Integrated Flood Model (IFM)

WRTC / MWCOG
January 13, 2023

DEPARTMENT OF ENERGY & ENVIRONMENT

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In one slide...

The IFM will map the **depth and extent of flooding** from the three sources of flooding in the district: **riverine, tidal, and interior**, under various scenarios including **increased risk due to climate change**

The results will be **used to design and test solutions to reduce flood risk** throughout the District

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VARIABLES IN THE IFM

Variables

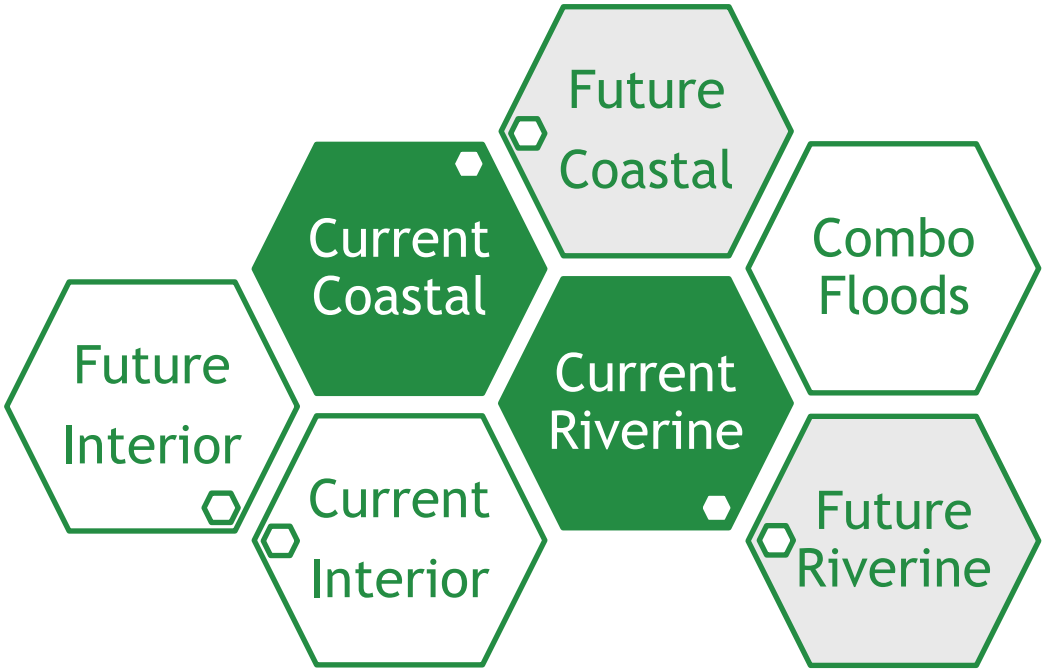
- Rainfall amount / duration
- Location of rainfall
- River levels / sea level rise
- Pump station status
- Soil infiltration rate
- Etc.

Example Outputs

- _____-yr event over 24 hours + storm surge at high tide
- 3” rain over 24 hours
- 2” rain + no pump stations
- Back to back storms

WHY DO WE NEED AN IFM?

Missing pieces in our understanding of flood risk...



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WHY DO WE NEED AN IFM?

Flooding is frequently reported outside FEMA floodplains

Flood risk increases with climate change

Need to assess risk to plan and prepare residents for the future

Source: Bloomingdale Neighborhood Blog

HOW WE GOT HERE

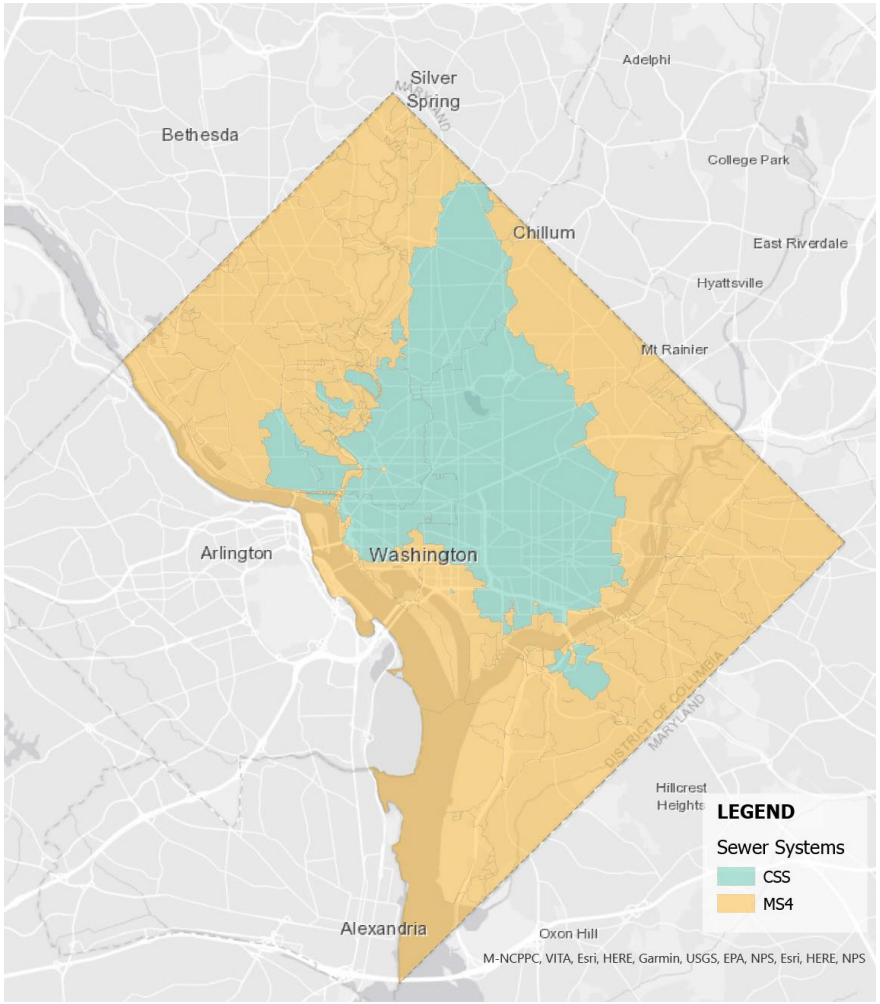
- **2015-2017:** Initial Idea for the IFM
- **2019:** Idea included in *Resilient DC* report
- **2020:** $5.7M included in District Budget
- **2020-2021:** Market research / contracting
- **2022:** Contract awarded in March, up to 5 years

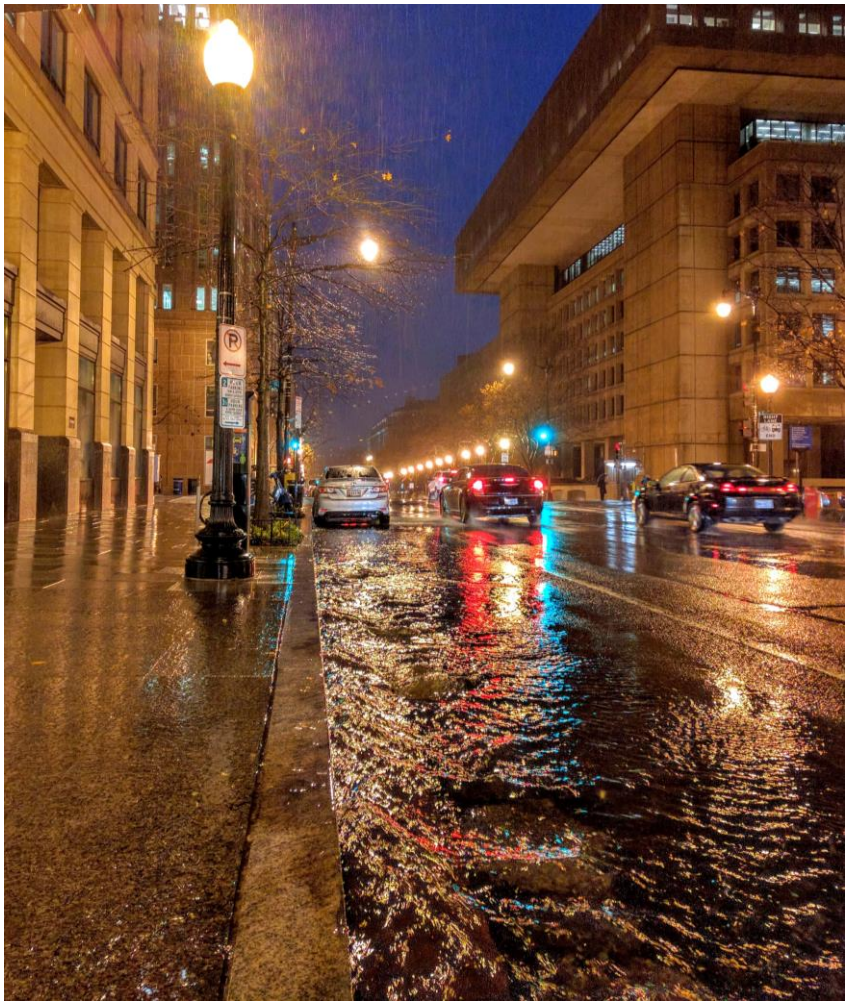
WHAT WILL THE IFM INCLUDE?

Major Tasks

C.5.2 – Meetings and Reports
C.5.3 – Detailed Work Plans
C.5.4 – Model Advisory Group
C.5.5 – Systems Architecture Document
C.5.6 – Data Collection and Management
C.5.7 – Integrated Flood Model (IFM)
C.5.8 – Materials and Connection to the Network
C.5.9 – Scenario Recommendations Document
C.5.10 – Creation of 15 Scenario Maps
C.5.11 – Training
C.5.12 – Operation Manual
C.5.13 – Framework Plan for Flood Risk Management
C.5.14 – Floodshed Management Plans
C.5.15 – Rainfall Sensitivity Analysis

WHY IDIQ? SO MANY UNKNOWNS





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WHERE WE ARE NOW

Major Tasks

C.5.2 – Meetings and Reports ..... Ongoing - monthly
C.5.3 – Detailed Work Plans ..... In progress
C.5.4 – Model Advisory Group ..... Ongoing – met May 2022
C.5.5 – Systems Architecture Document ..... In progress
C.5.6 – Data Collection and Management ..... In progress
C.5.7 – Integrated Flood Model (IFM)
C.5.8 – Materials and Connection to the Network
C.5.9 – Scenario Recommendations Document ..... Drafted in July 2022
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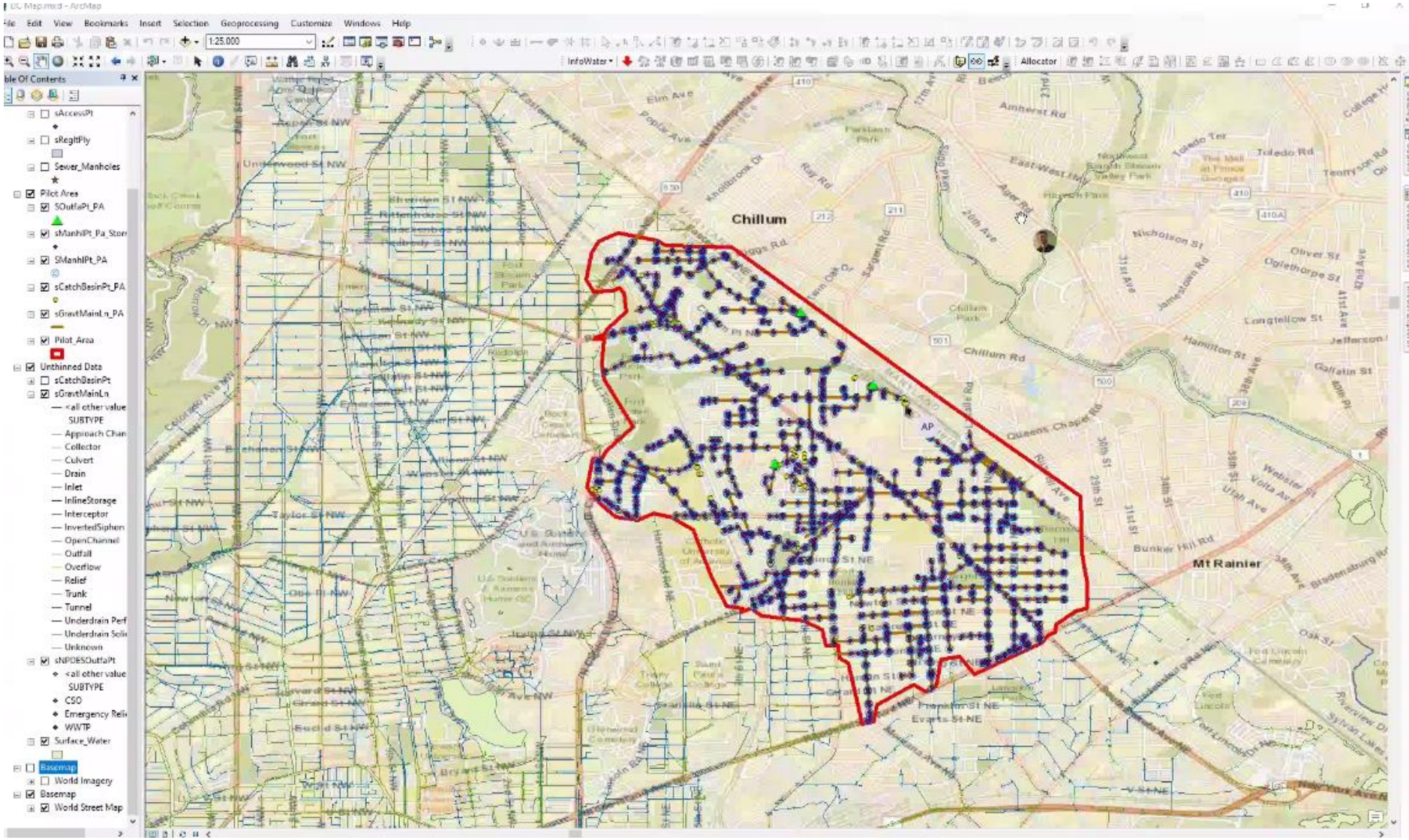
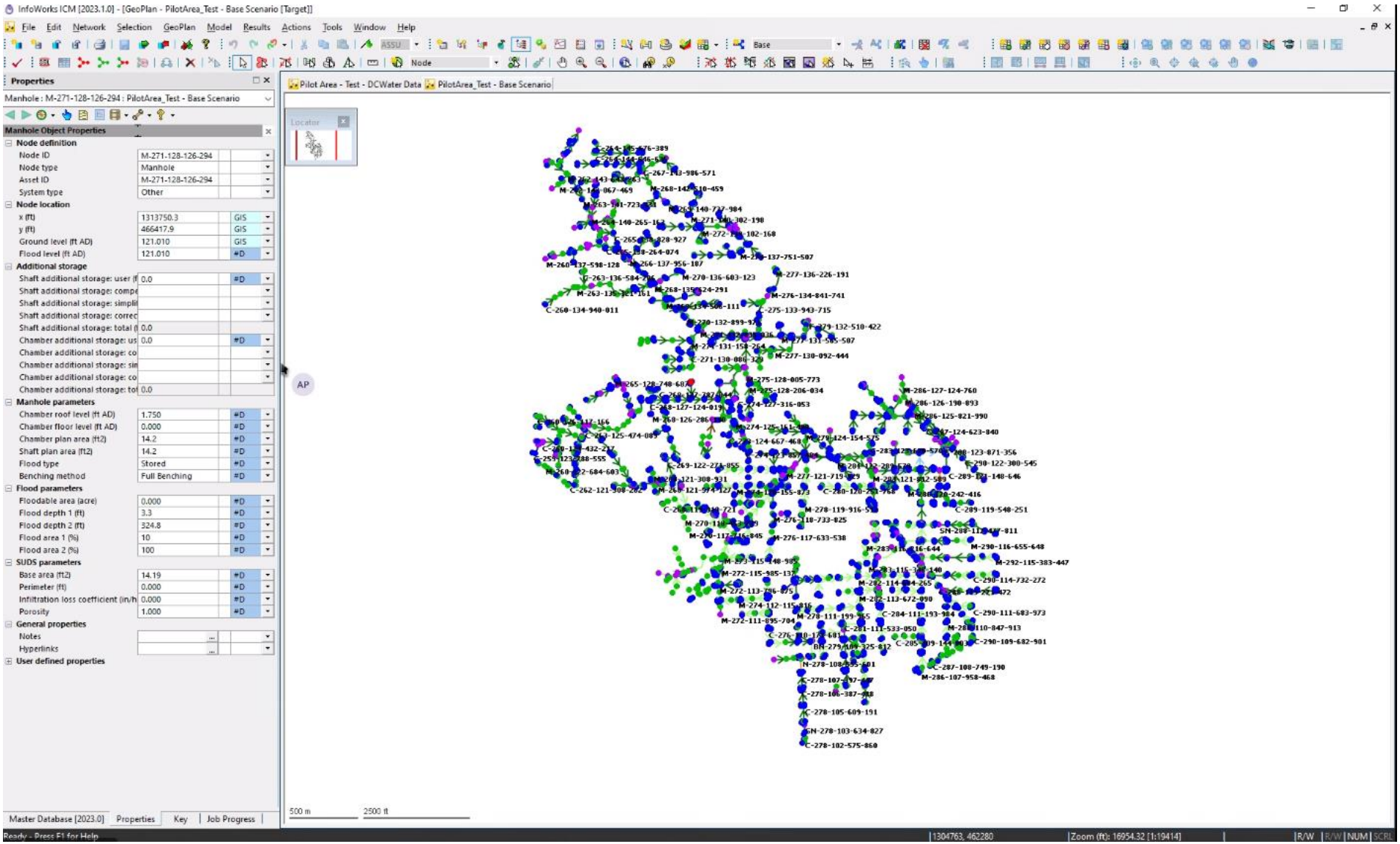
WHERE WE ARE NOW



WHERE WE ARE NOW

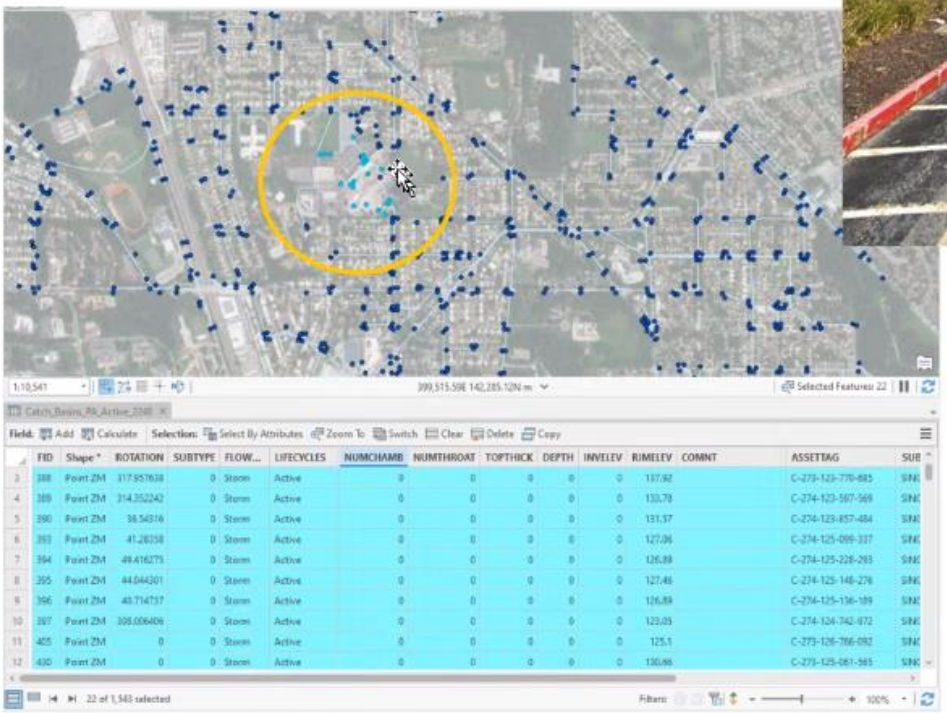


WHERE WE ARE NOW

Catch Basins subtypes: Unknown

Definition of Unknown catch basin subtype

- Elements with no data (no NUMCHAMB and or NUMTHROAT)

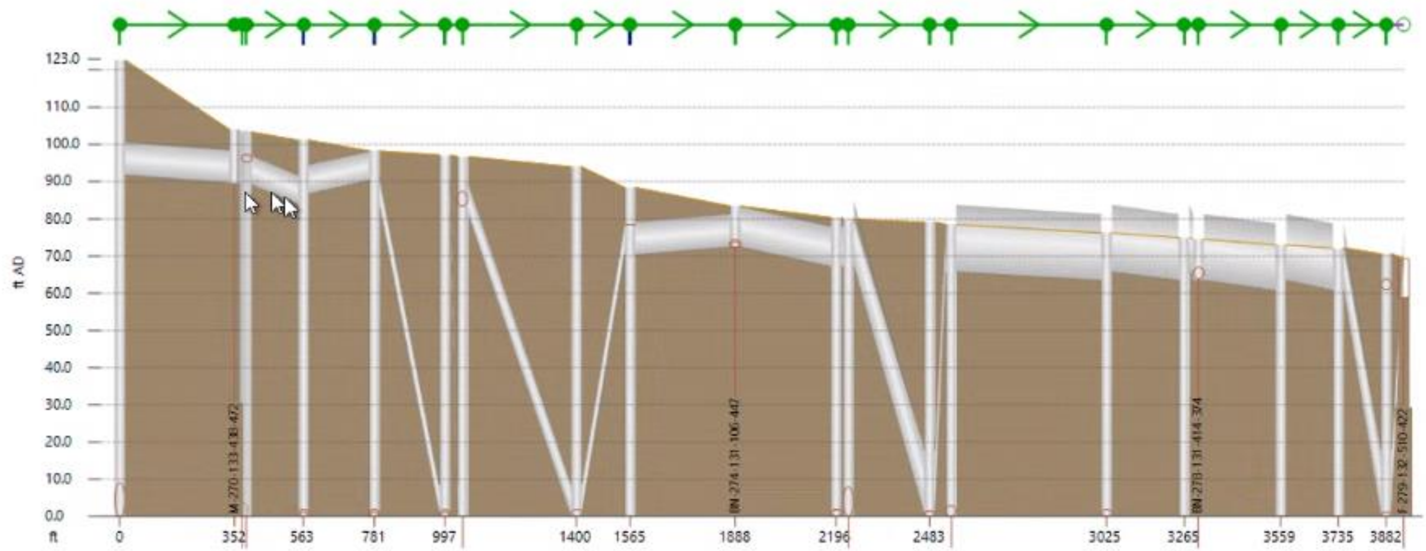


Single

If there is no data and no “relation” between the missing elements the subtype should be the most common around.

WHERE WE ARE NOW

Example 1: Original

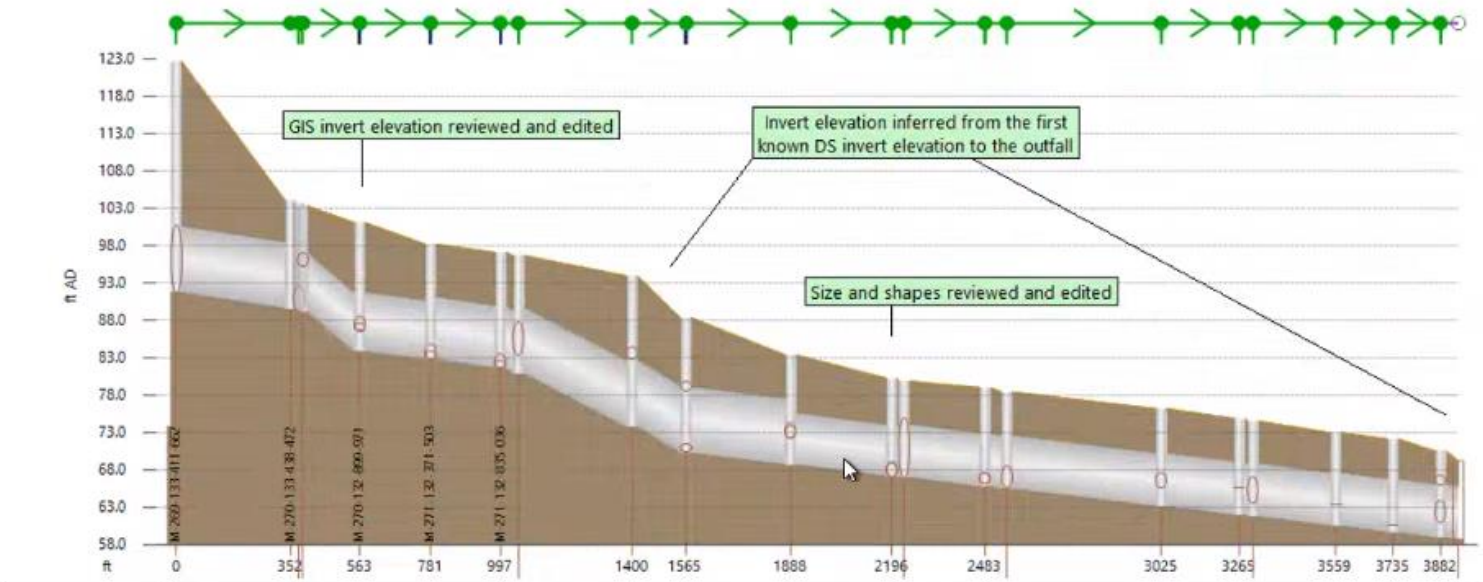


Link																	
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
width (in)	108.0	96.0	96.0	102.0	-	108.0	108.0	108.0	132.0	216.0	-	216.0	216.0	216.0	216.0	216.0	-
us inv (ft AD)	91.700	89.070	86.610	82.770	-	80.810	0.000	70.240	72.360	66.970	-	65.620	65.620	63.420	63.420	60.670	-
ds inv (ft AD)	89.550	83.860	90.250	0.000	-	0.000	70.360	72.360	67.070	0.000	-	63.420	63.420	60.670	60.670	0.000	-
grad (%)																	

Node																				
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ground (ft AD)	-	-	-	-	98.205	-	96.673	93.960	88.373	83.363	-	-	-	78.448	76.217	-	-	72.985	-	-
Ch floor lev (ft AD)	0.000	89.480	-	0.000	0.000	-	0.000	0.000	0.000	72.360	0.000	-	0.000	0.000	0.000	-	-	0.000	0.000	-

WHERE WE ARE NOW

Example 1: ICM reviewed



Link	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
width (in)	108.0		96.0	96.0	102.0	-	108.0	108.0	108.0	132.0	-	216.0	-	216.0	216.0	216.0	216.0	216.0	216.0	-
us inv (ft AD)	91.700		89.070	83.860	82.770	-	80.810	73.724	70.240	68.663	-	66.974	-	65.432	63.116	61.741	60.509	-	-	-
ds inv (ft AD)	89.550		83.860	82.770	81.540	-	73.724	70.360	68.663	67.158	-	65.757	-	63.116	61.945	60.509	59.649	-	-	-
grad (%)	0.610		2.977	0.500	0.570	-	2.040	2.040	0.488	0.488	-	0.488	-	0.488	0.488	0.488	0.488	0.488	-	-
Node	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ground (ft AD)	-	-	-	-	98.205	-	96.673	93.960	88.373	83.363	-	-	-	78.448	76.217	-	-	72.985	-	-
Ch floor lev (ft AD)	-	89.480	-	83.860	82.770	-	80.810	73.724	70.240	68.663	-	-	-	65.432	63.116	-	-	60.509	-	-

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Creating the IFM

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Using the IFM

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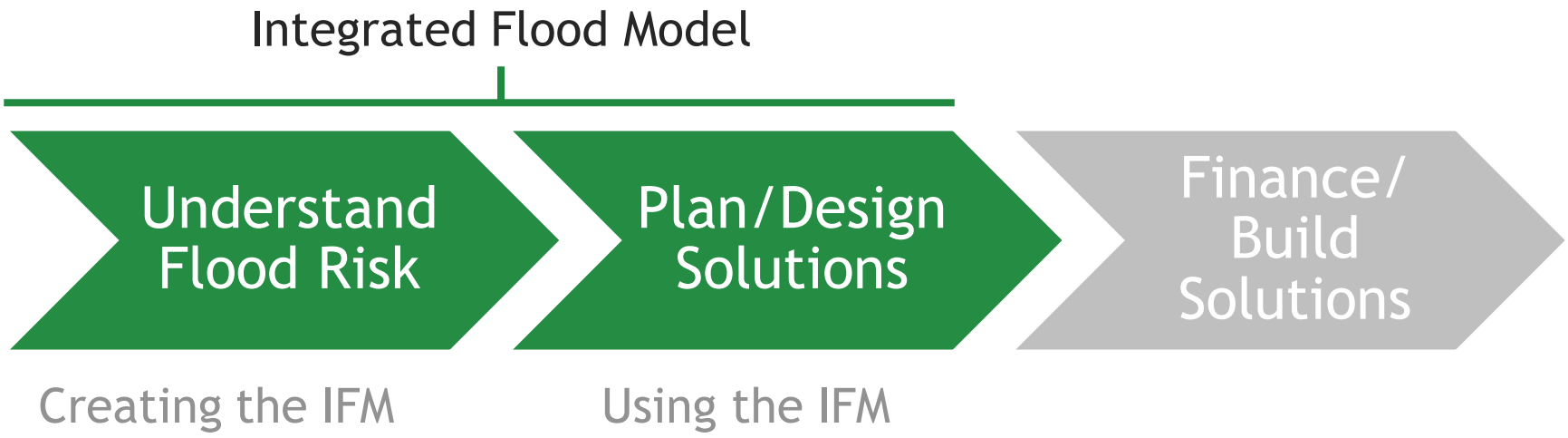
DC's Roadmap to Reduce Flood Risk



DC's Roadmap to Reduce Flood Risk

What do we want them look like?


photo Millad Pallesh

Questions?

Thank you!

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Integrated Flood Model Scope of Work

C.5.7 – Integrated Flood Model (IFM)

- Will integrate various existing and newly created H&H models together

- Will allow user to set variables prior to running. Some include:
  - Rainfall duration and depth
  - Sea level rise
  - Pump station capacity
  - Ground infiltration rate

- DOEE will be able to make as many maps as we want showing extent and depth of flooding

- Must be able to deliver 2 outcomes:
  - Outcome 1 - Creation of Scenario Maps
  - Outcome 2 - Ability to test effectiveness of proposed infrastructure

- Will be used to create Floodshed Management Plans

C.5.14 – Floodshed Management Plans

- First a Framework Plan (C.5.13)

- Multiple FMPs - high-level documents based on desktop analysis of how streets parks and other surface and subsurface spaces can be used to retain and convey water.

- Included in each FMP:
  - Concept locations of individual projects (blue-green, gray, multi-use infrastructure)
  - A construction phasing strategy
  - Rough cost estimates by project
  - Volume calculations
  - Illustrations

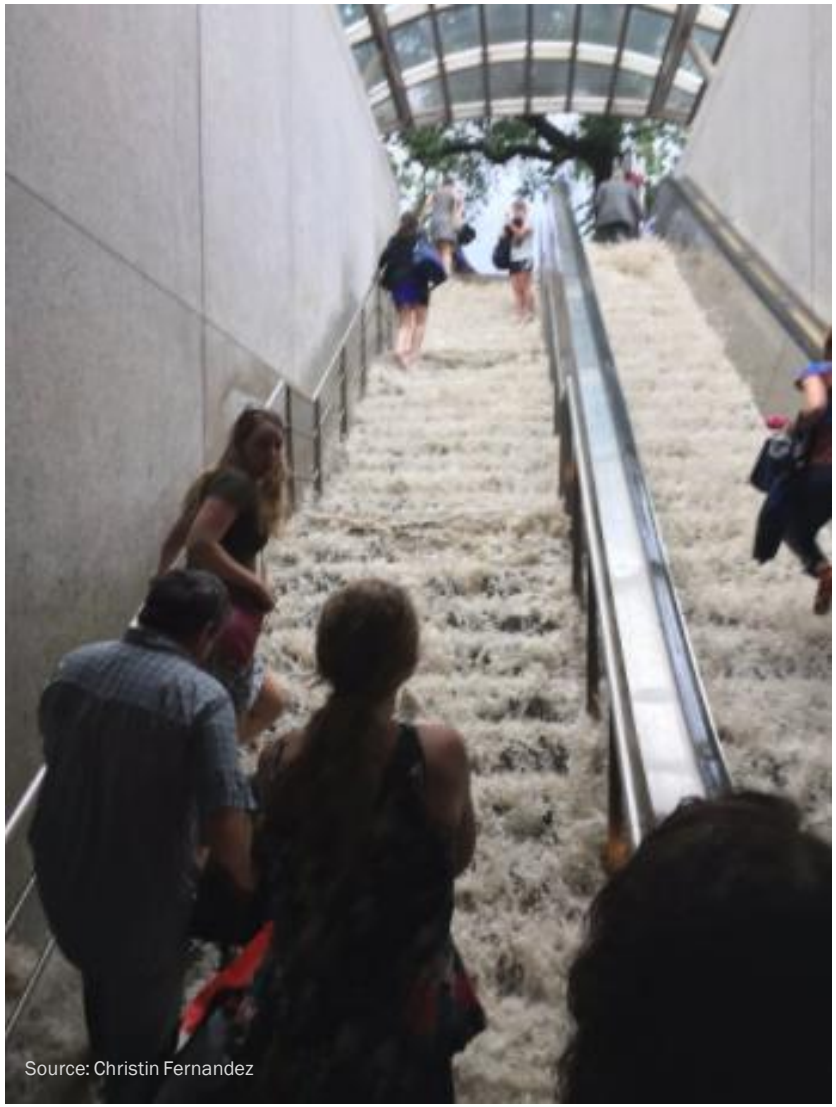
Interior Flooding - 2006

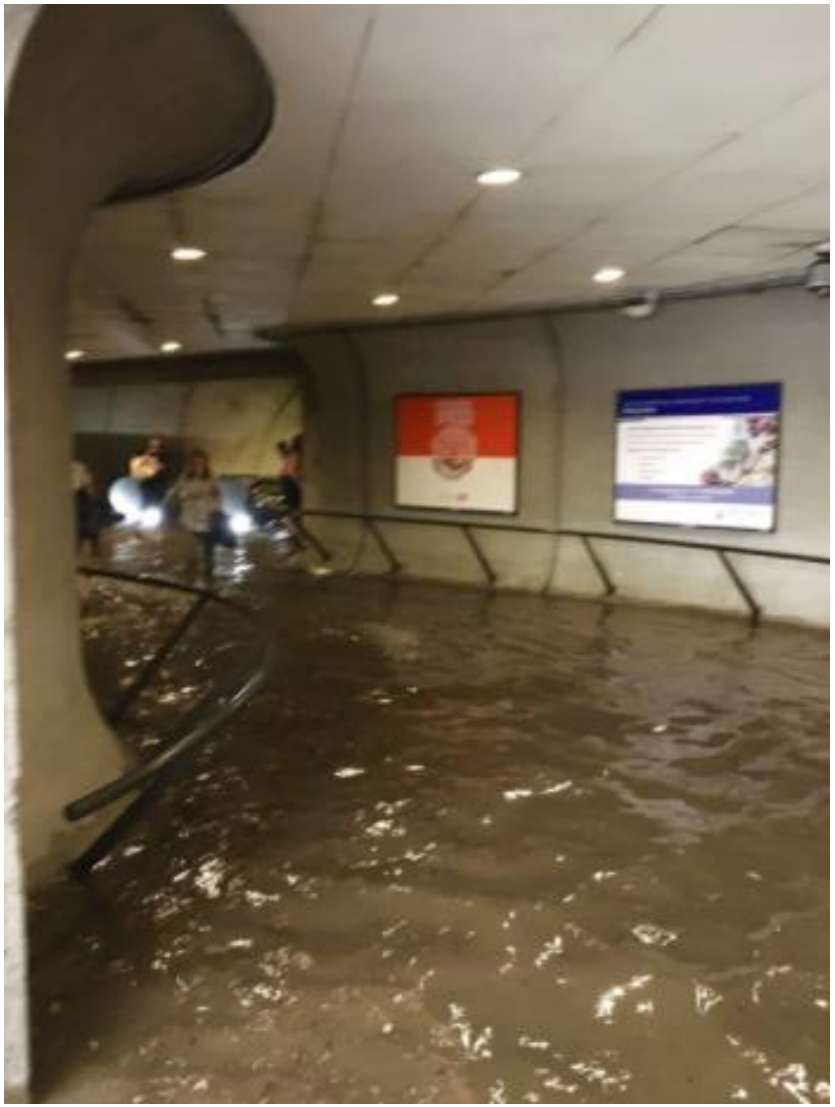
Source: General Services Administration

Interior Flooding - 2012

Source: Bloomingdale Neighborhood Blog

Interior Flooding - 2016

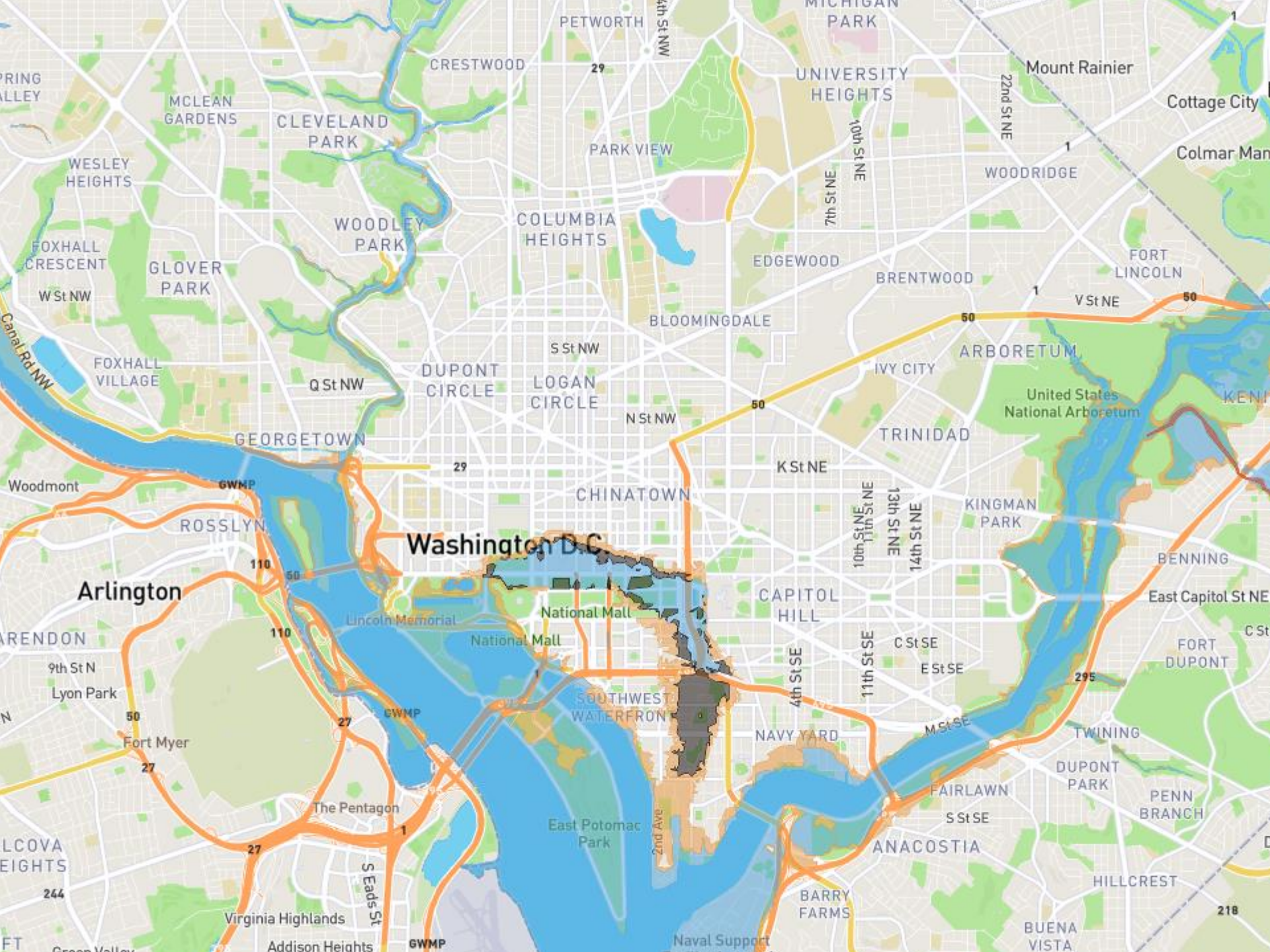

Source: Christin Fernandez

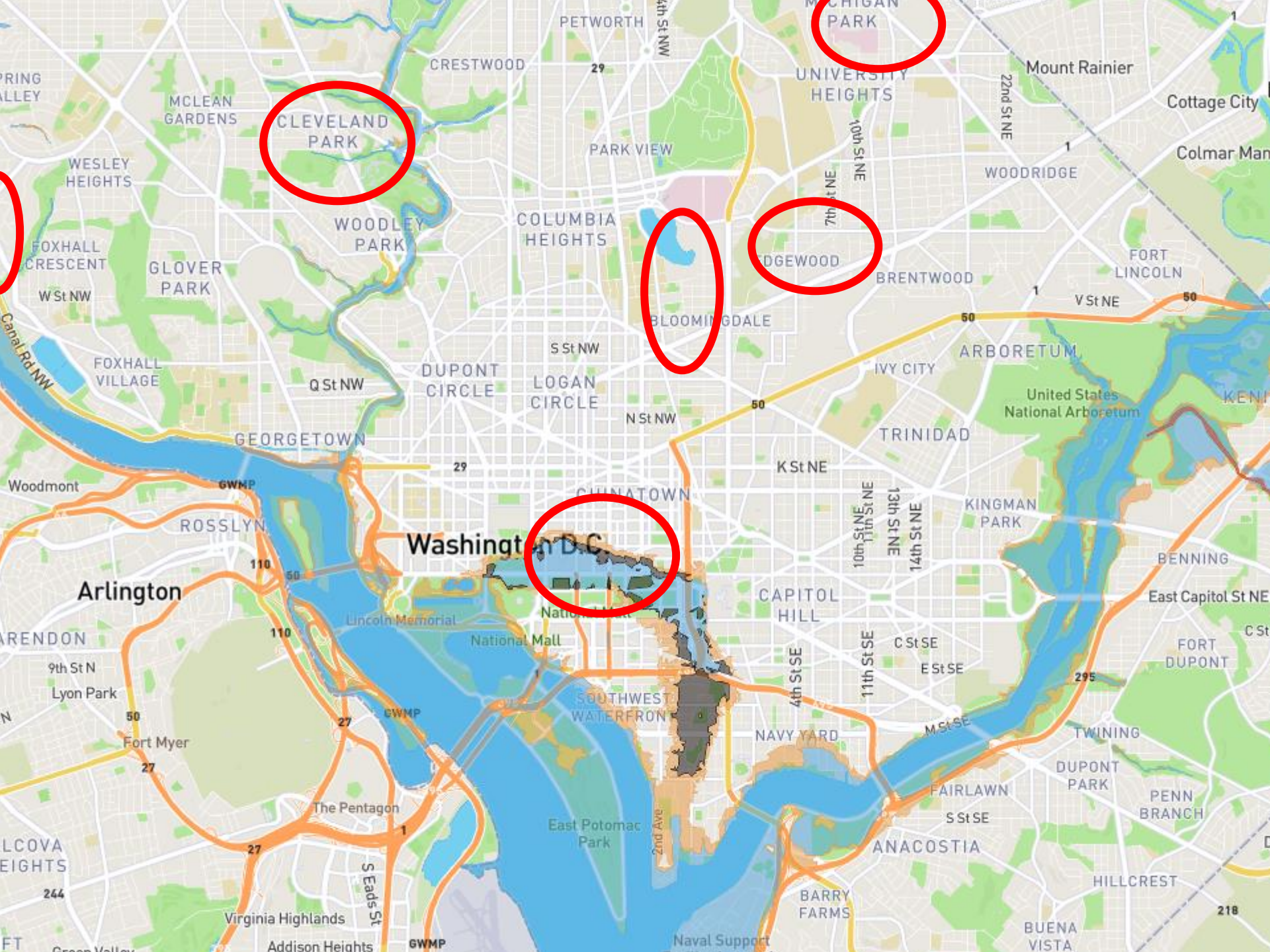


Interior Flooding - 2019

Photographer: Dave Dildine WTOP radio

Interior Flooding – September 10, 2020


PETWORTH
MICHIGAN PARK
CRESTWOOD
UNIVERSITY HEIGHTS
Mount Rainier
Cottage City
MCLEAN GARDENS
CLEVELAND PARK
PARK VIEW
WESLEY HEIGHTS
WOODRIDGE
WOODLEY PARK
COLUMBIA HEIGHTS
FOXHALL CRESCENT
GLOVER PARK
EDGEWOOD
BRENTWOOD
FORT LINCOLN
W St NW
V St NE
BLOOMINGDALE
S St NW
FOXHALL VILLAGE
Q St NW
DUPONT CIRCLE
LOGAN CIRCLE
IVY CITY
ARBORETUM
United States National Arboretum
N St NW
GEORGETOWN
TRINIDAD
K St NE
Woodmont
CHINATOWN
ROSSLYN
KINGMAN PARK
Washington D.C.
BENNING
Arlington
CAPITOL HILL
East Capitol St NE
Lincoln Memorial
National Mall
National Mall
FORT DUPONT
9th St N
Lyon Park
C St SE
E St SE
SOUTHWEST WATERFRONT
NAVY YARD
TWINING
Fort Myer
DUPONT PARK
The Pentagon
FAIRLAWN
PENN BRANCH
East Potomac Park
S St SE
ANACOSTIA
HILLCREST
BARRY FARMS
Virginia Highlands
Addison Heights
Naval Support
BUENA VISTA
Canal Rd NW
GWMP
7th St NE
10th St NE
11th St NE
13th St NE
14th St NE
4th St SE
11th St SE
2nd Ave
S Eads St
22nd St NE
10th St NE
4th St NW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2nd Ave
S Eads St
GWMP
295
218
244


photo Millad Pallesh


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Thank you!

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