



Maryland
Department of
the Environment

Maryland's Comprehensive Flood Management Watershed Studies Initiative: Engagement and Pilots

Prepared for the Maryland Department of Emergency Management (MDEM) and the
Federal Emergency Management Agency (FEMA)
Application for FFY24 Flood Mitigation Assistance (FMA) Grant - Project Scoping

Submitted by:

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Maryland's Comprehensive Flood Management Watershed Studies Initiative

Summary of the Watershed Studies Initiative

Each comprehensive flood management watershed study (watershed study) will deliver a new generation of flood models that are continuously maintained and publicly accessible, transforming how permitting decisions are made to reduce flood risk and providing a long-term plan for implementation of flood risk reduction strategies for NFIP communities. Each watershed study will be completed on a HUC-12 scale and consist of three core components: watershed modeling, a flood risk assessment, and a flood management plan.

Each watershed study will:

- Develop watershed models that utilize HEC-RAS 2D Rain on Mesh to quantify fluvial and pluvial flood risks at multiple flood frequency events, while also incorporating coastal, tidal, and nuisance flood influences. In addition to the standard 24-hour design storms at current and non-stationary/ ultimate development conditions, diverse and memorable historic events will be studied along with a short-duration convective storm. Resultant flood mapping will show flood risk upstream and outside of the FEMA floodplain because the FEMA floodplain ends at a 1 square mile drainage area.
- Quantify flood risk under each of the study events, including repetitive loss and severe repetitive loss structures, to determine the watershed flooding damage centers in the Flood Risk Assessment to understand current and future watershed hazards and vulnerabilities; and identify areas needing mitigation measures.
- Develop a Flood Management Plan that will provide mitigation actions and a strategy to help implement mitigation projects, including cost estimates and project priorities that will be needed for development of future hazard mitigation projects. Mitigation actions include structural and non-structural solutions that will reduce flood risk and flood claims against the NFIP.
- Recommend the steps needed for all participating governmental units to formally adopt the flood management plan, incorporate mitigation projects into local Hazard Mitigation Plans, and implement the "Living Models" (continuously- maintained and publicly-accessible assets) for use in development permitting.
- Communicate flood risk that exists outside of the Special Flood Hazard Area, and enhance community flood resilience for Maryland's NFIP participating communities.

Connections to Other Grants

The activities in this FFY24 FMA scope of work are distinct and built upon the foundational materials created under the FFY22 FMA grants, however, the activities in this scope of work are **independent and not duplicative of previously funded activities.**

Previously funded watershed study activities include:

- FMA-03-2022-0007: GIS Watershed Prioritization Tool for Building Flood Resiliency
 - Investigation of simplified conceptual flood models vendors
 - Purchase of Fathom data for use as Hazard layer in GIS index
 - Creation of GIS based index for prioritization of watersheds for study
 - Creation of a GIS map showing areas of known flooding to validate prioritization
- FMA-03-2022-0008: Watershed Assessment Framework for Risk Based Flood Mitigation
 - Investigate and procure GPS survey equipment for field collecting conveyance system and first floor elevation data
 - Development of website functional requirements, website creation, and website updates
 - Creation of schema for field collection of conveyance system structures (bridges, culverts, and stormdrain systems) and first floor elevation estimates of building structures; and modifications of the bridges/ culvert database for communicating structure data
 - Creation of a Watershed Studies Framework guidance document
 - Creation of Watershed model standards Framework guidance document
 - Creation of GIS Framework guidance document
 - Creation of Flood Risk Assessment Framework guidance document
 - Creation of Flood Management Plan Framework guidance document
 - Creation of Mitigation solutions Framework guidance document
 - Creation of a Water Quality Connection Framework guidance document
 - Creation of a Stormwater and Land Use Solutions Framework guidance document
 - Creation of a comprehensive Watershed Governance guidance document
- FMA-03-2022-0009: Pilot Watershed Assessments for Conceptual Flood Mitigation Solutions
 - Classification of the the state into watershed modeling units for study and levels of detail to establish unit prices
 - Procurement of an on-call contractor to perform watershed studies in Maryland
 - Pilot watershed studies in the Southern and the Central/Western portion of the state.

- FFY23 BRIC Building Code Plus Up: (selected but not awarded)

This list is not exhaustive of all activities in the FFY23 BRIC scope of work, only those activities directly related to watershed studies are listed below:

- Pilot watershed studies in the Georges Creek watershed
- Analysis to determine appropriate State Resiliency Riverine Floodplain (once completed, the results will be incorporated into future watershed studies)
- Land Use Policy workshops that will help set a plan to incorporate watershed study results into planning documents

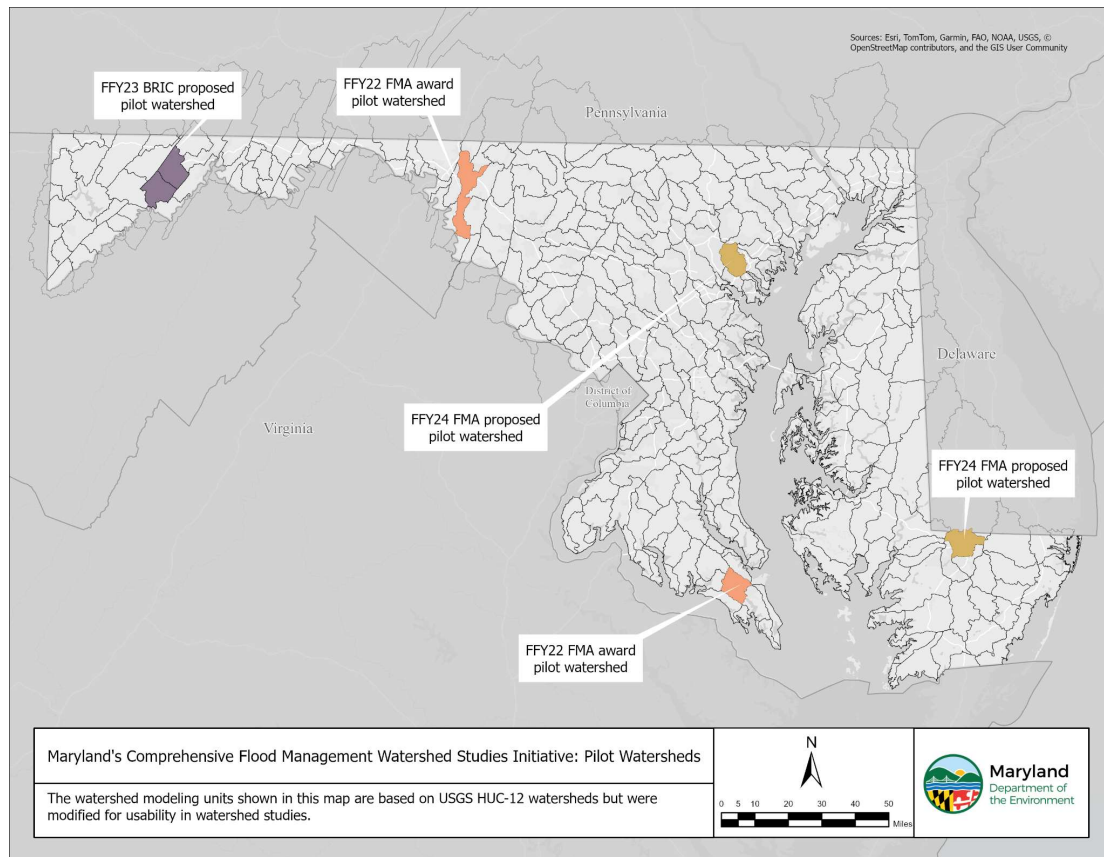


Figure 1: Location of Pilot watershed studies utilizing FEMA funding. Studies proposed in this FFY24 FMA application include an Eastern Shore watershed and the first urban watershed study.

Scope of Work

Task 1: Gathering Resources and Hiring Contractual Services

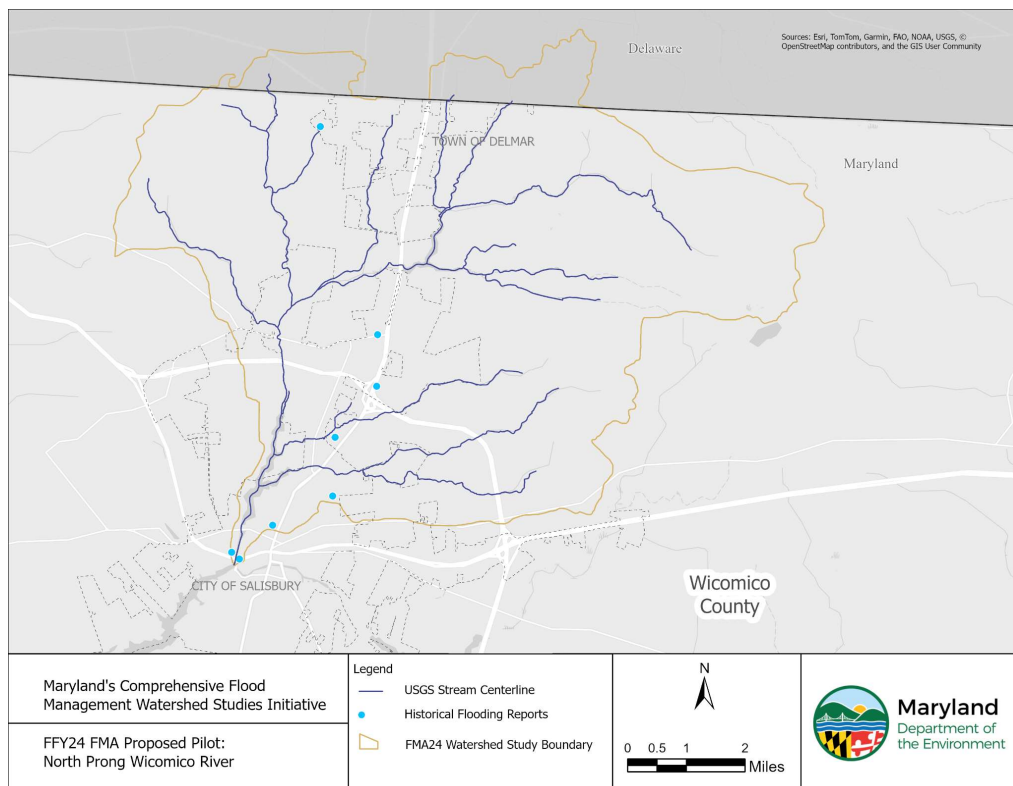
MDE will begin by gathering resources and developing a scope of work for hiring qualified contractual services. This process will be expedited because MDE already procured an on-call

contractor for watershed studies and watershed study related activities with options totaling an eight-year contract (2026-2034).

This task will include: review and approval of sub-award agreement with Maryland Department of Emergency Management; develop scopes of work using our existing on-call contractor for watershed studies; determine extents of field survey needed for pilot watershed study; establish detailed project schedules; and issue task orders (MES/contractor) and purchase orders (MDE/MES).

Task 2: Pilot Watershed Study: North Prong Wicomico River

MDE will complete a pilot watershed study in the North Prong Wicomico River watershed (based on USGS HUC-12 watershed 020801100301). The North Prong Wicomico River is selected as a pilot site due to preliminary data indicating high flood risk, proximity to repetitive loss areas, and the opportunity to test inter-jurisdictional governance. The watershed study will follow the MDE watershed study scope of work, including coordination with the local governments, field survey of hydraulically significant conveyance structures, completion of watershed models, a flood risk assessment, a flood management plan, and assistance with adoption.



The North Prong Wicomico River is a 38.8 square mile watershed encompassing a large portion of Salisbury, MD with over 44 miles of stream length. There are three NFIP communities in the watershed:

NFIP Community	CID	Repetitive Loss Structures in watershed	NFIP insured structures in the watershed	Properties in the SFHA in the watershed
Salisbury	240080	3	30	59
Delmar	240186	0	7	0
Wicomico County	240078	3	31	28

This pilot study provides an opportunity to demonstrate inter-jurisdictional coordination and watershed governance guidance activities such as model adoption and hazard mitigation planning. Additionally, some of the watershed falls in Delaware, so we will be able to demonstrate how we model out of state areas cost effectively.

The watershed study will show flooding outside of the Special Flood Hazard Area (SFHA). Figure below is an estimation of the flood risk in this watershed outside of the SFHA.

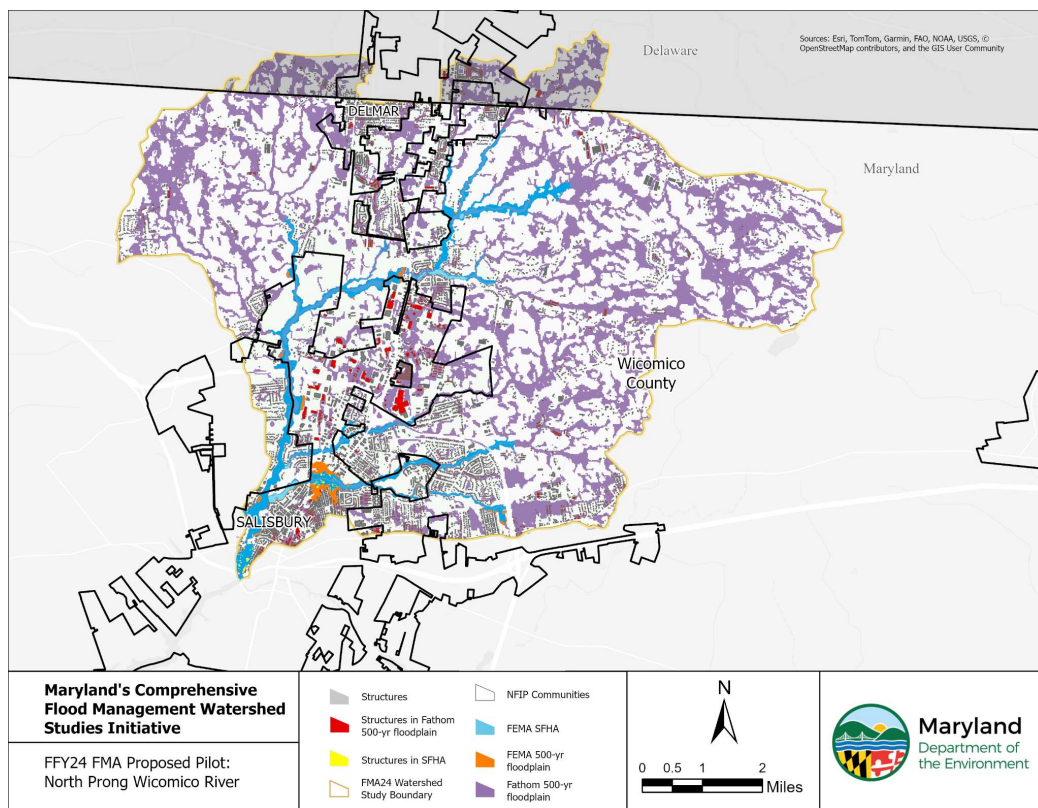


Figure 3: Preliminary estimate of the flood risk to be studied in the North Prong Wicomico River Pilot Watershed Study. This estimate shows 1,844 structures with flood risk in the watershed, however only 68 structures are insured through the NFIP

The flood management plan that will result from the watershed study will identify and rank flood risk mitigation projects with preliminary cost estimates. MDE, Wicomico County, Salisbury, and Delmar will engage Maryland Department of Emergency Management (MDEM) as a partner for updating the local Hazard Mitigation Plan(s) to incorporate these priority mitigation projects.

Task 3: Pilot Watershed Study: Redhouse Creek- Back River (Herring Run)

MDE will complete its first urban watershed study by studying the Redhouse Creek-Back River watershed (based on USGS HUC-12 watershed 020600030702). The watershed study will follow the MDE watershed study scope of work, including coordination with the local governments, field survey of hydraulically significant conveyance structures, completion of watershed models, a flood risk assessment, a flood management plan, and assistance with adoption.

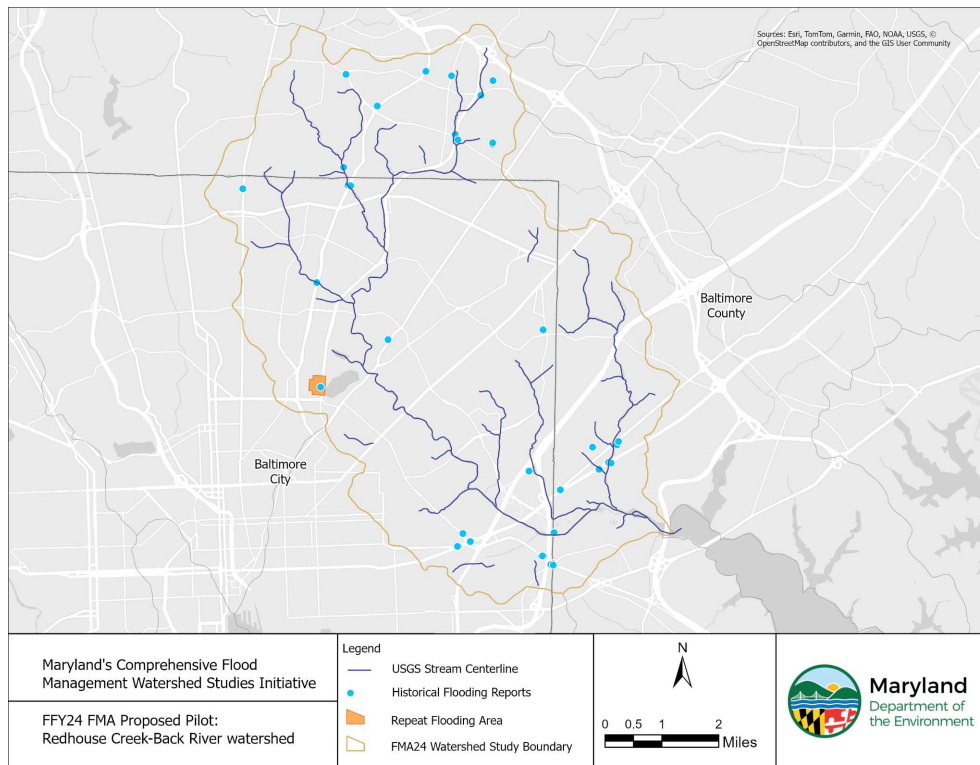


Figure 4: Location and Extents of Redhouse Creek-Back River Pilot Watershed

The Redhouse Creek-Back River watershed is an urban 31.3 square mile watershed encompassing two NFIP communities (Baltimore City and Baltimore County) with over 41 miles of stream length.

NFIP Community	CID	Repetitive Loss Structures in watershed	NFIP insured Structures in the watershed	Properties in the SFHA in the watershed
Baltimore City	240087	4	93	236
Baltimore County	240010	0	69	139

MDE will coordinate with Baltimore City, Baltimore County, Baltimore Urban Waters Partnership, and other watershed organizations active in the watershed. Additionally, this will be the first pilot where the watershed study is also leveraged for CRS credits (Baltimore City activity), further enhancing the flood resilience co-benefits of the watershed study.

The watershed study will show flooding outside of the Special Flood Hazard Area (SFHA). Figure below is an estimation of the flood risk in this watershed outside of the SFHA.

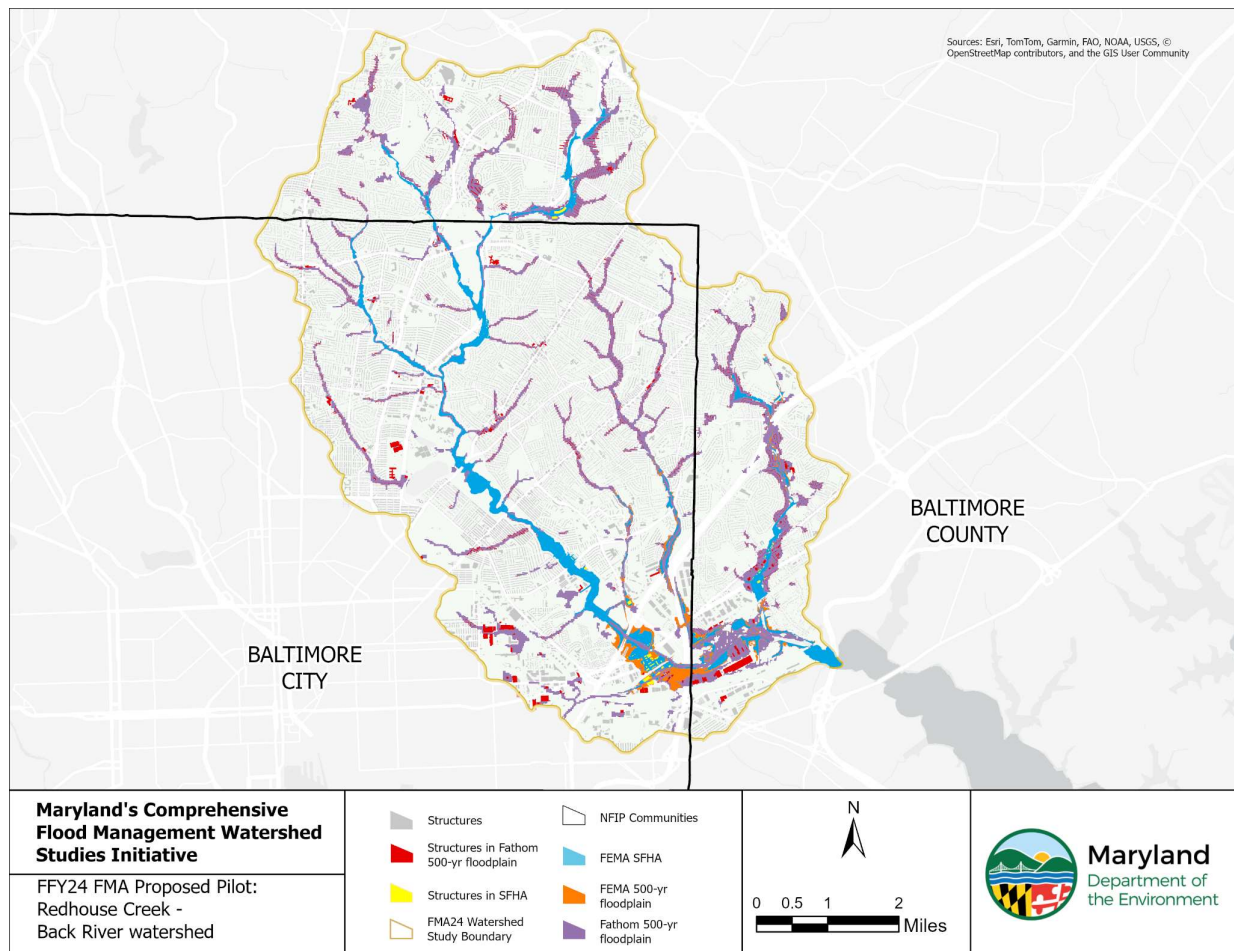


Figure 5: Preliminary estimate of the flood risk to be studied in the Redhouse Creek - Back River Pilot Watershed Study. This estimate shows 4,960 structures with flood risk in the watershed, however only 162 structures are insured through the NFIP

The flood management plan that will result from the watershed study will identify and rank flood risk mitigation projects with preliminary cost estimates. MDE, Baltimore County, and Baltimore City will engage Maryland Department of Emergency Management (MDEM) as a partner for updating the local Hazard Mitigation Plan(s) to incorporate these priority mitigation projects.

Task 4: HEC-RAS 2D Training and Education

MDE's watershed studies initiative is a bold and comprehensive program that will change how watersheds are governed in Maryland. It will require training for the engineers in both the private and public sectors to adopt these watershed models as "living models" that are properly maintained and used for development permits. The development community and private sector engineers will need to learn HEC-RAS 2D to be able to show the effects of their development project on the watershed flooding in their permit applications using the living models. Public sector engineers will need to learn HEC-RAS 2D to be able to review those permits efficiently and maintain those models for the next development project.

Existing HEC-RAS 2D training is targeted at model development, but our new curriculum is uniquely designed around Maryland's 'Living Models' framework. This MDE-specific training will ensure engineers learn the precise interpretation and maintenance procedures required for utilizing these models in local development permits, guaranteeing long-term model integrity and usability across the state. In short - we will remove the "noise" that other HEC-RAS 2D training programs include and only focus on those software features that are utilized in the MDE watershed studies framework.

MDE will develop the curriculum for this training program using the framework documents already created as the "textbook". We intend to offer 10 one-day training workshops and 7 two-hour online refresher trainings as follows:

Grant Year	Training Type	Format	Duration	Quantity	duration x quantity
Year 2	Instructional - Basic	Virtual	6 hours	3	18 hours
Year 2	Instructional - Basic	In-person	6 hours	2	12 hours
Year 2	Refresher	Virtual	2 hours	3	4 hours
Year 3	Instructional - Basic	Virtual	6 hours	3	18 hours
Year 3	Instructional - Basic	In-person	6 hours	1	6 hours
Year 3	Refresher	Virtual	2 hours	4	8 hours
Year 3	Instructional - Advanced	Virtual	6 hours	1	6 hours
				TOTAL = 17 COURSES	TOTAL = 72 HOURS

MDE will work with our partners at Chesapeake Water Environmental Association (CWEA) and Maryland Association of Floodplain Managers (MAFSM) to ensure attendees of these trainings receive Continuing Education Credits (CECs) for Professional Engineers (PEs) and Professional Development Hours (PDHs) for Certified Floodplain Managers (CFMs), however courses will not be limited to members of these organizations. MDE will ensure that all courses are free. We will need to purchase a subscription to an online training platform. In-person courses will be offered at diverse locations around the state. Engineering and non-engineering staff from County and local governments in areas that received pilot watershed studies, and watersheds deemed high risk to flooding will be directly contacted and encouraged to attend. It is expected that 5-10 people will attend each training session, resulting in 360-720 contact hours of training.

Task 5: Outreach and Engagement

MDE has set up the framework for comprehensive flood management watershed studies and has been working to develop buy-in, and will maintain this momentum to solidify the initiative as sustainable. MDE will continue to promote watershed studies through targeted outreach to engineers, elected officials, and local/County staff. MDE will also attend conferences where watershed studies will be discussed, provide presentations at events where the targeted audience will be present, participate in meetings and discussions with interested parties, promote watershed studies in state planning workgroups, and work to incorporate watershed studies into state planning documents.

MDE will offer technical assistance to:

- NFIP communities to help them apply for State Comprehensive Flood Mitigation Grant Program and FEMA Hazard Mitigation Grants, **specifically targeting the mitigation projects recommended by the newly completed watershed studies.**
- NFIP communities in watersheds determined to be high flood risk to help them apply for State Comprehensive Flood Mitigation Grant Program grants to fund watershed studies.

Additionally, Maryland Law already identifies that watershed studies are eligible for State Comprehensive Flood Mitigation Grant program. As part of this activity, MDE will review and recommend specific statutory or regulatory updates to clarify and streamline the use of state grant funds for both initiating future comprehensive watershed studies and implementing the resulting flood mitigation projects (no lobbying is included in this activity).

Conclusion

The activities in this FFY24 Flood Mitigation Assistance grant request marks the critical transition for Maryland's Comprehensive Flood Management Watershed Studies Initiative, moving from foundational framework development to practical implementation. This funding is essential for successfully deploying our innovative approach across the state, ensuring that planning leads directly to mitigation action.

The two targeted pilot studies— the North Prong Wicomico River and Redhouse Creek–Back River watersheds—will serve as vital proving grounds. They will validate the technical standards for our “Living Models,” test crucial inter-jurisdictional governance protocols, and demonstrate how our comprehensive Flood Management Plans translate directly into priority mitigation projects that reduce flood risk and claims against the NFIP.

Furthermore, the customized HEC-RAS 2D Training and Education program will build the necessary public and private sector capacity to ensure these models are adopted, maintained, and utilized for all local development permitting. By coupling this technical rigor with robust outreach and buy-in, including technical assistance and legislative review, MDE is committing to a sustainable and transformative model. This investment guarantees that our scientifically rigorous watershed studies will translate into measurable, long-term flood resilience for Maryland's NFIP communities.

Sub-Recipient Project Management

Project management costs include salary and fringe costs to complete project management and project administration tasks of Maryland's Comprehensive Flood Management Watershed Studies Initiative: Engagement and Pilots associated with managing the award (e.g., quarterly reporting including managing milestones, writing and submitting amendments, writing and submitting closeout documents, financial reporting, tracking project budget and schedule, and reviewing contractor blanket purchase order); and professional development that is related to the implementation of this project.