditions, what is proposed, and the reasons for the new proposals. In future reports, the plan maps should be "continuous", rather than the present arrangement, where in some cases there are small gaps between different sections.

- Are there plans to dredge the canal? If so, to what depth and in which sections?

- What is the proposed surface of the towpath in each section and under each Alternative?

- Purpose and Needs states that the canal is poorly lit, but it appears that the canal is not now open at night.[30] Will this change? If so, what is the lighting plan and will all lighting fixtures be flood-sustainable?

- Would all lighting meet the standards for a seal of approval from the International Dark-Sky Association?[31]

- Purpose and Needs states, "Visitors with limited mobility can only access the towpath from Grace Street, NW (south of the canal). All other access points are not compliant with the Architectural Barriers Act Accessibility Standards (ABAAS)." Is it possible to modify the access and towpath behind the Four Seasons Hotel to comply with ABAAS, and create an additional access point?

- Will more people be attracted to the canal and adjacent areas? How many more? What is the maximum number of visitors that the canal infrastructure can accommodate? What methods can be used to regulate the number of visitors, if necessary?

- How will visitors reach the canal? Public transportation, ride sharing, private automobile, biking, walking? What are the parking needs because of increased visitation to the Canal? What will be the effect on air quality?

Questions on mules

- The mules are a vital part of the canal's history and their welfare is very important.[32]

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[30] "The Chesapeake and Ohio Canal National Historical Park is open during daylight hours year round." www.nps.choh/planyourvisit/hours.htm updated 28 Oct. 2016.

[31] Fixtures approved by IDA employ warm-toned (3000 K or lower) white light sources or employ amber light sources or filtered LED light sources, are full-shielded, emit no light above the horizontal plane, have no sag or drop lenses, side light panels, or uplight panels, etchttp://darksky.orf/fsa/apply-fsa.

[32] "Meet the Mules," https://www.nps.gov/choh/planyourvisit/meetthemules.htm.

- Will the mules be housed in a stable in the mule yard?
- What sections of the canal will the mules traverse?
- What routes will the mules follow to pull the future canal boat from the Locks to the west?
- How far west will they pull canal boat (as far as the Aqueduct or beyond)? This decision has a number of influences on the design of the canal.[33]
- The proposal to cantilever the canal edge, creating a wider towpath might interfere with mules towing the canal boat (changing the angle of the towrope). How would this arrangement affect the flow of mule and pedestrian traffic?
- What will be the surface of the towpath in those areas, and will it be safe for mules?

Rock Creek

- Where would the towpath be regraded? Near Rock Creek Parkway?
- How would the West Heating Plant be accessed? Inside the wall?

The Locks

- Is the arcade in an existing building? How would it be accessed?

The Bend

- Is bridge over the canal to be changed to a more horizontal orientation? Alternative A seems to be a straighter access than Alternative B.
- Will the jasmine on the north wall remain?
- Are the proposed flowerbeds on private property?

The Aqueduct

- How is this space used currently?
- What is the distance from the shore to the edge of the aqueduct.?
- Will the new proposed surface be gravel or hardscape?
- Will railings be added? (None are there now).
- Both Alternatives include a new boathouse. Who would use it? How would it be accessed from the towpath? What is the estimated cost and the amount and source of funding for construction?

[33] In the past, canal boat rides pulled by mules began and ended at the NPS visitor center at 1057 Thomas Jefferson Street, NW. "Special Musical Boat Rides Available on the C&O Canal in Georgetown Saturdays in July By Georgetown Visitor Center." 2006. https://www.nps.gov/choh/learn/news/musicalboatridesingeorgetownduringsummer.htm

Figure 1. Projected sea level rise in DC historic districts. Arrow points to C&O Canal in the 2080 flood plain. Source: Kelsey Robertson, arrow added.

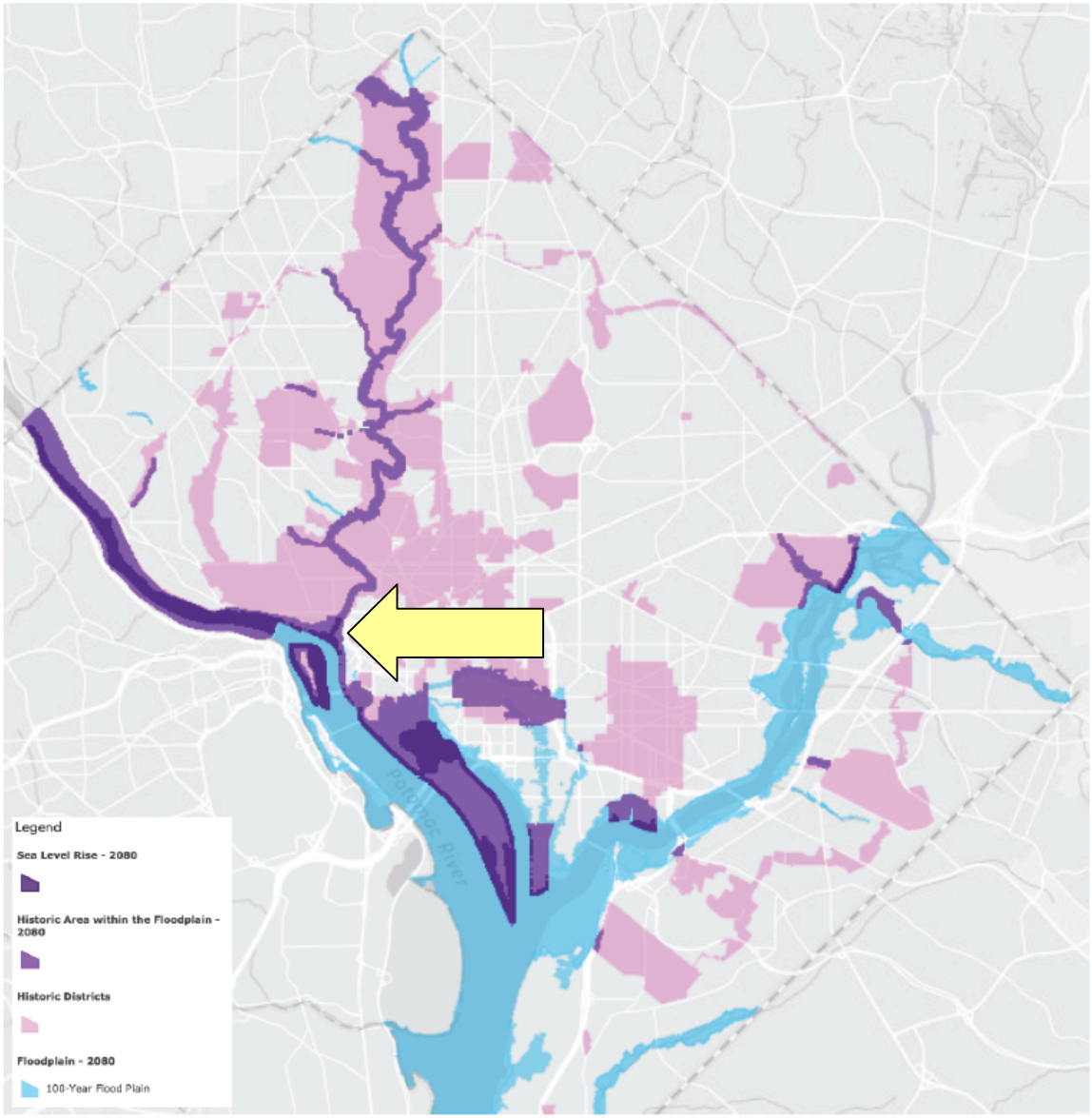
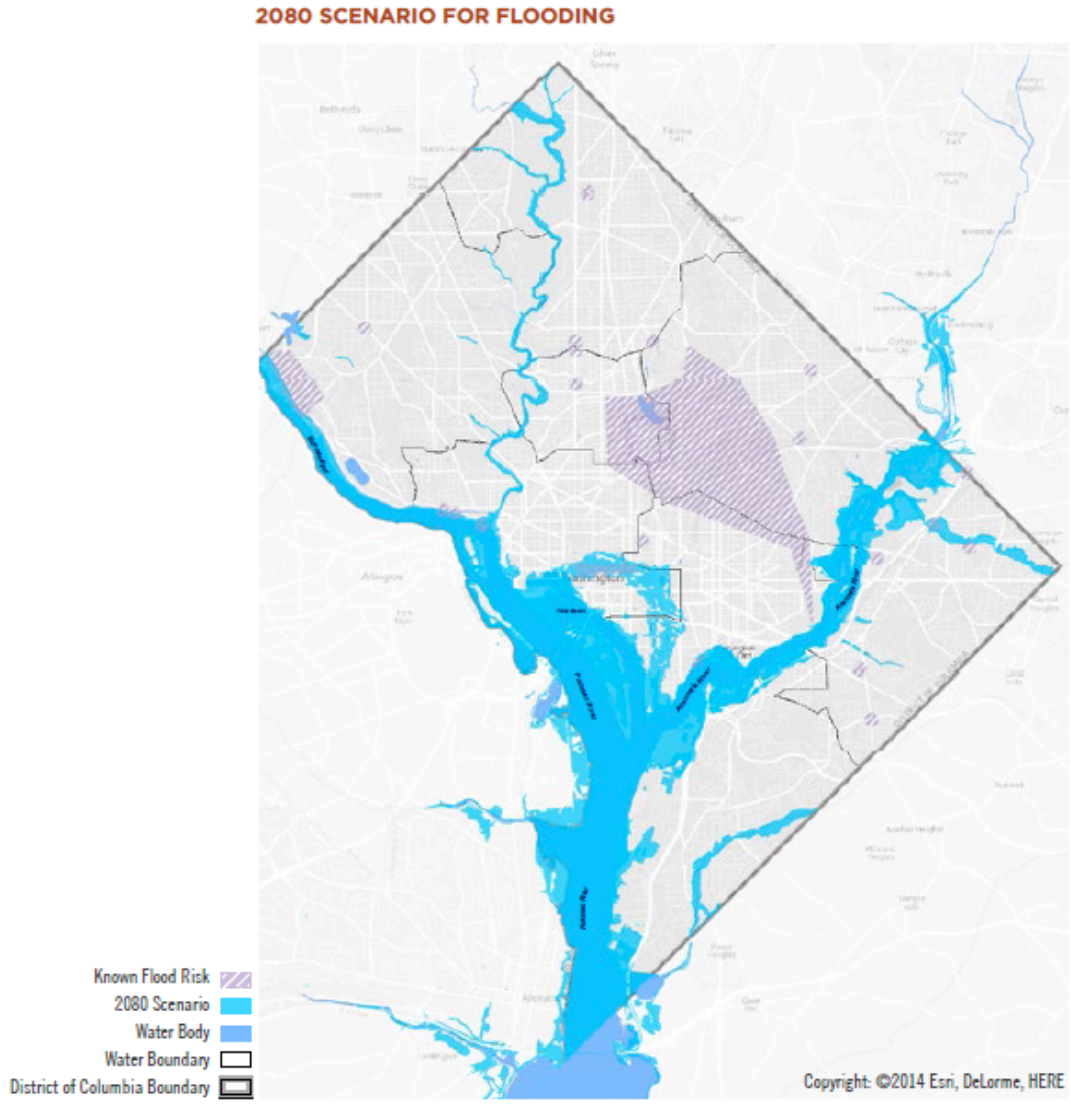


Figure 2. DOEE, "Vulnerability & Risk Assessment: Climate Change Adaptation Plan for the District of Columbia" (2016), Map 4 (500-year flood plain, 2080).



MAP 4: 2080 Scenario based on current FEMA 500-year floodplain as a proxy for the current FEMA 100-year base flood elevation + 4 feet of sea level rise. (Source: NACCS map and historic flooding as identified by stakeholders overlaid on GIS map base, Kleinfelder, 2015)

Figure 3. Zone AE: 100-year floodplain and Zone X Shaded (orange): 500-year floodplain) according to the effective Flood Insurance Rate Map, dated September 27, 2010 and FEMA approved revisions.

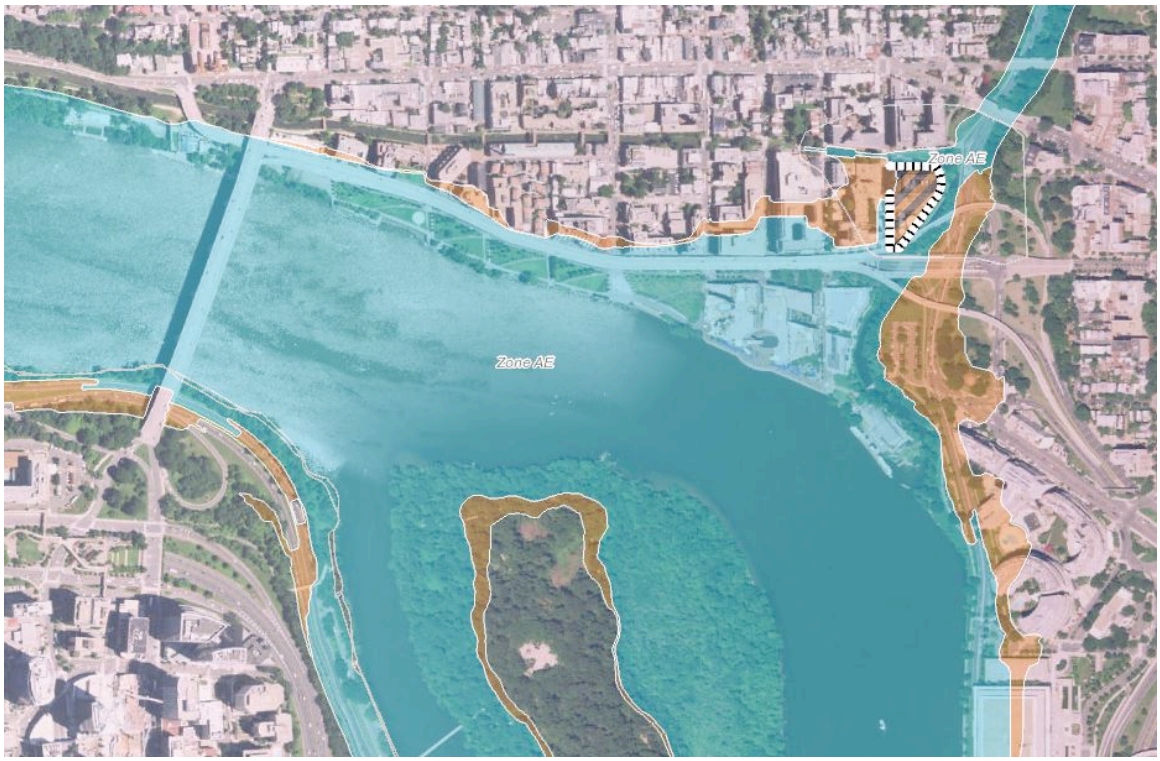


Figure 4. DOEE, "Climate Ready DC," p. 3.

Rainfall & Flooding

Rainfall: Annual amounts of precipitation have not changed significantly; however, more precipitation is falling in the fall and winter and less in the summer. What is expected to change significantly is the frequency and intensity of heavy rainfall events that can cause flooding and pollution from stormwater run-off. As shown in the chart, today's one in 100-year rainfall event could become a one in 25-year event by mid-century, and a one in 15-year event by the 2080s.