Virginia Coastal Resilience Technical Advisory Committee

Research, Data and Innovation
Quarterly Subcommittee Meeting

Date: Tuesday, August 22nd, 2023
Time: 01:00 pm

Location: DEQ 3rd Floor Conference Room
1111 East Main St., Suite 1400
Richmond, VA 23219

Virtual Public Access: Register at
https://vcu.zoom.us/meeting/register/tZ0rcOirrzkoG9EDuz17YlRbK0BEG3nyj9Cv

1

Meeting Agenda

1) Call to Order, Roll Call, and Introductions
2) New Business
   a) Subcommittee Role and Objectives
   b) Subcommittee Advisors
   c) Pluvial Modeling Pilot Study Review
   d) Fluvial Flood Hazard Data
3) Subcommittee Members Discussion
4) Action Items, Scheduling
5) Public Comment
6) Adjourn

2

Name	Title	Organization
Evan Branosky (Chair)	Chief Stormwater Policy Advisor	Virginia Department of Environmental Quality
Dave Davis (Alternate Chair)	Manager of the Office of Wetlands and Stream Protection	
Whitney Katchmark	Principal Water Resources Engineer	Hampton Roads Planning District Commission
Ben McFarlane (A)	Chief Resilience Officer	
Norm Goulet	Director of NVRC's Environment and Resiliency Planning	Northern Virginia Regional Commission
Rebecca Murphy (A)	Coastal Zone Program Manager	
Dr. Jessica Whitehead	Director of the Institute for Coastal Adaptation and Resilience	Old Dominion University
Carol Considine (A)	Director of Applied Projects, CCRFR	
Dr. Karen McGlathery	Director of the Environmental Resilience Institute	University of Virginia
Dr. Mark Luckenbach	Associate Dean for Research and Advisory Services	Virginia Institute of Marine Science
Jamie Green	Commissioner	Virginia Marine Resources Commission
Rachael Peabody (A)	Director of Coastal Policy, Restoration and Resilience	
Randy Owen (A)	Chief of Habitat Management	
Dr. Troy Hartley	Director	Virginia Sea Grant
Dr. Robert Weiss	Director of the Center for Coastal Studies	Virginia Tech
Dr. Wendy Stout (A)	Coastal Resilience Extension Specialist	
G. Michael Fitch, Ph.D.	Acting Director	Virginia Transportation Research Council
Mary-Cason Stiff	Executive Director	Wetlands Watch
John Bateman (A)	Planning Program Director	

3

Subcommittee Role and Objectives

CRMP Phase II

Subcommittee Objectives

4

CRMP Phase II - Overview

The Phase II plan will be delivered by December 2024.

This planning process will result in two major deliverables:

1) an updated Coastal Resilience Web Explorer
2) a PDF Document Plan

The key components of these two deliverables are:

1) Flood Hazard Exposure Model
2) Flood Hazard Risk Assessment
3) Planned Resilience Actions
4) Financial Need for Flood Resilience
5) TAC Subcommittee Recommendations

Outreach and engagement will be utilized throughout the plan's development to collect feedback on the content and direction of these key components.

5

CRMP Phase II - Plan Development Timeline

Jul 23	Aug 23	Sep 23	Oct 23	Nov 23	Dec 23	Jan 24	Feb 24	Mar 24	Apr 24	May 24	Jun 24	Jul 24	Aug 24	Sep 24	Oct 24	Nov 24	Dec 24
Meetings																	
	Sub	**TAC**		**Sub**	**TAC**		**Sub**	**TAC**		**Sub**	**TAC**		**Sub**	**TAC**		**Sub**	**TAC**
Schedule																	
Develop Flood Hazard Exposure Model Research, Data, and Innovation																	
		Data Collection *Project Prioritization*							**Flood Hazard Risk Assessment** Project Prioritization								
Project and Initiative Info Collection *Project Prioritization*									**Analyze Planned Resilience Actions** Project Prioritization, Funding								
				Quantify Financial Need for Flood Resilience Funding													
Ongoing Stakeholder Outreach and Engagement Outreach and Coordination																	
Develop TAC Subcommittee Recommendations All Subcommittees																	

6

6

Research, Data, and Innovation Objectives

1. **Inform Development of Flood Hazard Exposure Model.**
   Using the best available data, provide recommendations to DCR and Dewberry to select pluvial modeling approach (including climate scenarios), advise on the selection of fluvial modeling data and scenarios, and advise on approach to compound flooding joint probability analysis.
2. **Inform Inputs to Flood Hazard Risk Assessment.**
   Based on the flood hazard exposure model developed, advise DCR and Dewberry on how to utilize the flood hazard model for conducting the flood hazard risk assessment.
3. **Develop recommendations for future planning.**
   This includes, but is not limited to:
   - Develop a data development plan to fill gaps in advance of future planning processes. Consider research and data products that can meet the state's needs.
   - Advise on innovations suited to address flood risks and fill gaps in resilience action for future planning efforts. Consider R&D, public-private partnerships, collaborative research.

7

Subcommittee Schedule

2023Q3	CRMP PII - Pluvial Modeling Pilot Study
2023Q4	CRMP PII - Flood Hazard Data Scenario Planning
2024Q1	CRMP PII - Flood Hazard Risk Assessment Methodology Future Plans - Recommendations
2024Q2	Future Plans - Recommendations
2024Q3	CRMP PII – Flood Hazard Assessment Review Future Plans - Recommendations
2024Q4	Future Plans – Final Recommendations

8

Comments + Questions

9

Decision Point

Recommendations to change objectives

10

Subcommittee Advisors

- The Coastal Resilience TAC Chair may appoint Advisors to subcommittees with recommendations from Subcommittee Chair
- Advisors may participate in subcommittee meeting discussions
- Advisors are non-voting members of the subcommittee
- Advisors are members of the public body (FOIA)
- Subcommittee may request presentations from non-members

Comments + Questions

Decision Point

Advisor Recommendations

13

Pluvial Pilot Study Review

Overview of Pilot Results

Climate Scenario Approach and Selection

14

Dewberry

CRMP Pluvial Modeling Pilot

Coastal Resilience TAC: Research, Data, and Innovation Subcommittee Meeting

8/22/2023 | Richmond, VA

15

Agenda

Pilot Overview

Development Process
- Foundational data, scenarios, and process

Results and Products
- Models and data

Discussion Topics
- Use cases for outputs
- Limitations
- Planning needs

16

Pilot Basins in Study Area

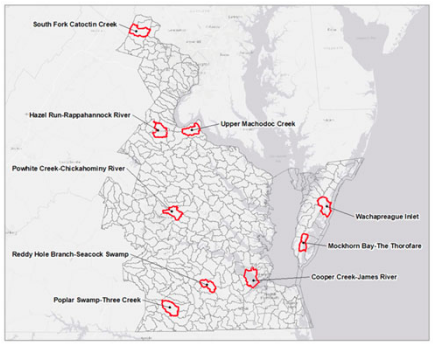


Figure 1. A map of the HUC-12's in the study area with locations modeled in the pilot study shown in red.

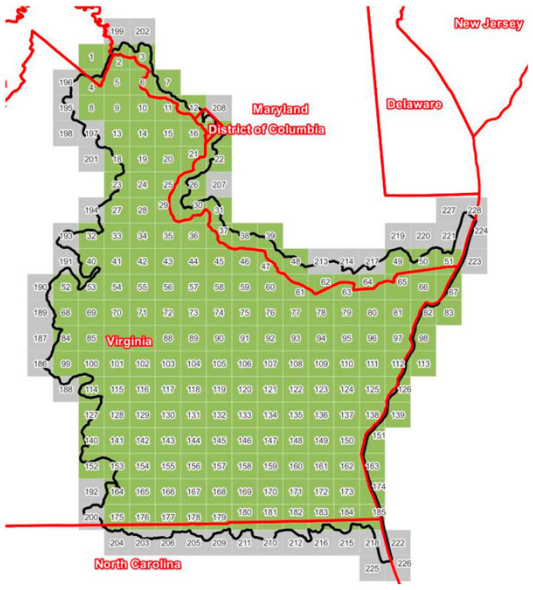
HUC	Name	Terrain	Population Density Type	Tidal Conditions
020403040104	Wachapreague Inlet	Shoreline/tidal flats	Rural	Yes
020403040301	Mockhorn Bay-The Thorofare	Moderate ridge/shelf above tidal flats	Rural	Yes
020700080301	South Fork Catoctin Creek	High relief with stream network	Dispersed rural suburban and farmsteads	No
020700110601	Upper Machodoc Creek	High relief with stream network, steep ridge/shelf, outlet directly to the Potomac River	Rural	Tidal River
020801040102	Hazel Run-Rappahannock River	Moderate relief with major river	Urban	Tidal River
020802060501	Powhite Creek-Chickahominy River	Moderate relief with swamp	Urban	No
020802060906	Cooper Creek-James River	Shoreline	Urban	Yes
030102011004	Poplar Swamp-Three Creek	Moderate relief with swamp	Rural	No
030102020401	Reddy Hole Branch-Seacock Swamp	Moderate relief with swamp	Rural with small urban area	No

- 439 HUC 12's in Study Area
- 57 Pilot Models from 9 HUC-12's

Development Process

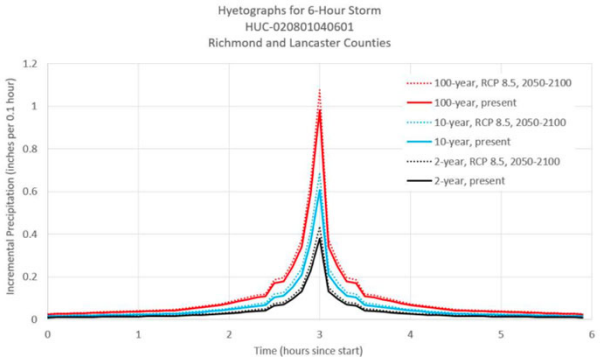
Data Development

- Updated and augmented topography (10 ft) from CRMP Phase 1
- Infiltration
  - SSURGO and NLCD 2019
- Friction
  - NLCD 2019 with USACE parameters
- Vectors
  - VGIN Transportation
  - USGS NHD



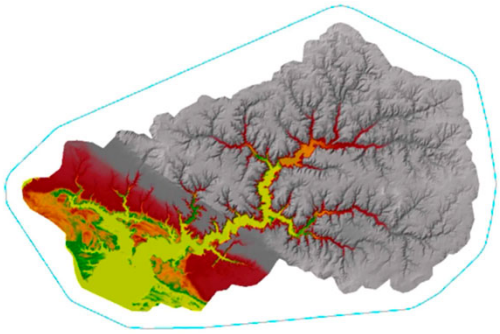
Scenarios

- Plans 1 – 21
  - Existing conditions
  - Current NOAA Atlas 14 rainfall
- Plans 22 – 42
  - 2020 – 2070 conditions
  - MARISA RCP 8.5 Scenario adjusted rainfall.
  - Plans 43 – 63
    - 2050 – 2100 conditions
    - MARISA RCP 4.5 Scenario adjusted rainfall.

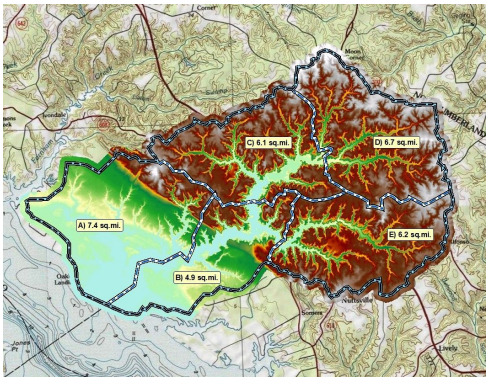


- Plans 64 – 84:
  - 2050 – 2100 conditions
  - MARISA RCP 8.5 Scenario adjusted rainfall.

Model Development Pipeline



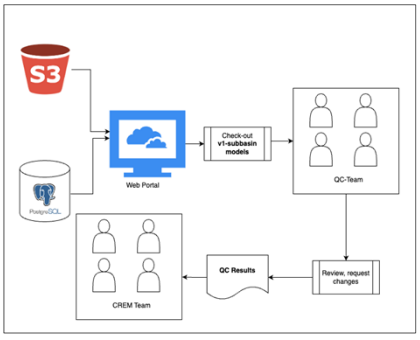
HUC -12 with Open Boundary

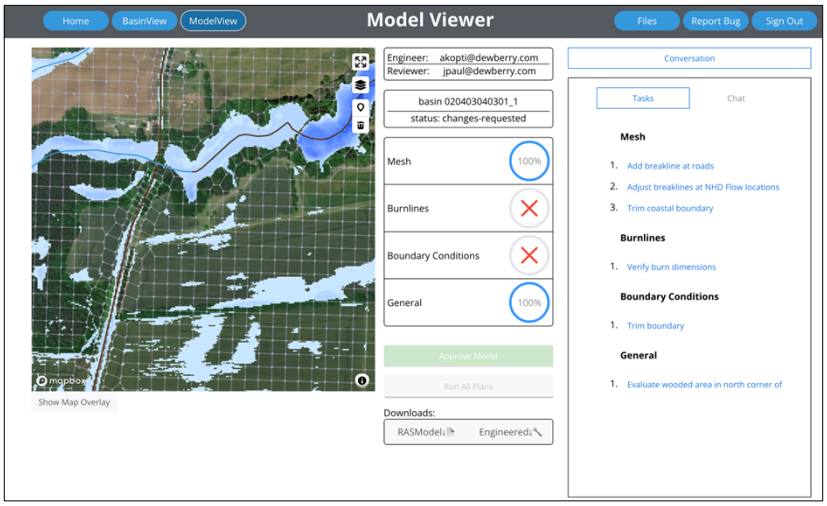


HUC -12 split into Modeling Basins

21

Model Review and Quality Assurance

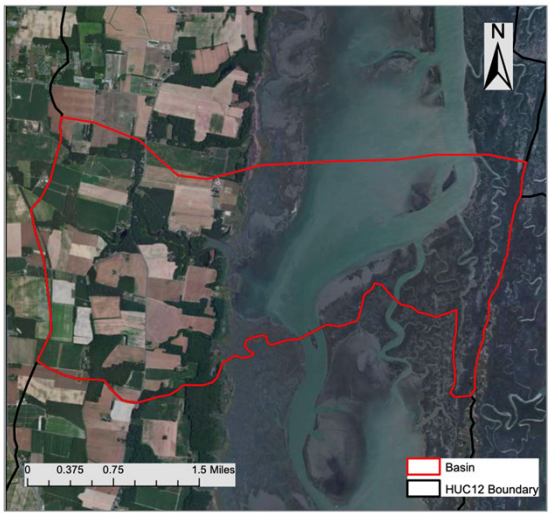




22

Sensitivity Analysis

- Simulation info
  - Compute time window
  - Warm-up, interval, and parameters
- Geometry
  - Transportation Layers
  - NHD flowlines
- Domains
  - Tidal boundary clipping
  - Normal Depths

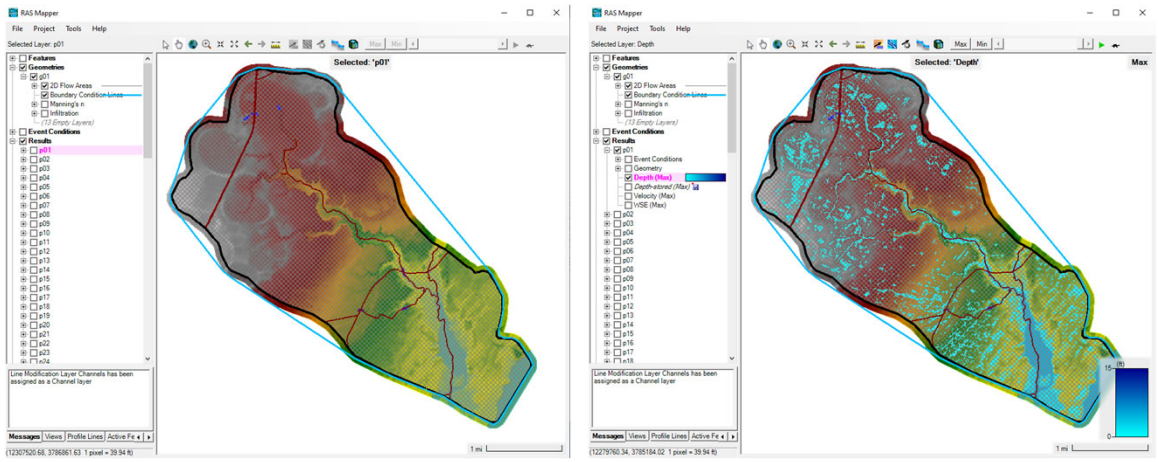


23

Results and Products

24

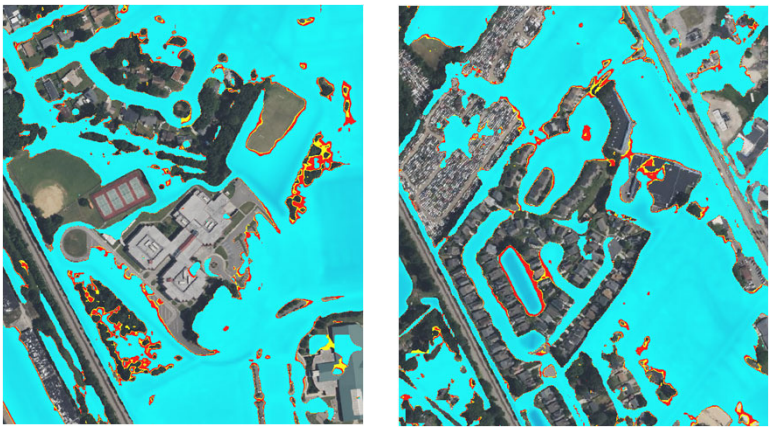
RAS Models



Depth Grids

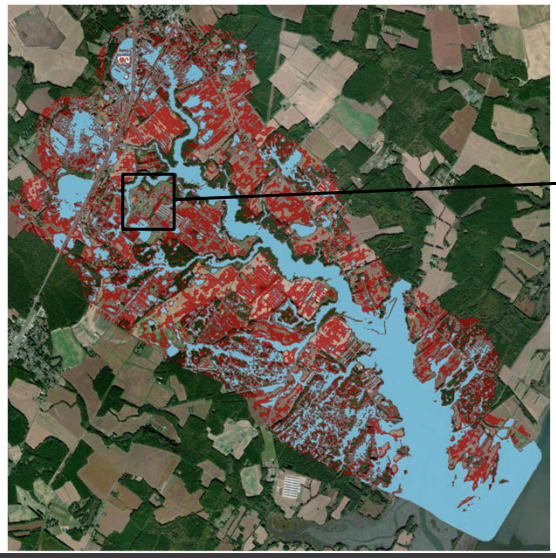
- Very limited change observed among the Marisa-based climate projections

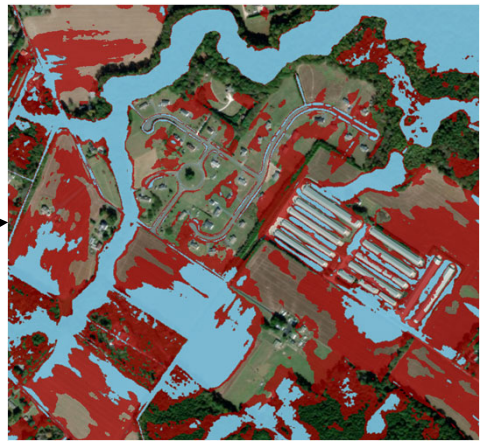
Examples of the 4% - 6hr Event



Current conditions in Blue. 8.5 RCP scenarios for 2020-2050 in red, 2050-2100 in yellow

Depth Thresholds

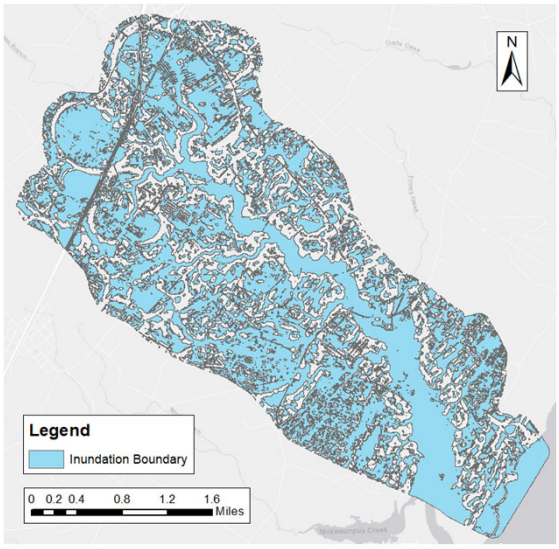




2050-2100 100yr 24 hr Storm	Area (mi²)
Inundation Boundary	6.99
Inundation Boundary (filtered to 0.5')	3.61

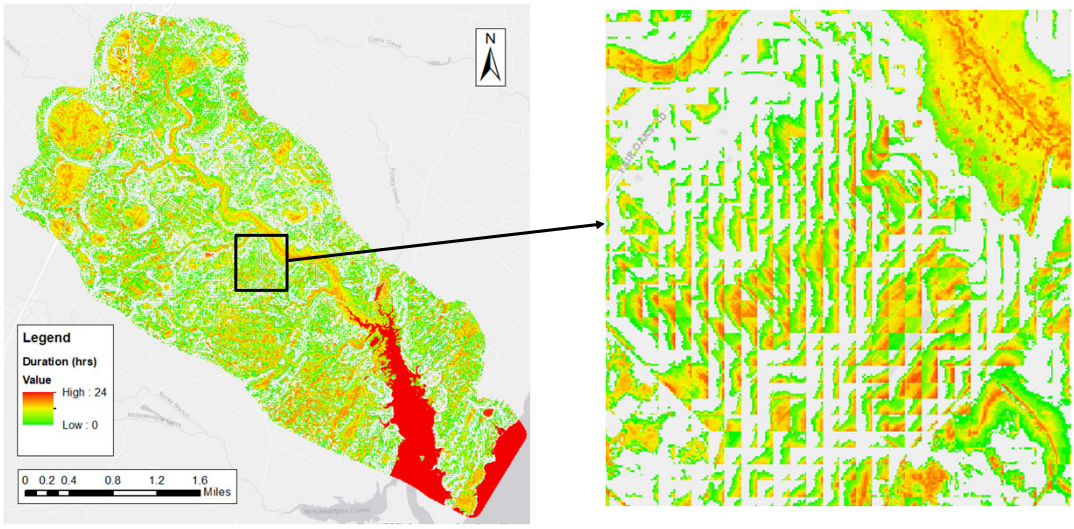
Flood Polygons

- Generated using HEC-RAS software
- Large data size (many vertices)
- Limited utility at this scale



Present 1% AEP 24hr storm

Duration Grids



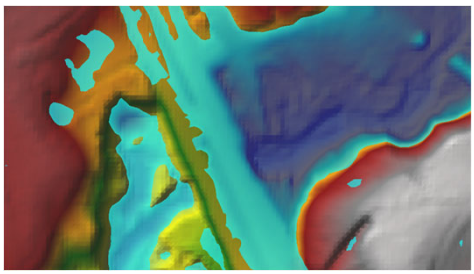
Use Cases and Limitations

Using the Results – Models

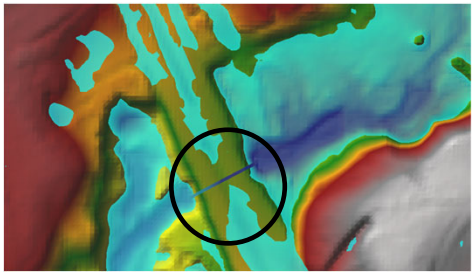
- HEC-RAS models may be customized to
  - Compute new or additional storm scenarios
  - Evaluate changes in topography / land use, development, community growth, etc.
  - Vet project proposals and locations to provide insight into flood impacts at the site and potential impacts to neighboring areas.
  - Incorporate fluvial impacts through linkage or boundary condition changes

Anticipated Use Cases

- Hazard planning and screening
- Evaluating potential for pluvial flooding at development sites away from streams
- Rapid development of custom HEC-RAS models for design, analysis, and alternatives analysis
- Model linkages



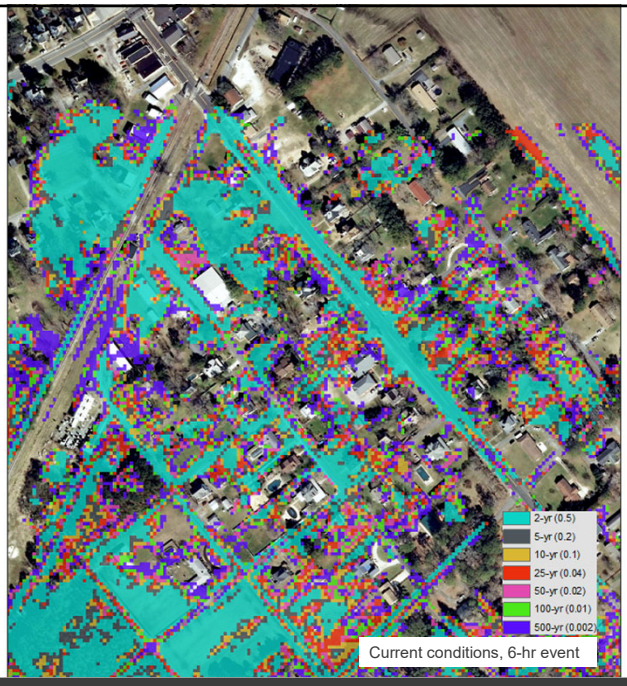
No Culvert burned into the terrain



Culvert burned into the terrain (note difference in depths and extent)

Derivative Products – Composite Grids

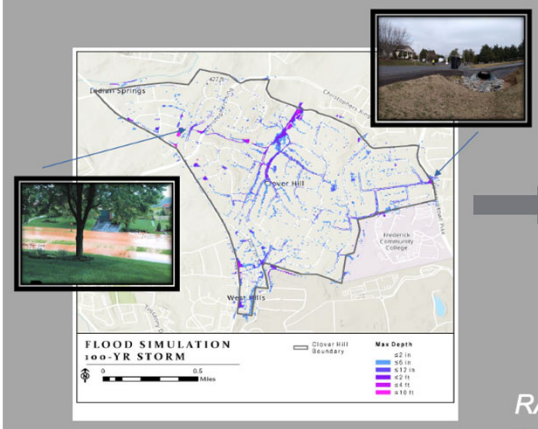
- Annual exceedance
- Interval-based
- Epoch-based
- Combinations



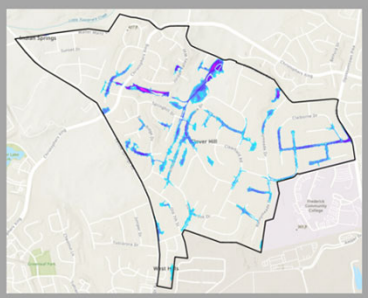
33

Example Use Case: Frederick County, MD

Comparison with Clover Hill Results



Detailed Clover Hill Model



Frederick County Pluvial Model

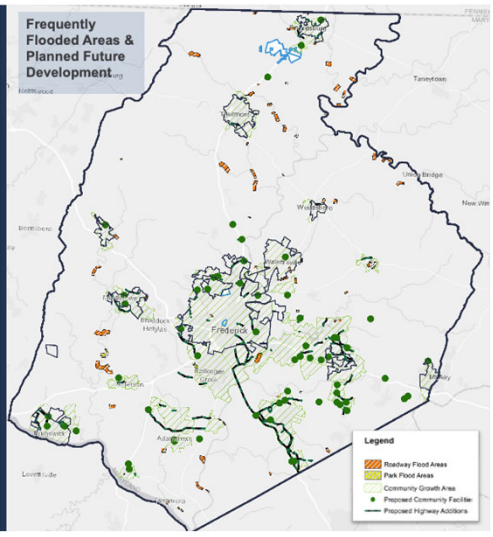
RAS simplified model shows qualitative agreement with detailed Clover Hill model.

34

Example Use Case: Frederick County, MD

Future Conditions Planning

- Comprehensive planning data from the Livable Frederick Master Plan
  - Proposed community facilities
  - Proposed highway additions
  - Community growth areas
- Overlaid with hazard areas to help identify areas of future risk due to increased exposure from future development



35

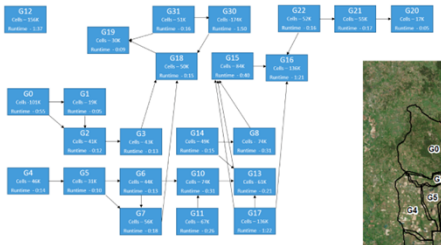
Limitation – Stormwater Conveyance

What about the pipes?

36

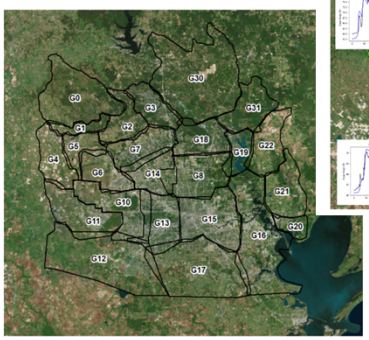
Limitation – Fluvial Reaches

Simulation Manager

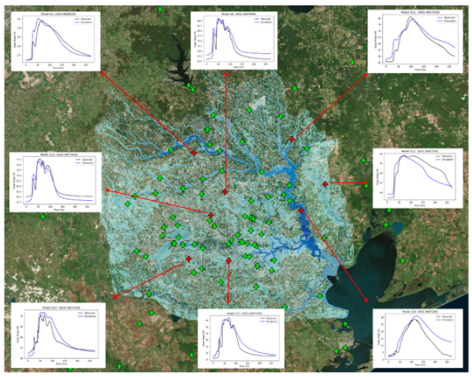


HEC-RAS 2D Hydraulic Model Domains

~1,500 mi², with a total of ~1.75 Million cells at 250 ft. resolution.



Depth Grid & Validation



Hurricane Harvey

37

Discussion

38

Planning Needs

- How do subcommittee members see this information being used in community resilience planning?
- What data is / is not useful?
- What data would be helpful that is not included?
- Are any changes recommended on the interval-based forcing?
- Other comments, concerns, etc.

Pluvial Modeling – Land Use Cover Data

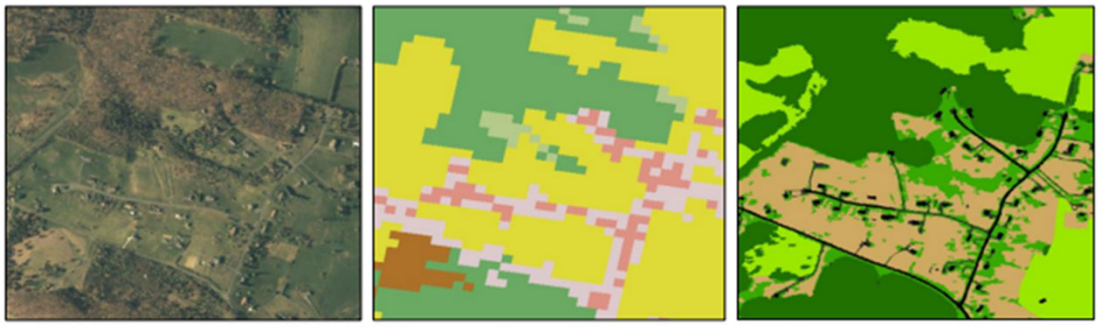


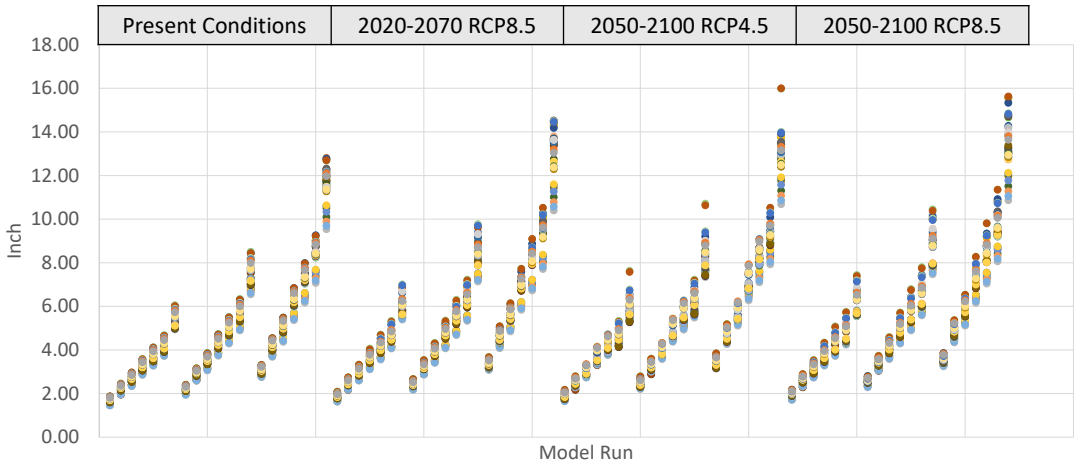
Figure 1. VBMP imagery, 30-meter NLCD, and one-meter VSLCD.

Pilot Study Pluvial Flood Model Scenarios

- Intensity via Climate Scenarios and Location
  - Atlas 14 values
  - Median 2020-2070 RCP8.5 values
  - Median 2050-2100 RCP4.5 values
  - Median 2050-2100 RCP8.5 values
- Duration
  - 2-hr, 6-hr, 24-hr durations;
- Frequency
  - 2-, 5-, 10-, 25-, 50-, 100-, 500-year
- Intensity via Intervals
  - 2-hr Duration
    - Range = 1.45 – 7.63 in
    - 1 – 8 in @ 0.5-in interval (15+ runs)
  - 6-hr Duration
    - Range = 1.94 – 10.71 in
    - 1 – 11 in @ 1-in interval (11+ runs)
  - 24-hr Duration
    - Range = 2.75 – 16 in
    - 2 – 16 in @ 1-in interval (15+ runs)
- Frequency
  - 2-, 5-, 10-, 25-, 50-, 100-, 500-year
- + runs needed at tidal boundary for SLR considerations

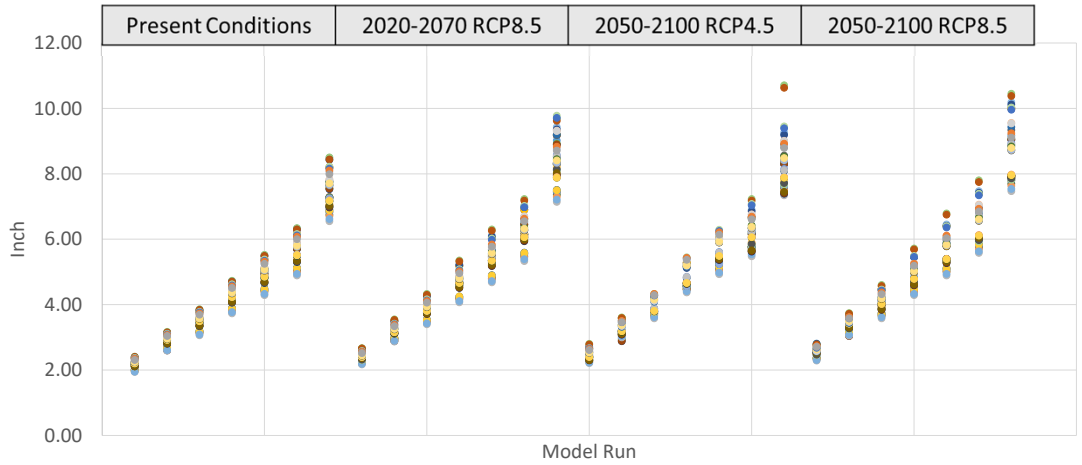
41

All Pilot Study Simulations



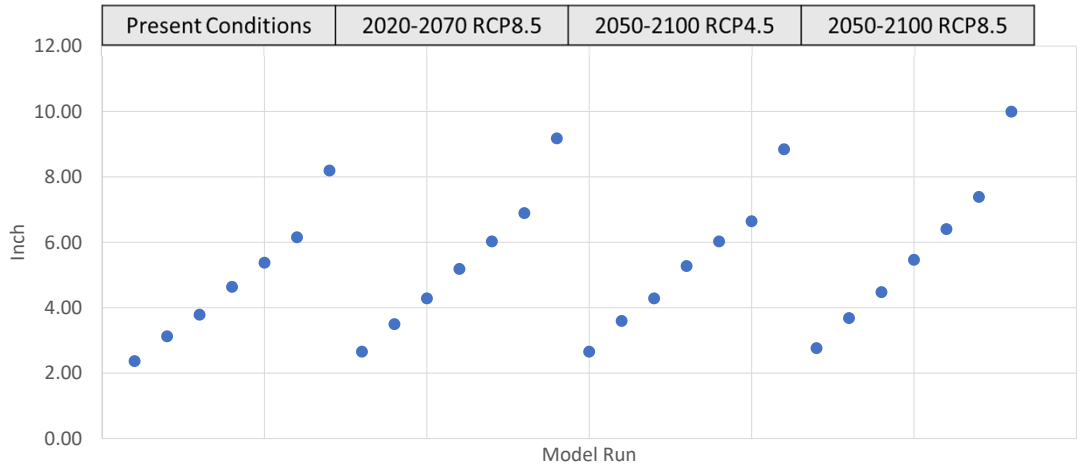
42

All 6-hr Model Simulations



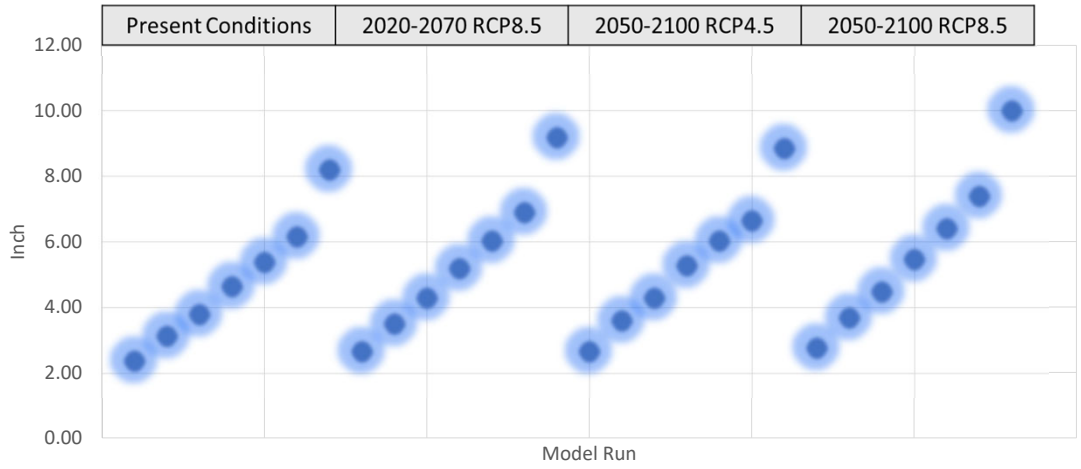
43

Individual Subbasin, 6-hr Model Simulations



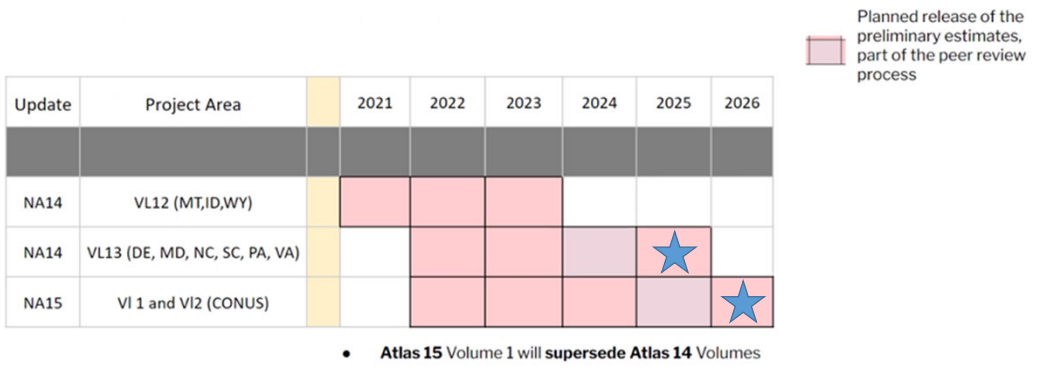
44

Individual Subbasin, 6-hr Model Simulations



NOAA Atlas 14/15 Updates

Timeline



- **Atlas 15** Volume 1 will **supersede Atlas 14** Volumes

Pilot Study Pluvial Flood Model Scenarios

- Climate Scenarios
  - Frequency Based (Return Interval)
  - Facilitates impact data calculation and summary
  - Data shelf life due to Atlas 14/15 Updates (Models are available to be updated)
  - Consistent with CRMP Coastal Flood Hazard
  - Does not represent full range of conditions (Median Value only)
- Intensity via intervals
  - Intensity Based (Inches)
  - Cross-walk needed for each subbasin for return interval
  - Adaptable for future data/conditions
  - Relatable to weather forecasts

Comments + Questions

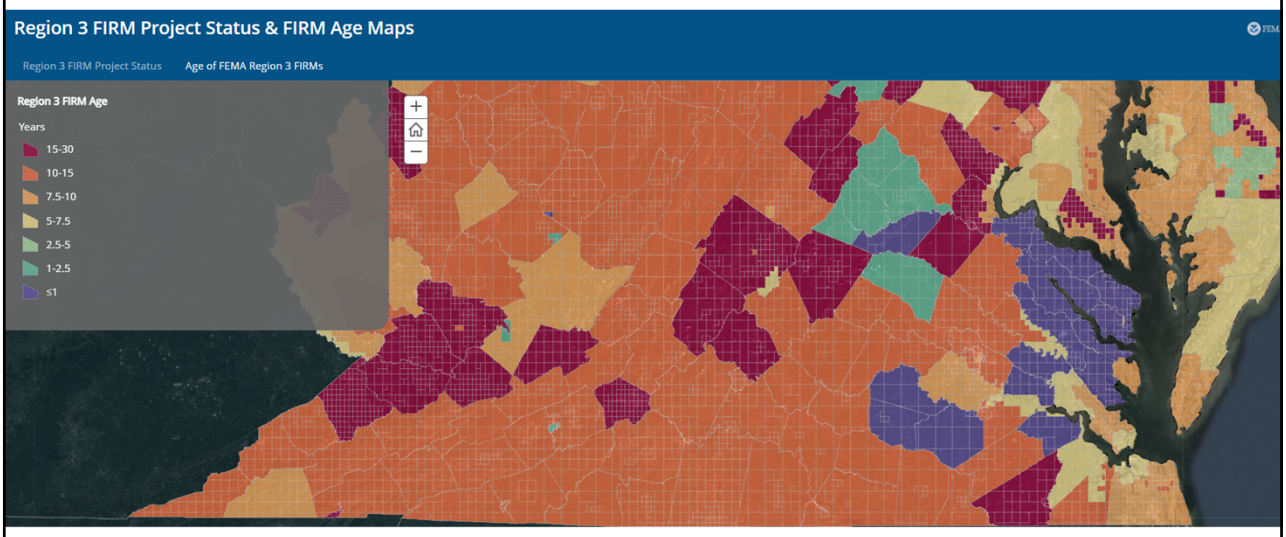
Decision Points

Land Use Cover Dataset Recommendation

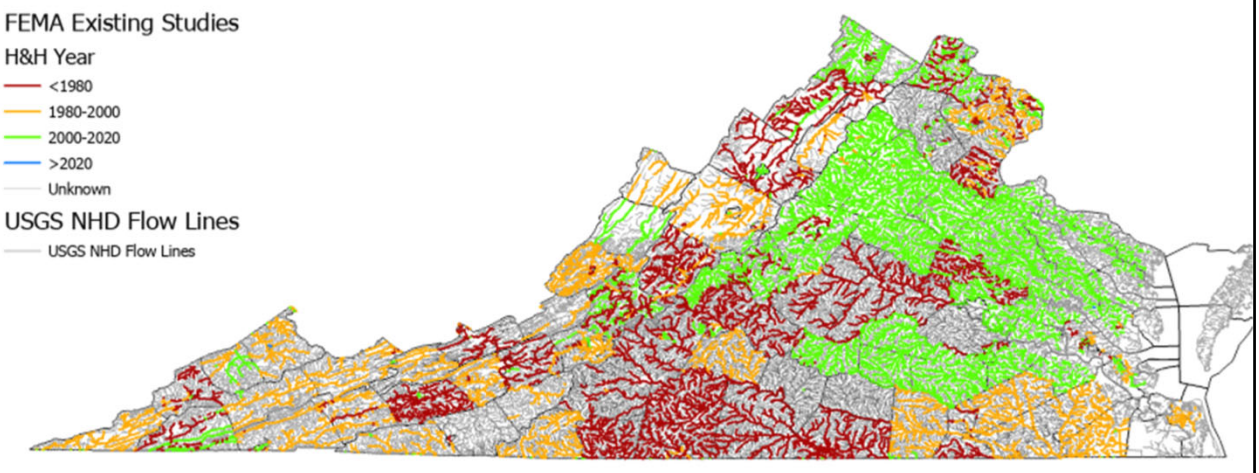
Climate Scenario Approach Recommendation

Other Recommendations

FEMA Fluvial Flooding Data

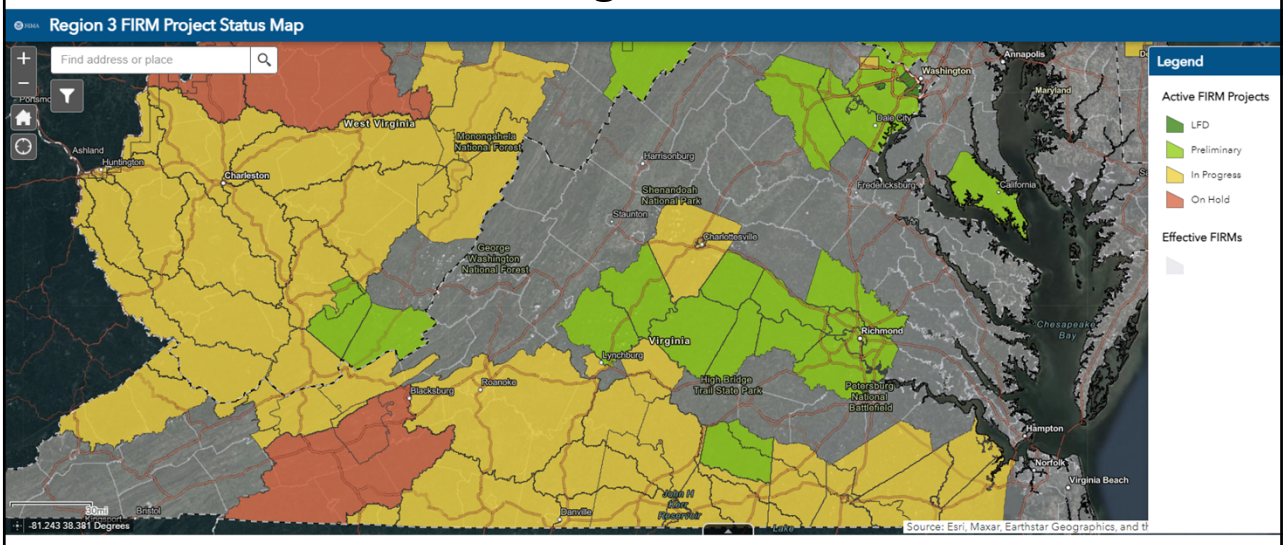


FEMA Fluvial Flooding Data

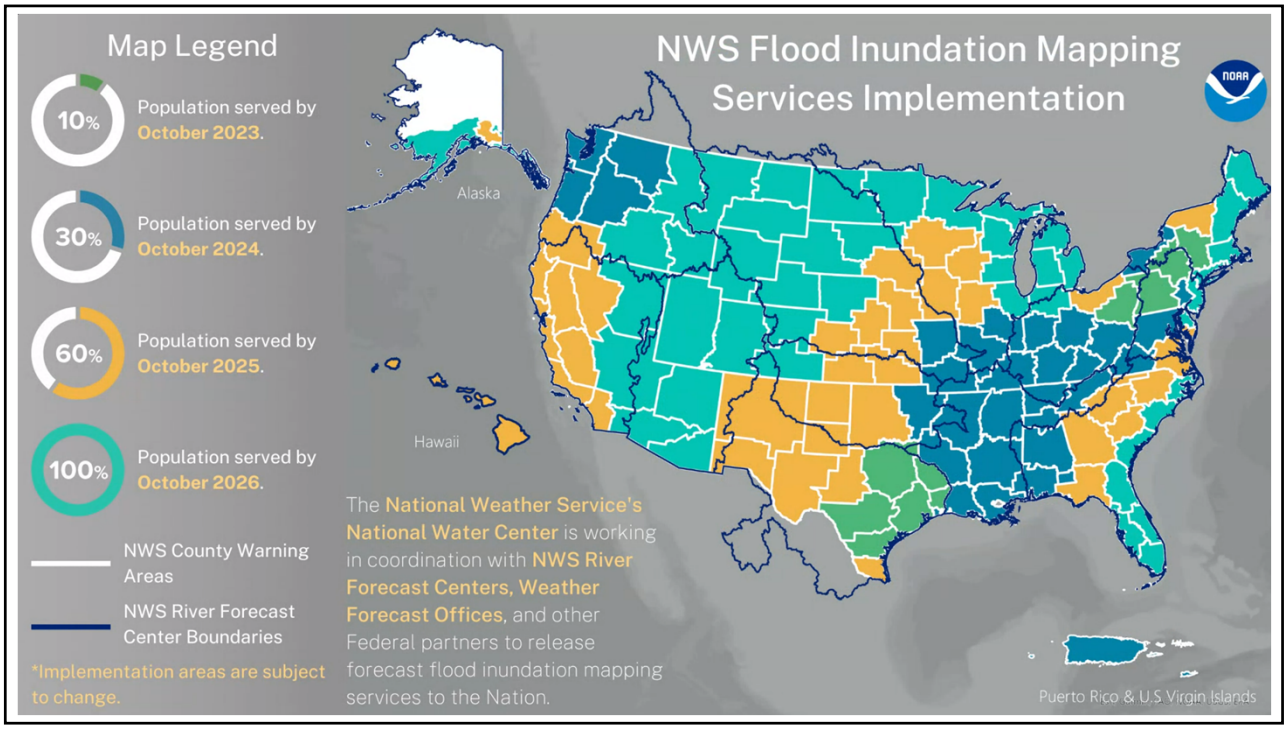


51

FEMA Fluvial Flooding Data



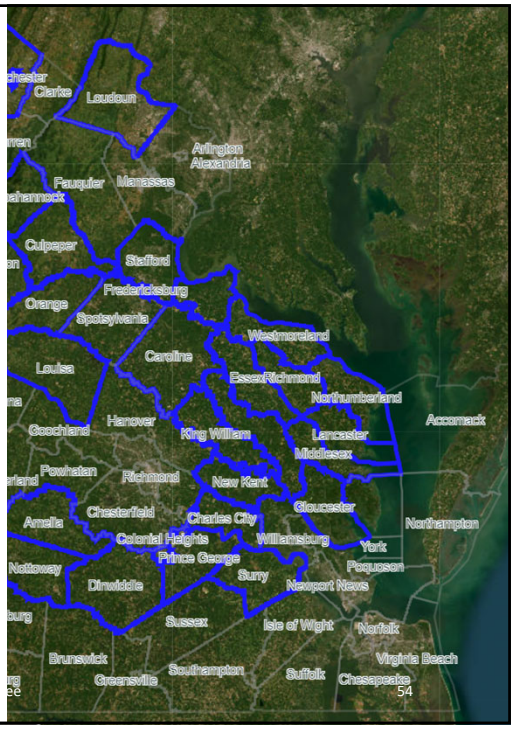
52



53

Fluvial Flood Hazard Data

- Existing FEMA Data
  - Pluvial Not Included
  - Fluvial Limited
- Future Federal Data
  - FEMA Data Updates
  - NWS Flood Inundation Models
  - Climate Informed Scientific Approach Data
- VFPMP 2025
  - Data Development vs Data Leasing via 3rd Party Vendors?



8/22/2023

54

What are the 3rd Party Vendors Offering?

- Coastal, pluvial, fluvial full coverage models
- Coarser resolution (~10m)
- Multiple return periods
- Multiple climate scenarios
- Impacts and risk scoring
- Leased/licensed data
- Quick data delivery

Decision Point

Recommendations for VFPMP Flood Hazard Data

- Best Available v Data Development v Data Leasing

Subcommittee Members Discussion

57

Action Items, Scheduling

- Action Item Review
- 2023Q4 Meeting
  - Date/Time
  - Location
  - Agenda Items

58

Public Comment

- If you seek to provide public comment, please sign up either in-person or virtually using the Chat window.