



RIVERINE FLOOD MAPPING IN MARYLAND

STATE OF THE SCIENCE AND
OPTIONS FOR HIGHER STANDARDS

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Coast Smart Council

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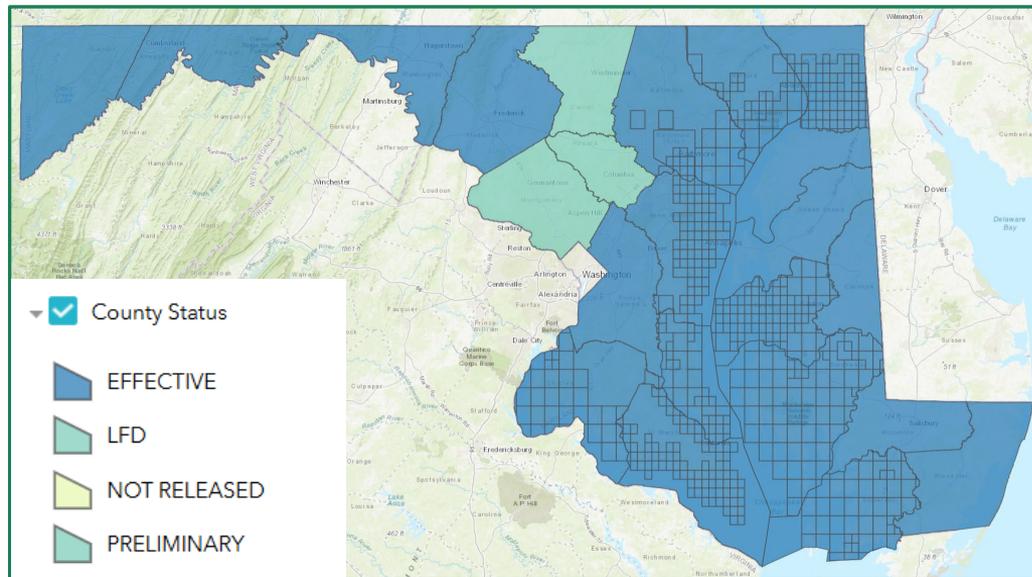
Agenda

- Current status of FEMA flood maps using 1D modeling
- Future flood maps
 - 2D modeling
 - FFRD and probabilistic modeling
 - Simplified conceptual models
- R-CRAB status and the case against freeboard methodology
- Higher Standards Floodplain options



1D Mapping Tranche

County	Age (years)	Riverine Effective Date
Calvert	14	Dec 2011
Anne Arundel	13	Oct 2012
Cecil	12	July 2013
Charles	12	Sept 2013
Garrett	12	Oct 2013
Talbot	12	Aug 2013
Kent	11	June 2014
Queen Anne's	11	Nov 2014
Caroline	11	Jan 2015
Somerset	11	March 2015
Dorchester	11	May 2015
Carroll	10	Oct 2015
Wicomico	10	Aug 2015
Worcester	10	July 2015
Harford	9	April 2016
Prince Georges	9	Sept 2016
Washington	8	Aug 2017
Allegany	5	April 2020
Baltimore City	4	June 2021
Baltimore County	2	Nov 2023
Frederick	2	Aug 2023
Saint Mary's	1	May 2025
Montgomery		TBD
Howard		Fall 2026

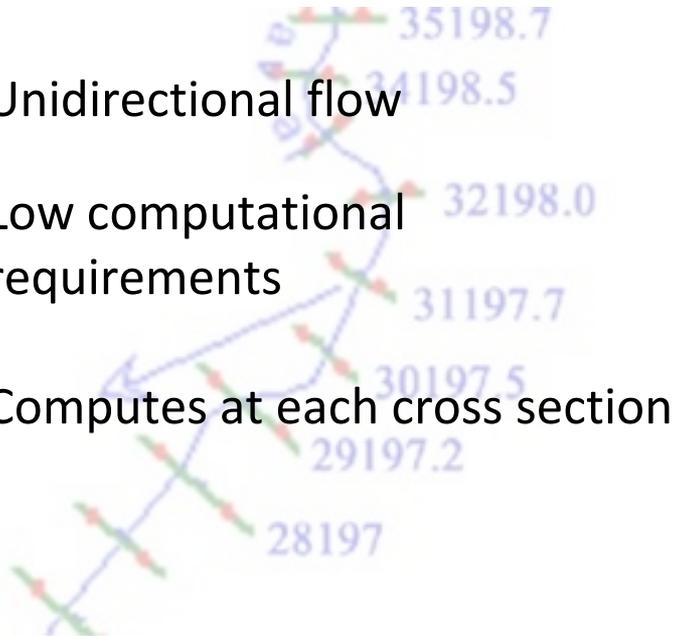




Advancement to 2D

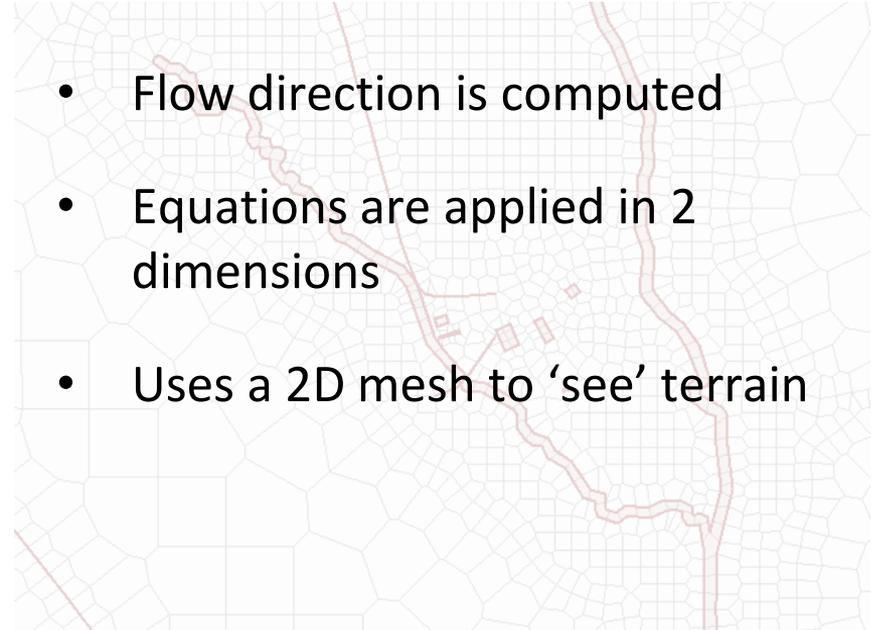
1D Models

- Unidirectional flow
- Low computational requirements
- Computes at each cross section



2D Models

- Flow direction is computed
- Equations are applied in 2 dimensions
- Uses a 2D mesh to 'see' terrain





2D Mapping





Future of Flood Risk Data (FFRD)



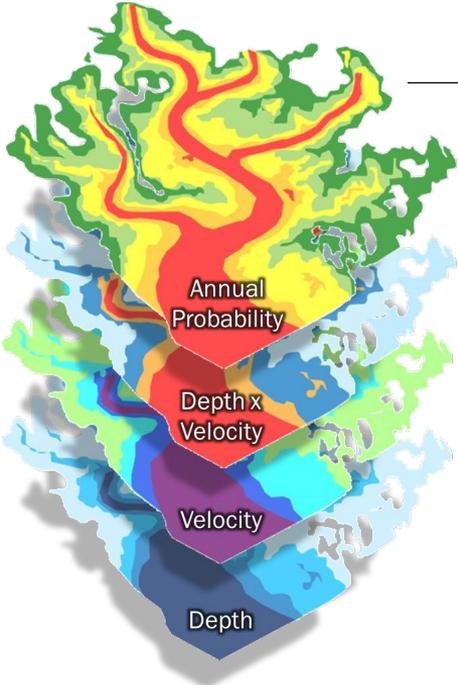
FEMA

FFRD Approach – Probabilistic Modeling

Probabilistic flood hazard modeling means running **thousands of flood simulations** with **real-world storm data**.

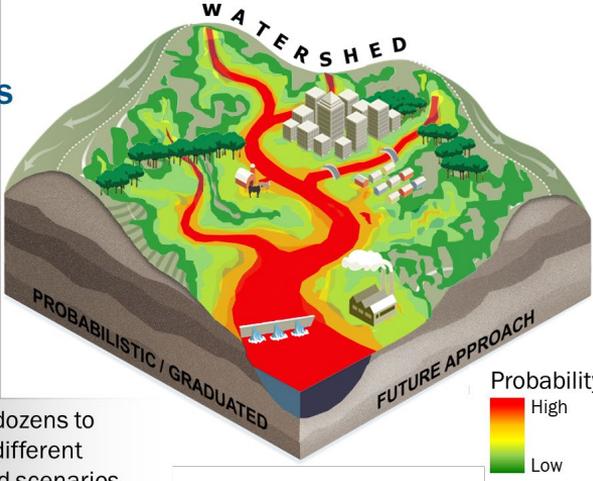
This allows engineers to **quantify uncertainty**.

It also enables **graduated flood hazard data**, which provides richer risk information to stakeholders.



Probabilistically-derived from the extensive range of flood scenarios analyzed

Key Outputs



Available for dozens to hundreds of different modeled flood scenarios

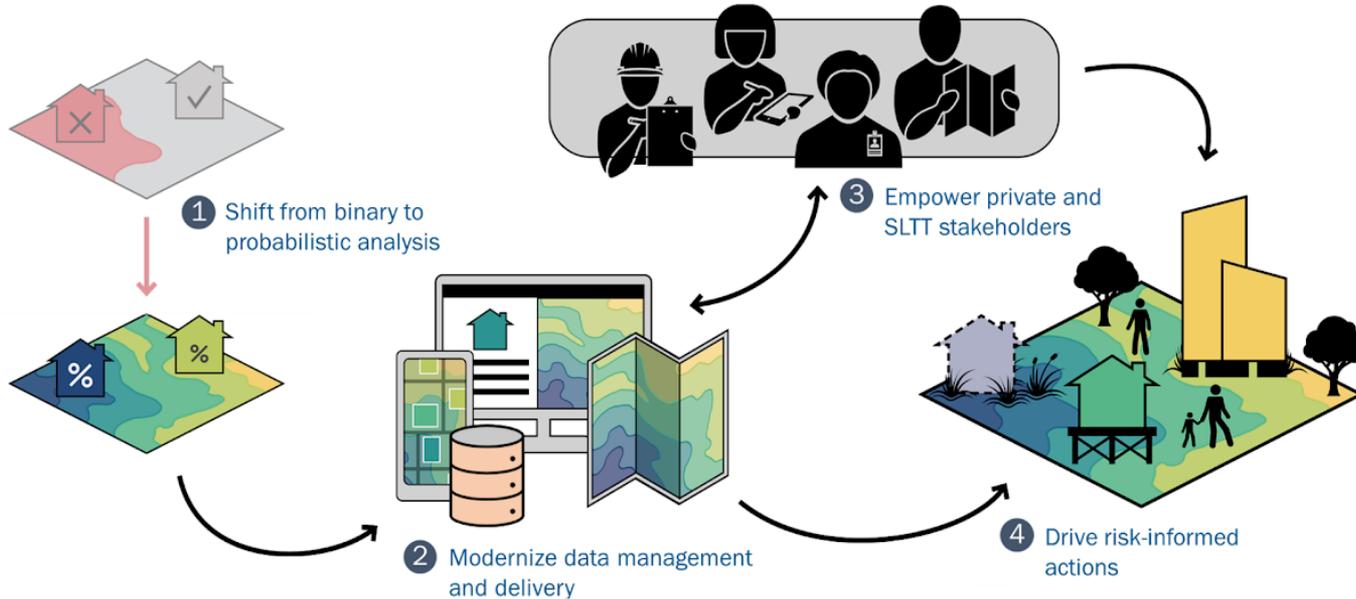


Future of Flood Risk Data (FFRD)



FEMA

FFRD Objectives



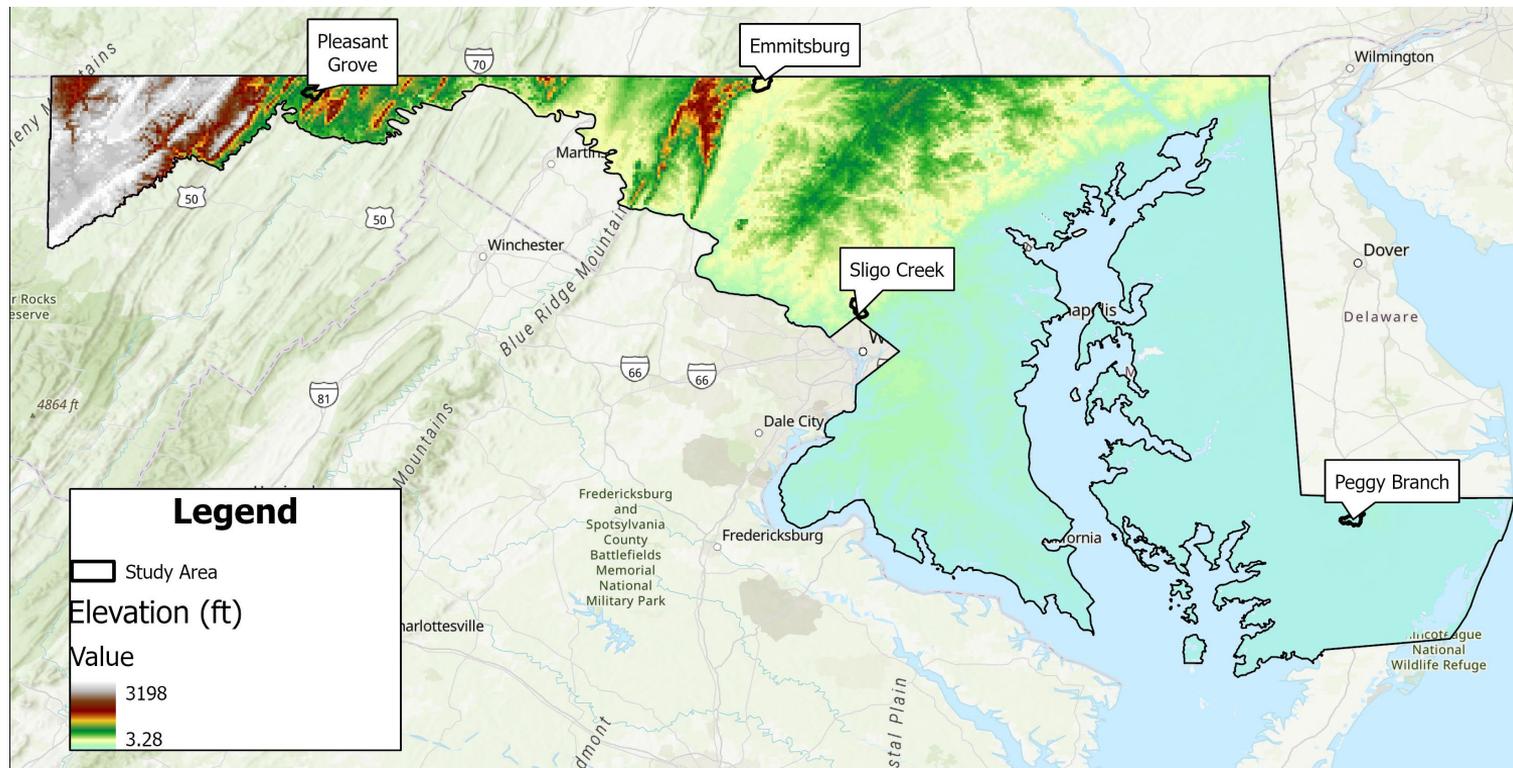


Simplified Conceptual Models

- For profit, proprietary flood analyses and models
- User has limited or no legal rights to inspect the details of the analyses or to modify those details
- Ex. First Street Flood Factor, Fathom, Stantec Flood Predictor, etc.



Simplified Conceptual Model Investigation

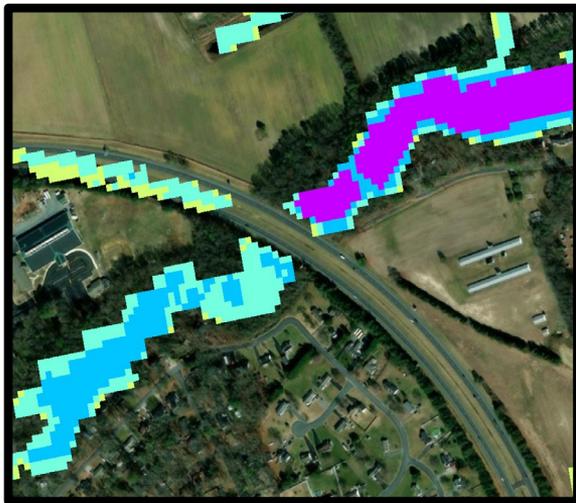
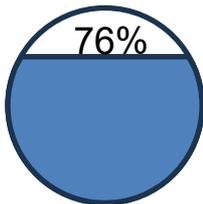




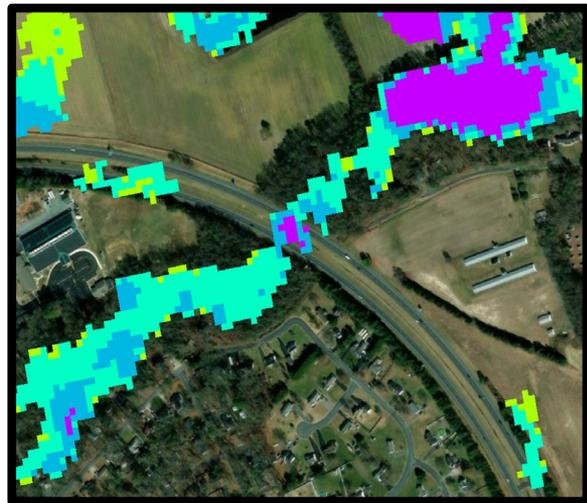
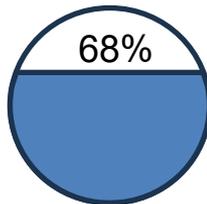
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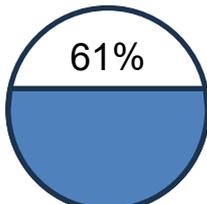
Base Model



Vendor 1



Vendor 2



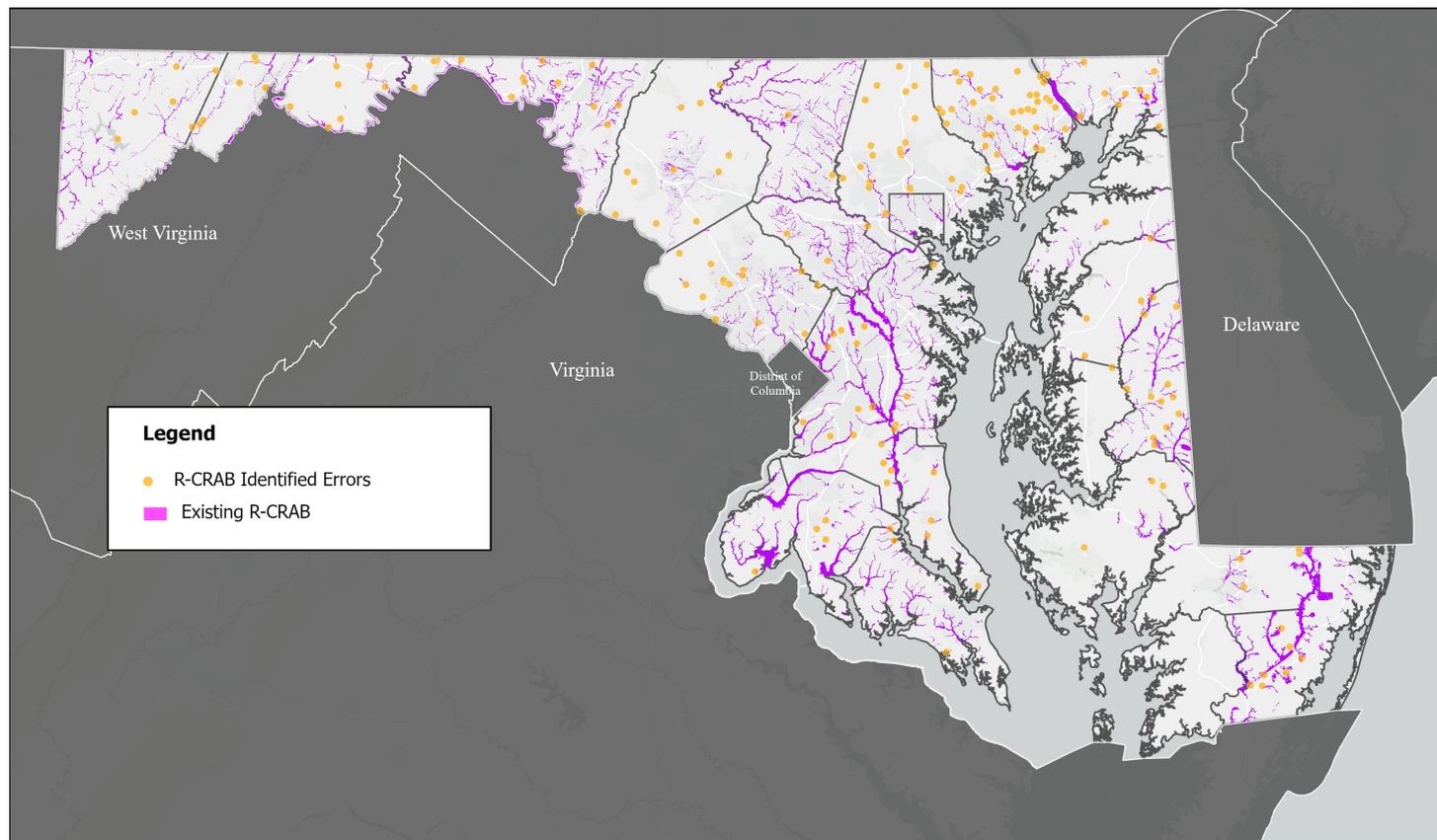


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- **R-CRAB status and the case against freeboard methodology**
- Higher Standards Floodplain options

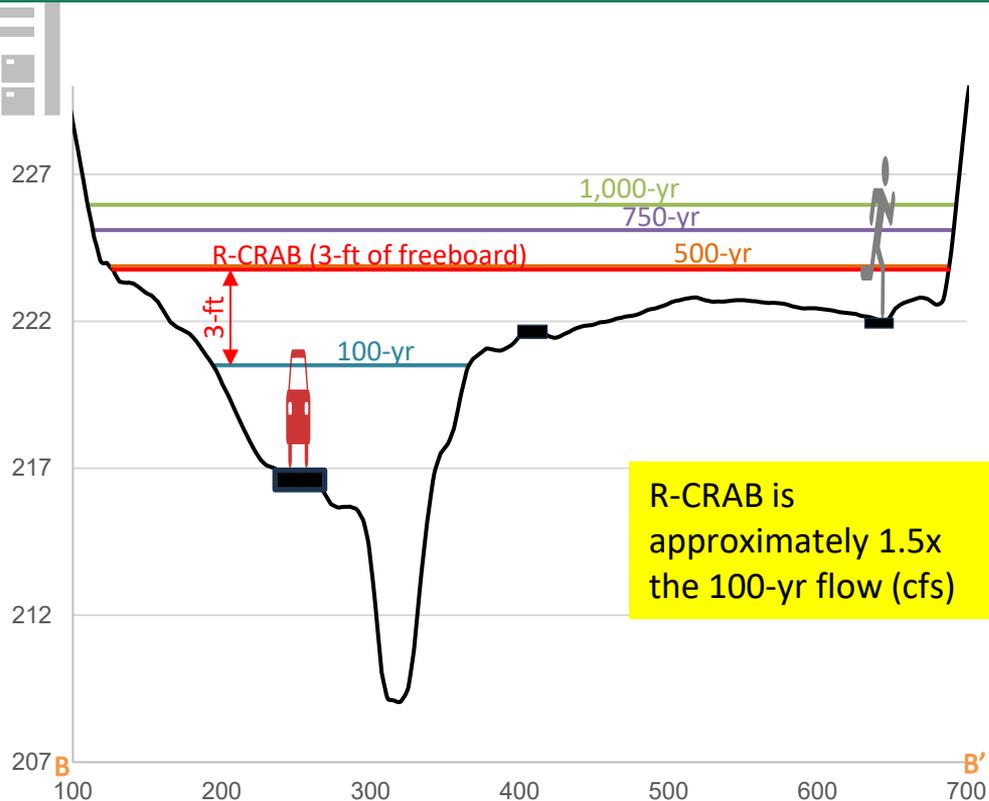
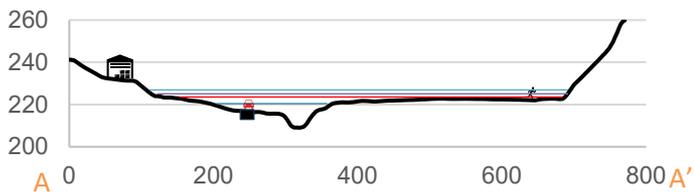


R-CRAB current mapping





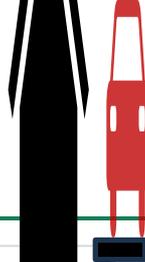
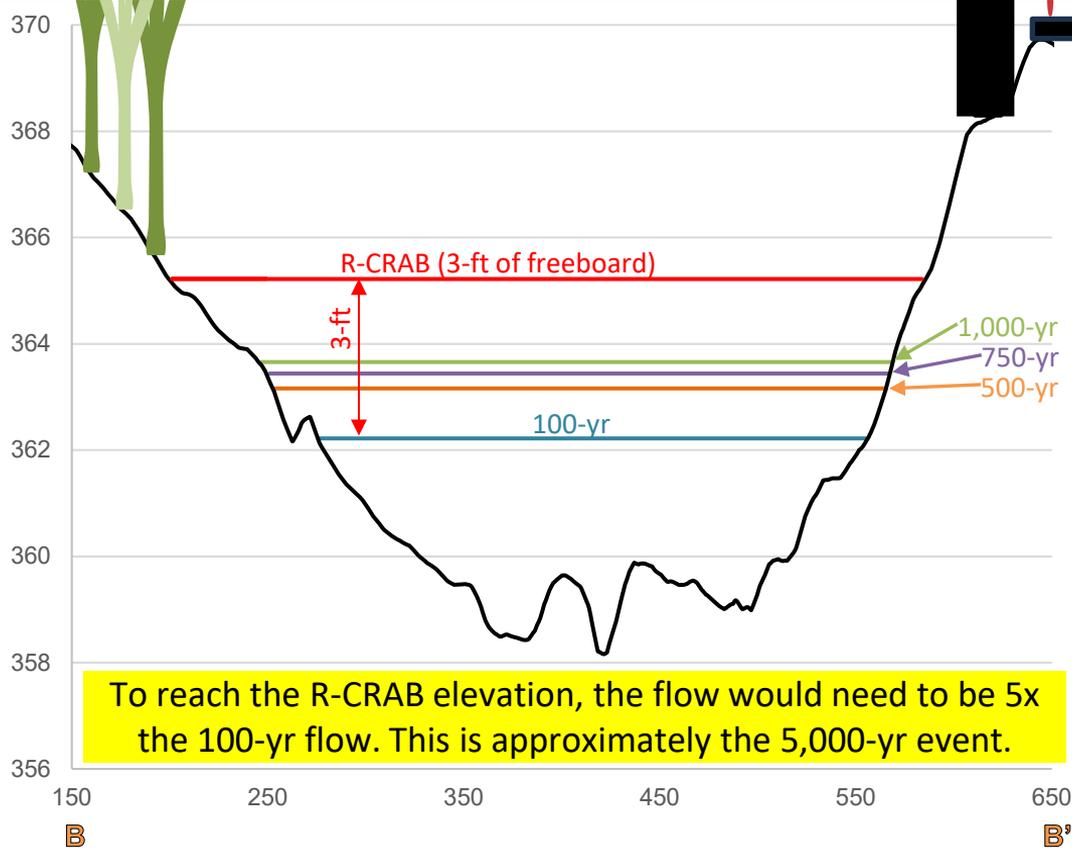
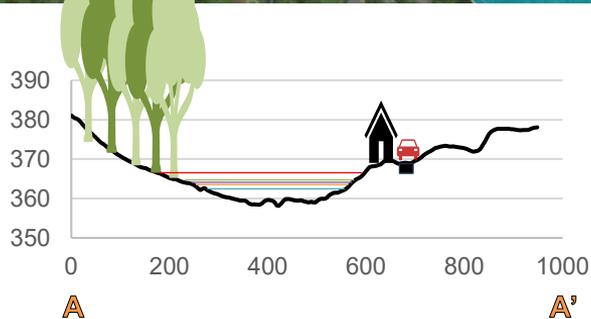
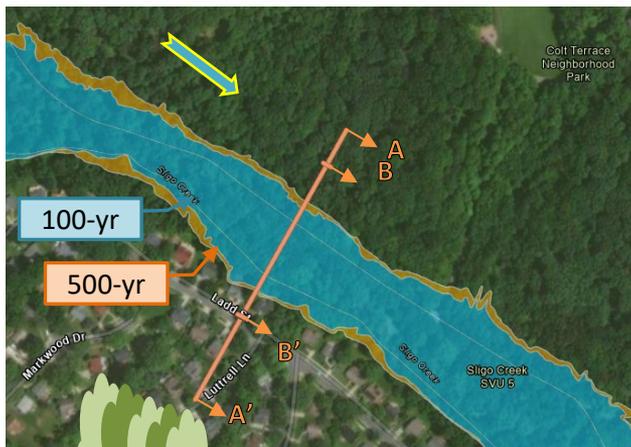
Sligo Creek near Silver Spring, MD



R-CRAB is approximately 1.5x the 100-yr flow (cfs)

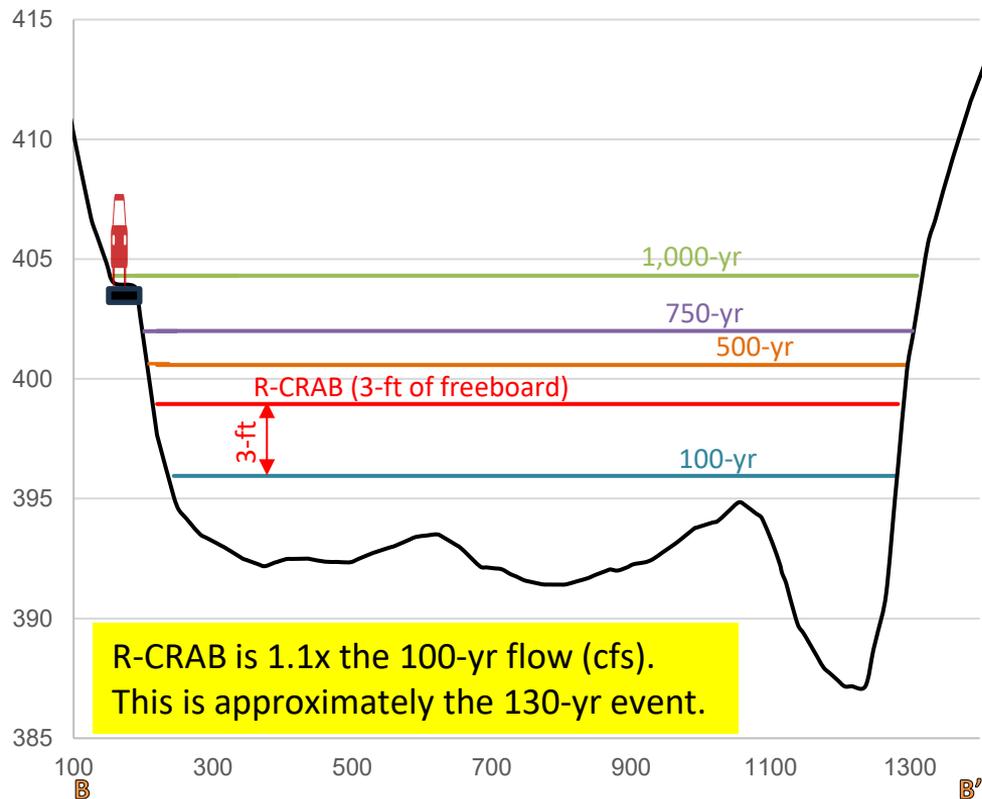
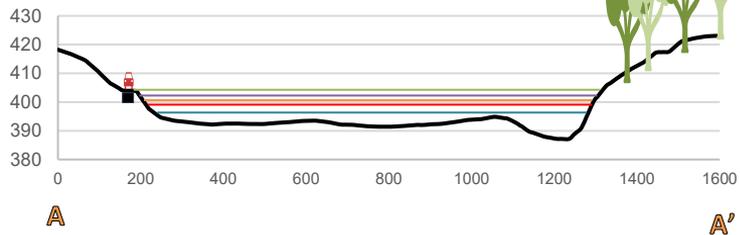
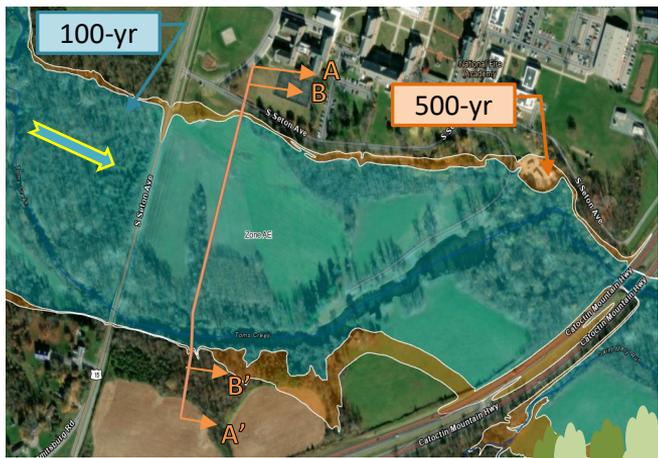


Sligo Creek near Wheaton, MD





Tom's Creek at Emmitsburg, MD





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- **Higher Standards Floodplain options**
 - Physical features (Vermont approach)
 - 500-yr floodplain
 - Newly mapped statewide floodplain
 - New flood standards without a map
 - Watershed studies



High Standards Floodplain Options

Option 1: Physical Features

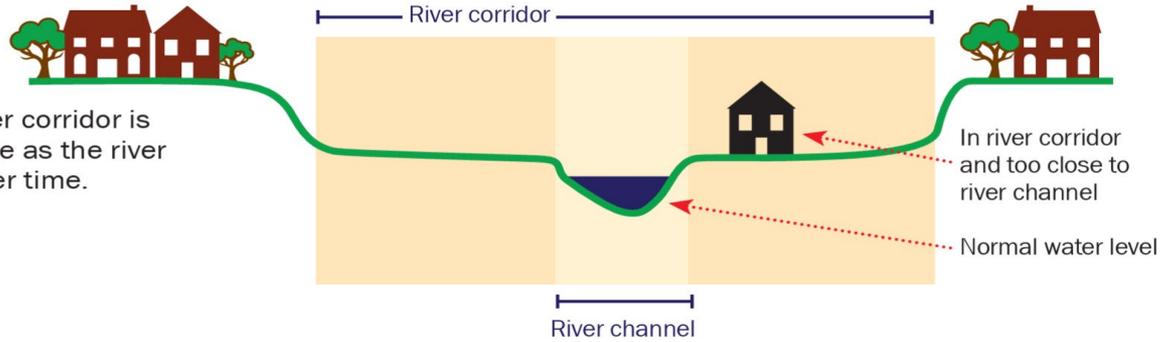
example: Vermont's river corridors approach is based on stream restoration concepts

Pros: accounts for river migration, conservative

Con: still requires statewide mapping or technical analysis of every project

Development in River Corridor

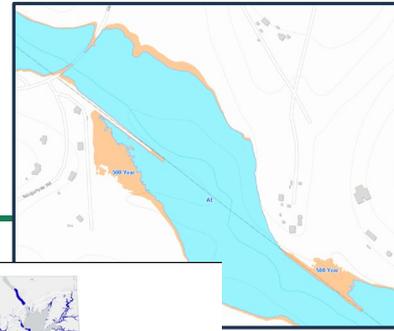
Structure built in river corridor is vulnerable to damage as the river channel changes over time.





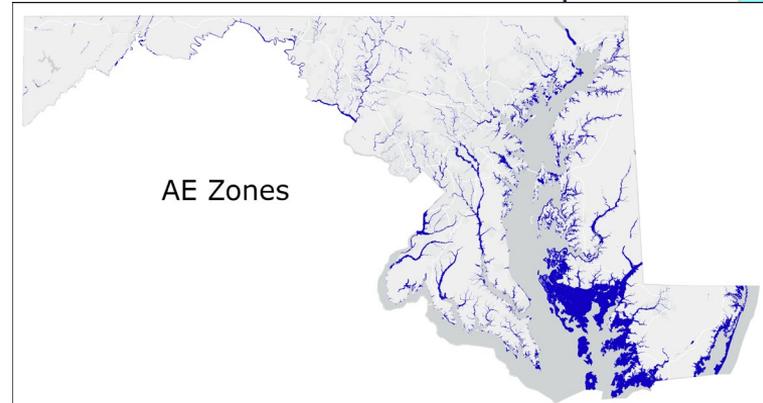
High Standards Floodplain Options

Option 2: FEMA 500-yr floodplain



Pro: already mapped by FEMA in many areas of MD

Cons: not mapped everywhere (A zones and upstream), may not meet goals





High Standards Floodplain Options

Option 3: New Statewide Floodplain

Many approaches available. Could limit to where we already have models (\$) or map statewide (\$\$\$)

Pro: could tailor to desired recurrence interval, or account for climate change

Con: expensive (\$6M-\$20M depending on scope) and not supported by FEMA



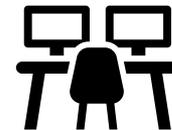
High Standards Floodplain Options

Option 4: Flood standard with screening tool

Coast Smart could adopt an approximate floodplain or a threshold – any project within the parameter would requires technical review

Pro: No upfront cost to map

Con: would require engineering staff to review every project (funding agencies and CH are not capable of this review)





High Standards Floodplain Options

Option 5: Higher standards in SHFA

Focus on siting requirement in existing floodplain

Pro: No cost to map, could be managed with existing staff

Con: may not meet goals



High Standards Floodplain Options

Option 6: Watershed studies

2D models, flood risk assessments, and flood management plans that will provide targeted higher standards for the watershed

Pros: confidence behind decisions due to reliable mapping, would align priorities and initiatives

Cons: requires funding (\$300k-\$500k per watershed), not statewide



Higher Standards Floodplain Options

1. Physical features (Vermont approach)

Pros: accounts for river migration, conservative

Con: requires statewide mapping or project technical analysis

2. FEMA 500-yr Floodplain

Pro: already mapped by FEMA in many areas of MD

Cons: not mapped everywhere, may not meet goals

3. New Statewide Floodplain

Pros: could tailor to desired recurrence interval, account for climate change

Con: very expensive and not supported by FEMA

4. Flood Standard with screening tool

Pro: No upfront cost to map

Con: new PINs for engineering staff to review every project

5. Higher Standards in 100-yr floodplain

Pros: No costs for mapping or technical reviews

Con: May not meet goals

6. Watershed Studies

Pros: reliable mapping, alignment of priorities and initiatives

Cons: not statewide, expensive