Virtual Conference Program

MAFSM 2020 Conference Schedule

DAY 1

Thursday, November 5, 2020

Time	*Min*	VIRTUAL ROOM 1	VIRTUAL ROOM 2
8:30 – 9:00	*30*	**SIGN ON**	
9:00 – 9:15	*15*	Day 1 - Kick Off **Jason Sevanick Durant, CFM, GISP** - MAFSM Chair	
9:15 – 9:45	*30*	National Flood Insurance Program Updates **Richard J. Sobota, CPCU** - Federal Emergency Management Agency (FEMA)	Emergency Services Due to Flooding **Micah Ceary, PhD, PE, DBIA** - Brudis and Associates, Inc. **Shayaq Ahmed, PE, PTOE** - Brudis and Associates, Inc.
9:45 – 10:15	*30*	100 Year +3 / New Coast Smart Guidelines (Sept 1): Mapping, Siting, and Design Criteria for State Construction and Funding in Coastal Areas **Dave Guignet** - Maryland Department of the Environment (MDE)	Understanding Active and Passive Floodproofing Options for Non-Residential Buildings in a Special Flood Hazard Area **Kurt Luecke, CFM -** Floodproofing.com
10:15 – 10:30	*15*	**BREAK**	
10:30 – 11:00	*30*	Comparison of Hydrologic Routing Methods **Laura Chap, PE, CFM** - Atkins	Lower North East Creek Watershed Master Plan **Bryan Lightner, CFM** - Cecil County Department of Land Use & Development Services
11:00 – 11:30	*30*	Floodplain Delineation Using HEC RAS 2D in Charles County, MD **Katie Scott, PE** - Coastal Resources, Inc. **Lara Mulvaney** - Spatial Systems Associates, Inc.	Evaluation of Rainfall Trends in Fairfax County, Virginia **Donald R. Demetrius, PhD, PE, CFM** - Atkins **Dipmani Kumar, PhD, PE, CFM** - Fairfax County
11:30 – 12:00	*30*	NOAA's National Water Model – Mapping the Forecast Inundation Areas **Michael Manen** - Maryland Environmental Service **Jennifer McGee, PE, CFM, GISP** - Wood PLC	Pluvial Flooding Vulnerability Assessment in Clover Hill, Frederick County, MD **Dano Wilusz, PhD** - Dewberry Engineers Inc. **Angelia Miller** - Frederick County Government (Sustainability and Environmental Resources)
12:00 – 12:15	*15*	**DAY 1 Conference Close Out**	

MAFSM 2020 Conference Schedule

DAY 2

Friday, November 6, 2020

Time	*Min*	VIRTUAL ROOM 1	VIRTUAL ROOM 2
8:30 – 9:00	*30*	**SIGN ON**	
9:00 – 9:15	*15*	Day 2 - Kick Off **Jason Sevanick Durant, CFM, GISP** - MAFSM Chair	
9:15 – 9:45	*30*	Land Subsidence Contributions to Relative Sea Level Rise in Baltimore Inner Harbor, MD **Yi Liu, D.Eng., P.G.** - Morgan State University	2021 State of Maryland Hazard Mitigation Plan Update **JaLeesa Tate, CFM** - Maryland Emergency Management Agency (MEMA)
9:45 – 10:15	*30*	Compound Urban Flooding in the Large Metropolitan Areas Located along Tidal Rivers **Selina Sumi** - AECOM	Refining Local Hazard Mitigation Plans Through Enhanced Floodplain Manager Involvement **Joshua Norris** - Federal Emergency Management Agency (FEMA) **Joseph Bucovetsky** - Federal Emergency Management Agency (FEMA)
10:15 – 10:30	*15*	**BREAK**	
10:30 – 11:00	*30*	Courses of Action to Support Current and Future Flood Risk Management at a US Naval Installation **Sivaramakrishnan Sangameswaran, PhD, PE, D.WRE, CFM** – Dewberry, Inc. **Matthew Breitenother** - USACE, Baltimore District	Quantifying the Benefits of Natural and Nature-Based Features in Maryland's Chesapeake and Atlantic Coastal Bays to Inform Conservation and Management under Future SLR Scenarios **Jackie Specht** - The Nature Conservancy **Daniel Coleman, PhD** - George Mason University
11:00 – 11:30	*30*	Leveraging Local Data for Better Planning and Flood Outreach **Susanna Pho, CFM** - Forerunner	Generalizing Wave Attenuation from Living Shorelines **Kristine Mosuela, EIT** - Wood PLC and Virginia Tech
11:30 – 12:00	*30*	Getting More Floodplain and Stormwater Managers to Reflect the Diversity of Communities We Serve (STEM Student Showcase) **Lynn Mayo, PE** - RePicture **Noran Shahin** - University of Houston	Climate Adaptation and Resiliency Planning for the City of Aberdeen **Christopher L. Overcash, PE, BCEE, ENV SP, LEED AP** - EA Engineering, Science, and Technology, Inc., PBC **Nicole E. Williamson** - EA Engineering, Science, and Technology, Inc., PBC
12:00 – 12:15	*15*	**DAY 2 Conference Close Out**	

National Flood Insurance Program Updates

Time / Room *Day 1 (Nov 5): 9:15 – 9:45am in Virtual Room 1*

Presentation Summary Shortly before the MAFSM conference, the deadline for reauthorization of the National Flood Insurance Program stood at September 30th, 2020. We will explore in detail any Program changes occurring as part of anticipated reauthorization legislation.

In addition, this presentation will highlight major Program changes that are part of the ongoing NFIP "Transformation" including enhanced data reporting and analytics, updates to the NFIP "Moonshot" efforts, and the upcoming introduction of a brand new rating methodology, Risk Rating 2.0.

Finally, we will review outreach tools and strategies available to Floodplain Managers and other Stakeholders.

Presenter(s) **Richard J. Sobota, CPCU**
Sr. Insurance Specialist
Federal Emergency Management Agency (FEMA)

As the Sr. Insurance Specialist for FEMA, Rich Sobota serves as a subject matter resource for internal and external NFIP stakeholders. His current area of focus includes outreach efforts related to "Closing the Insurance Gap" and helping to build a culture of preparedness and resilience. Rich assumed responsibilities as the Regional Community Rating System (CRS) Coordinator in January 2016. More recently, Rich was designated as Regional PIVOT Coordinator as part of the ongoing NFIP Transformation.

Before joining FEMA in 2008, Rich served as the Northeast Territorial Manager under FEMA's NFIP Bureau & Statistical Agent contract. In this role, he conducted numerous seminars, workshops and informational meetings for various NFIP audiences. He has also assisted FEMA's disaster response efforts during deployments to numerous Federally Declared disaster sites throughout the United States and its territories, including a recent (virtual) deployment to assist with COVID-19 response efforts.

Emergency Services Due to Flooding

Time / Room *Day 1 (Nov 5): 9:15 – 9:45am in Virtual Room 2*

Presentation Summary Brudis & Associates, Inc. (BAI) was tasked by the Division of Public Works for Washington County, MD to prepare construction plans for the repair of Back Road after failure of the roadway from overtopping stream flow. During a severe storm in May 2018, 525' of Back Road washed away due to extreme flooding from the Unnamed Tributary to the Chesapeake and Ohio Canal. In addition to the road washing away, more damage occurred upstream where the Tributary crosses under Back Road. Significant erosion occurred around the wing walls of an existing single span concrete slab bridge structure over the Tributary and approximately 725' of partial roadway damage occurred along Back Road uphill from the culvert. The entirety of the project is operating as a Design Build with a one-year schedule of completion. Portions of the work were performed under emergency stream closure measures, including replacement of the culvert and 150' of channel bed reestablishment and stream bank stabilization measures. The remaining 57' of channel bed reestablishment, 105' of stream bank stabilization adjacent to Back Road, and 170' of stream bank stabilization on National Park Service (NPS) property were performed after the emergency stream closure measures.

BAI conducted a field review to examine the roadway and stream alignment, a preliminary assessment of existing roadway, roadside ditches, shoulders, other roadway features to collect the necessary data and evaluate stream flow characteristics and channel stability. BAI performed a visual field inspection of all bridge structural elements to verify existing conditions and previous inspection report findings, measure and verify key as-built dimensions to assess problem areas and conditions that may impact the roadway reconstruction and special use permit application. BAI also examined existing highway drainage, existing signs, pavement markings, utilities, and other relevant field conditions.

BAI conducted a hydrologic study to determine the ultimate development conditions peak discharges for the 2-, 10-, 25-, and 100-year recurrence intervals. The discharges from these analyses were then used to perform existing and proposed conditions hydraulic analysis of the tributary to the canal, and to determine the waterway opening size of the replacement structure.

The objective of the stream stabilization design was to restore the stream channel to Pre-Existing Conditions adjacent to the reconstructed Back Road. Additionally, the stream stabilization design is to convey the 2-year storm discharge event without spreading it across the roadway. The NPS requires the proposed design minimize impacts to NPS property that include restoring the existing channel bed by removing the sediment and minimizing any bank grading on the opposite bank from the roadway through the washed-out section. Secondary objectives included minimizing increases in flood elevation and floodplain boundary, and promoting public welfare and protection.

Presenter(s) **Micah Ceary, PhD, PE, DBIA**
Director, Structure Division
Brudis and Associates, Inc.

Dr. Micah Ceary is a professional engineer, holds a PhD from the University of Maryland at College Park, and is a design-build professional with over 21 years of experience in structural engineering inspection, design, and analysis of various types of structures. He specializes in the design, condition inspection, and load ratings of steel and concrete highway bridges for grade separations and stream crossings; alternative bridge studies and bridge widening projects. He is also experienced in the design of new highways, roadway widening and improvement projects, highway alignment studies, sign structure details, drainage, and the preparation of ROW plans. He works for Brudis and Associates, Inc.

Shayaq Ahmed, PE, PTOE
Project Manager
Brudis and Associates, Inc.

Mr. Shayaq Ahmed is registered professional engineer and professional traffic operations engineer with more than 15 years of engineering experience. His expertise includes highway design, horizontal and vertical alignments, sidewalks and ADA compliance/upgrades, bicycle lanes, traffic and feasibility studies, establishment of right-of-way needs, signing and pavement marking, erosion and sediment control, stormwater management, maintenance of traffic plans, as well as quantities and cost estimates. He works for Brudis and Associates, Inc.

100 Year +3 / New Coast Smart Guidelines (Sept 1): Mapping, Siting, and Design Criteria for State Construction and Funding in Coastal Areas

Time / Room *Day 1 (Nov 5): 9:45 – 10:15am in Virtual Room 1*

Presentation Summary The boundary of the 100-year floodplain does not convey risk to those just outside the line on the FEMA Flood Insurance Rate Map (FIRMs). We have been using these maps for 50 years with success inside the flood boundaries, but we need to expand the message beyond the floodplain to demonstrate that there are flooding risks outside the floodplain. FIRMs may not reflect current conditions and, with only a few exceptions, they do not illustrate risk for future conditions: sea level rise, increased amounts of impervious surface, antiquated and undersized stormwater systems, changing precipitation patterns, and more frequent and stronger coastal storms. Simply adding freeboard to compensate for where FIRMs are lacking does not fully compensate for the flood risk to properties because it only addresses the risk vertically.

BFE Plus Three Feet: Up and Over (BFE +3') is a method that can be used to show potential flood risk to properties both inside and outside the FEMA mapped regulatory floodplain and it accounts for future conditions. Using GIS, this method of calculating flood levels shows the extent of flooding both vertically and horizontally at levels three feet above the base flood elevation. The method is scalable and can be run to calculate and illustrate any level of flooding above the base flood elevation, such as five or ten feet. This presentation will walk the audience through running the BFE +3' process to create maps and use them to communicate risk and empower communities to address risk in ways that promote community awareness and resilience.

Presenter(s) **Dave Guignet**
State NFIP Coordinator
Maryland Department of the Environment (MDE)

Mr. Guignet is the State National Flood Insurance Program Coordinator and Mapping Coordinator for the State's DFIRM floodplain mapping process within the Maryland Department of the Environment (MDE). He attended Penn State University where he received an Associate Degree in Surveying Technology and a B.S in Civil Engineering. He has worked for the State Highway Administration (SHA), the Maryland Department of Natural Resources (DNR).

Understanding Active and Passive Floodproofing Options for Non-Residential Buildings in a Special Flood Hazard Area

Time / Room *Day 1 (Nov 5): 9:45 – 10:15am in Virtual Room 2*

Presentation Summary Floodproofing measures are required for all buildings located in a FEMA floodplain. This course identifies the effects of hydrostatic pressure on building sustainability and explains dry and wet floodproofing techniques utilized to mitigate against flood damage. A review of the liability associated with each floodproofing option is provided. Relevant FEMA regulations, ICC building codes, and ASCE 24 are reviewed. The course provides an in-depth analysis of active and passive floodproofing options and the effect each of these options have on a design. Case studies will demonstrate how to effectively incorporate floodproofing techniques in projects:

- Identify the applicable ICC building codes and FEMA regulations pertaining to non-residential floodproofing options
- Understand the design benefits for each DRY floodproofing and WET floodproofing option
- Identify design issues and occupant' risk associated with active floodproofing techniques and the liability associated with those risks
- Analyze the differences between active and passive floodproofing techniques and how they affect the buildings' sustainability

Presenter(s)

Kurt Luecke, CFM
Flood Mitigation Specialist
Floodproofing.com

As a CFM and Flood Mitigation Specialist for Floodproofing.com, Kurt Luecke provides expertise on FEMA, NFIP, ICC and ASCE guidance found in current IRC/IBC code and analyze product solutions for hazard mitigation, disaster preparedness and floodplain design and construction. Floodproofing.com consults with all parties involved in floodplain management, design, build, and habitation to help identify compliance issues and find solutions that address current or future application needs. Our primary focus is on mitigating damage, improve recovery time and lower flood insurance liability.

Comparison of Hydrologic Routing Methods

Time / Room

Day 1 (Nov 5): 10:30 – 11:00am in Virtual Room 1

Presentation Summary

Hydrologic models require several inputs to estimate the runoff volume and timing from a watershed. One key input is the choice of routing method, which characterizes changes in the flow hydrograph as it travels downstream. Various hydrologic routing methods have been developed to model this change, which affects the peak flow, the hydrograph shape and the travel time downstream. There are several different hydrologic routing methods available within the HEC-HMS model. These methods require input of different parameters. Some of these parameters can be measured or determined from stream channel characteristics. Other parameters are estimates based on assumed channel properties and require interpretation and calibration to observed flows. There are many factors in choosing an appropriate method, including backwater effects are expected to have significant impact; if floodplain storage is a major factor; whether the channel has a steep or mild slope; and whether data is available to calibrate the model.

This presentation will explore the sensitivity of some of the input parameters used in hydrologic routing and provide comparisons to gaged data.

Presenter(s)

Laura Chap, PE, CFM
Senior engineer
Atkins

Ms. Chap has conducted numerous peer reviews and quality control/quality assurance reviews of studies performed for incorporation into FEMA floodplain maps. Reviews have included riverine models using both 100-yr precipitation and snowmelt runoff in Minnesota, mapping of risk zones behind uncertified levees on the Mississippi River, detailed recommendations for debugging and stabilizing a large XP-SWMM model for an urban area in Minnesota, and continuous simulation of closed basin lakes, as well as various other flood studies using HEC-HMS, HEC-RAS, XP-SWMM and FLO-2D. Ms. Chap has over 15 years of experience in hydrologic and hydraulic modeling for both detailed and approximate flood studies, stormwater and watershed planning, and land development.

Lower North East Creek Watershed Master Plan

Time / Room *Day 1 (Nov 5): 10:30 – 11:00am in Virtual Room 2*

Presentation Summary This project will perform hydrologic and hydraulic analyses within a 12-square mile sub-watershed of the North East River to forecast flood vulnerabilities for a range of extreme precipitation events for current and future land use scenarios. Model runs will be performed incorporating different Stormwater Best Management Practices (BMP's) to determine their effectiveness to reduce the extent of flooding and/or volumes. The results will be evaluated to create a plan that will identify potential stormwater system improvements. This plan will also compare upland stormwater runoff scenarios with sea level rise and storm surge scenarios in the coastal portion of the watershed. The Lower North East Creek Watershed Master Plan (WMP) will be developed that identifies recommendations for potential changes to stormwater management regulations, areas to improve upon the existing stormwater system infrastructure, installing new structural and non-structural practices, as well as, identifying procedures to protect and acquire sensitive natural areas and flood-prone properties.

Presenter(s) **Bryan Lightner, CFM**
Zoning Administrator
Cecil County Department of Land Use & Development Services

Bryan Lightner has his bachelor's degree in Geography. He has been working for Cecil County's Department of Land Use and Development Services for over three years. He's currently the County's Zoning Administrator and is staff to the Planning and Commission and Board of Appeals, reviews building permits and answers zoning questions related to County ordinances, and implements the County's Green Infrastructure Plan. He's also a Certified Floodplain Manager and is currently the County's CRS Coordinator.

Floodplain Delineation Using HEC RAS 2D in Charles County, MD

Time / Room *Day 1 (Nov 5): 11:00 – 11:30am in Virtual Room 1*

Presentation Summary Using HEC RAS 2D and GIS, mapping can be made showing the inundation level of landscapes for differing storm events. In this session we will show you how HEC RAS 2D and GIS was used in Charles County, MD as a planning tool to model future development in flood prone areas outside FEMA 100 and 500 year floodways:

- HEC RAS 2D and GIS produces accurate mapping with great visuals for presenting to jurisdictions for decision-making.
- HEC RAS 2D and GIS can show floodprone areas that are not within FEMA floodways.
- HEC RAS 2D is a good tool to use for comparing different storms including future projected storms based on climate change.

This session will present a lot of mapping with some animation to visually display the HEC RAS 2D program.
Different storm events and tidal events can be ran in the program resulting in maps showing the inundation for those events.

Presenter(s) **Katie Scott, PE**
Senior Water Resources Engineer
Coastal Resources, Inc.

Katie Scott, PE, works for Coastal Resources, Inc (CRI), a dynamic environmental consulting firm in Annapolis Maryland. Coastal is a small, woman-owned certified MBE/DBE with some of the most experienced environmental professionals in the area. About 31 people work at CRI in two teams: Natural Resources Team with environmental scientists who inventory wetlands, forests, and wildlife; and the Water Resources Team with engineers, environmental scientists, and a landscape architect who design stream restoration, wetland creation, and stormwater best management practices. Katie is the senior professional engineer on staff with an expertise in hydrologic and hydraulic modelling. For the past 5 years, Katie has provided the support needed to ensure that the designs proposed will remain stable during storm events. Katie has worked for other consulting firms and USDA NRCS in the past. In her spare time Katie volunteers with the Anne Arundel County Master Watershed Stewards.

Lara Mulvaney
GIS Project Manager/Analyst
Spatial Systems Associates, Inc.

Lara Mulvaney joined Spatial Systems Associates, Inc as a GIS Project Manager/Analyst in Oct 2018. At Spatial, she has been involved in GIS based analysis, development of web applications for field data collection, utilities mapping, database design and migration, geodatabase management for NPDES MS4 reporting, and floodplain mapping, Lara previously worked as a GIS specialist for Anne Arundel County. She holds a BA in Physics from the University of Rochester, and a Certificate in Advanced Geospatial Applications from CCBC, and is a former US Navy Hydrographer. As a volunteer Master Watershed Steward in Anne Arundel County, Lara recently spearheaded a $2.5 million stream restoration project beginning in her backyard.

Evaluation of Rainfall Trends in Fairfax County, Virginia

Time / Room *Day 1 (Nov 5): 11:00 – 11:30am in Virtual Room 2*

Presentation Summary This study was initiated as a result of the increasing incidence of high intensity-short duration storms in Fairfax County. The goal of the study was to determine if trends could be determined in relatively short-term historical data, and also evaluate the departure of estimates of rainfall depths from the data from NOAA Atlas 14 values for Fairfax County. Trend and frequency analyses of selected duration events was completed with particular attention to duration and frequencies of storms that are required/recommended for specific hydrologic analyses in the Fairfax County Public Facilities Manual (PFM). Historical data collected from 10 rainfall gauges maintained and operated by the Waste Water Collection Division (WWC) of the Fairfax County Department of Public Works and Environental Services was used in the analysis.

This presentation will discuss the data used in the analyses, the methods used in the trend and frequency analysis. Preliminary results from the analyses will be presented, and the significance of the results for various hydrologic techniques in PFM discussed, with a focus on duration and return periods that are most frequently used.

Presenter(s) **Donald R. Demetrius, PhD, PE, CFM**
Senior Project Manager
Atkins

Don Demetrius is a water resources engineer with several decades of experience in the areas of dam safety, floodplain management, and project implementation. He is currently a senior project manager at Atkins Global. Prior to joining Atkins, Don was served as Branch Chief of the Watershed Planning and Evaluation Branch within the Stormwater Planning Division at Fairfax County, where he also served as the Floodplain Administrator.

Dipmani Kumar, PhD, PE, CFM
Engineer V
Fairfax County

Dipmani Kumar has over 26 years of experience in water resources planning, analysis, and project implementation. He currently serves as chief of the Watershed Planning and Evaluation Branch within the Stormwater Planning Division at Fairfax County. He holds graduate degrees from Virginia Tech and is a licensed professional engineer and certified floodplain manager.

NOAA's National Water Model – Mapping the Forecast Inundation Areas

Time / Room

Day 1 (Nov 5): 11:30am – 12:00pm in Virtual Room 1

Presentation Summary

The National Water Model (NWM) "is a hydrologic model that simulates observed and forecast streamflow over the entire continental United States (CONUS)", based on the National Hydrography Dataset (NHDPlusV2) stream network of ~2.7 million stream reach forecast locations. This greatly expands the streamflow forecast beyond the currently gaged stream locations!

The Maryland Department of the Environment (MDE), in coordination with Maryland Environmental Service (MES), the US Army Corps of Engineers (USACE) and Wood PLC, completed a Pilot Study in the Whitemarsh Run watershed to test using the NWM streamflow forecast data to visualize the associated flood inundation extent in near real-time. Python code is running in the background to download and process the forecast data every hour. The final step of the project was to build a GIS Web Mapping application to visualize the forecast with flood inundation grids.

This presentation will provide a brief background on the NWM and coding, then focus on the mapping application data, features, and more.

Presenter(s)

Michael Manen
GIS Manager
Maryland Environmental Service

Michael Manen is the GIS Manager of the Geospatial and Engineering Services group of the Maryland Environmental Service (MES), a not-for-profit Independent State agency. He has a background in hazard mitigation and is responsible for oversight of various teams which create GIS custom applications, internet-mapping solutions, and mobile GIS solutions for federal, state, and local municipalities.

Jennifer McGee, PE, CFM, GISP
Water Resources Engineer
Wood PLC

Ms. McGee is a Water Resources Engineer with Wood. She has a background in FEMA's NFIP program and Public Assistance program for disaster recovery. Her overall focus is in developing data science applications for engineering projects.

Pluvial Flooding Vulnerability Assessment in Clover Hill, Frederick County, MD

Time / Room *Day 1 (Nov 5): 11:30am – 12:00pm in Virtual Room 2*

Presentation Summary

Recent flooding events and resident concerns resulted in Frederick County's Office of Sustainability & Environmental Resources (OSER) and the Division of Public Works (DPW) to undertake a drainage and capacity study of the Clover Hill neighborhood. Dewberry performed this study to analyze watershed characteristics, identify causes of flooding, evaluate recent flood events, and identify opportunities to increase the capacity of the existing stormwater conveyance systems to help alleviate flooding.

An analytic framework was developed as a process to streamline and prioritize goals. The framework embodied key objectives and questions, data needs, and metrics for tracking success. Detailed field assessments were performed to evaluate existing stream, watershed hydrologic and hydraulic conditions within the study area. Historical flooding data was collected from residents through a detailed landowner questionnaire, which served as an effective public involvement tool to generate calibration and validation data. A PCSWMM 2019 Professional 2D model was developed for the study area covering 630 acres, including ~ 6,200 linear feet of stream, ~ 22% impervious area, and composed of predominantly low and medium density residential development. The watershed model included a hydrologic runoff component, a 1D component for the urban stormwater infrastructure (ditches, storm drains, culverts, SWM facilities, etc.) and a 2D component to simulate overland flow and establish flood extents and depths. A rain-on-grid approach was utilized to determine stream and pluvial flooding impacts. The model was calibrated and validated using the land owner flooding survey data, regional regression equations for watershed hydrology, data from actual flood events in May 2018, July 2018, and May 2019, and effective FEMA flood risk data (2017). Results of the calibrated model showed that the extent of flooding increases as the storms become less probable and more intense.

The 2D urban stormwater model is capable of accurately predicting stream based (fluvial) and rainfall runoff based (pluvial) flood vulnerability in the Clover Hill neighborhood. Flooded area (extents) and average flood depths approximately double from the 2 year, 24-hour event to the 10 year, 24-hour event, and from the 10 year, 24-hour event to the 100 year, 24-hour rainfall event. The key issue in Clover Hill is the inadequate capacity of roadside ditches and culverts combined with ground saturation resulting from multiple events of varying intensity and duration within a short period of time. Findings of this study forma reliable basis for identifying, designing and implementing restoration measures within the stream, corridor, floodplain and upland regions within the study area. Flooding hot spots identified by the model can help focus and prioritize restoration activities to improve overall community resilience for current and future conditions.

Presenter(s)

Dano Wilusz, Ph D
Project Engineer
Dewberry Engineers Inc.

Dano Wilusz is an experienced water resources professional with nearly 15 years of experience in engineering, hydrology, integrated water resources management, and project management. He has lead and supported small technical teams to solve water supply and management problems using water quality modeling, floodplain mapping, climate change risk assessment, and stormwater drainage design for city, state, and federal clients. He got his Ph D from Johns Hopkins University in 2018 specializing in advanced watershed modeling. Prior to graduate school, he was a foreign affairs officer at the U.S. Department of State, where he oversaw over $1M in water-related foreign assistance and helped launch several global water and environment initiatives.

Angelia Miller
Project Manager
Frederick County Government (Sustainability and Environmental Resources)

Angelia Miller is an accomplished Project Manager for the Frederick County government in the Environmental Science field. She manages the Illicit Discharge Detection and Elimination Program and associated constituent communications to recommend corrective actions or adjudication; oversees permit compliance inspections and trainings for County-owned facilities; directs the Frederick County Stream Survey Program; maintains and validates program databases; ensures project execution and coordinates public outreach events. Her experiences and skills range from compliance inspections, monitoring and sampling field work, database management, contract auditing and administration, and ordinance development.

Land Subsidence Contributions to Relative Sea Level Rise in Baltimore Inner Harbor, Maryland

Time / Room *Day 2 (Nov 6): 9:15 – 9:45am in Virtual Room 1*

Presentation Summary

A NOAA tide gauge in Baltimore Inner Harbor, Maryland has monitored relative sea level rise since 1902 for 119 years. This gauge seats on the over semi-consolidated Cretaceous strata of Arundel clay (Kac) underlain by Patuxent sand (Kxs) facies and the Pre-Cambrian undifferentiated crystalline rock. The Patuxent sand layer was the most important confined aquifer in the Baltimore history. The shallow Arundel clay and the deep Pre-Cambrian crystalline rock consists of the aquifer's upper and lower confining units, respectively. It was estimated that the groundwater pumpage increased gradually from practically nothing in about 1850 to about 23 thousand-cubic-meter/day in 1900 in the Baltimore area. After this the pumpage only increased slightly to 53 thousand- cubic-meter/day until about 1915. After 1935 the pumpage increased rapidly to 142 thousand- cubic-meter/day in 1941 then decreased. Primary compaction subsidence due to groundwater withdrawal was identified from the tide gauge records while secondary compaction subsidence due to creep under constant geohistorical overburden pressure is assumed to be zero since the maximum historical overburden pressure was released by uplift of the compressible aquifer system. A GPS receiver at University of Maryland at Baltimore County (UMBC) is 12 km far from the tide gauge located in the Baltimore Inner Harbor and seats on the late Precambrian Baltimore Gabbro Complex (bgb). Tectonic subsidence of 1.57±0.52 mm/year was measured at UMBC by using the GPS UMBC. So land subsidence in the Baltimore Inner Harbor consists of tectonic subsidence and primary compaction subsidence. We found an absolute sea level rise (SLR) of 1.11±0.10mm/year by removing tectonic subsidence of 1.57 mm/year from a relative SLR of 2.68 mm/year during 1962 to 1980 with groundwater level stability in trend. Land subsidence in the inner harbor was estimated to be 1.93 mm/year during 1903 to 1920, -3.15 during 1920 to 1926, 4.13 during 1926 to 1947, 1.74 during 1947 to 1957, -1.91 during 1957 to 1962, 1.57 during 1962 to 1980, 2.17 during 1980 to 1992, and 0 after 1992, respectively. A cumulative land subsidence of 204 mm contributed about 62% to the relative sea level rise of 332 mm from 1903 to 2018 in the Baltimore Inner Harbor, Maryland.

Presenter(s)

Yi Liu, D.Eng., P.G.
Assistant Professor
Morgan State University

Dr. Yi Liu is Assistant Professor in Department of Civil Engineering, Morgan State University (MSU). He got his Bachelor in 1985 and Master in 1988 in hydrogeology and geotechnical engineering from China University of Geosciences and Doctorate in civil engineering from MSU in 2006. His research interest includes land subsidence, sea level rise and global warming impacts on headwater. He worked on geotechnical engineering, hydrogeology and land subsidence in Shanghai, China from 1988 to 2002 and agricultural hydrology in the U.S. Southwest from 2007 to 2014. He is a registered Professional Geoscientist in Texas Board of Professional Scientists. In 2018, Dr. Liu was granted with an NSF project entitled "Identification of Urban Flood Impacts Caused by Land Subsidence and Sea Level Rise in the Houston-Galveston Region". His paper entitled "Land subsidence contributions relative sea level rise at tide gauge Galveston Pier 21, Texas" was accepted by Scientific Reports in August 2020.

2021 State of Maryland Hazard Mitigation Plan Update

Time / Room *Day 2 (Nov 6): 9:15 – 9:45am in Virtual Room 2*

Presentation Summary In August, the State of Maryland officially began updating the 2016 State of Maryland Hazard Mitigation Plan. The mitigation planning process provides an opportunity for the State to identify hazards, assess risks and vulnerabilities, evaluate capabilities, and develop a mitigation strategy. In Maryland, flooding hazards pose the greatest risk to our people and assets. This presentation will focus on the Hazard Identification and Risk Assessment as it relates to flooding hazards and provide an opportunity for attendees to engage in the process to identify mitigation actions.

Presenter(s)

JaLeesa Tate, CFM
State Hazard Mitigation Officer
Maryland Emergency Management Agency (MEMA)

JaLeesa Tate is the State Hazard Mitigation Officer (SHMO) and Branch Manager for the Maryland Emergency Management Agency (MEMA). In this role, her primary focus is to identify and implement mitigation strategies on a statewide basis. JaLeesa accomplishes this through fostering relationships with stakeholders and administering FEMA's Hazard Mitigation Assistance grant programs for the state. Prior to joining MEMA, JaLeesa served as the Coastal Resources Planner for Baltimore City and Environmental Planner for Wicomico County – City of Salisbury. In these roles JaLeesa focused on water quality improvement and environmental land use at the local level in urban and rural communities. JaLeesa studied Geography and Geosciences and is a Certified Floodplain Manager by the Association of State Floodplain Managers.

Compound Urban Flooding in the Large Metropolitan Areas Located along Tidal Rivers

Time / Room *Day 2 (Nov 6): 9:45 – 10:15am in Virtual Room 1*

Presentation Summary Flooding is one of the major natural disasters around the world with far-reaching impacts on the environment, economy, and human lives. Compound floods resulting from the co-occurrence of multiple flood drivers like riverine flow, coastal storm surges, sea-level rise, and extreme rainfall have impacted several cities across the United States (US). Metropolitan areas, located in the coastal regions of the US, have become increasingly vulnerable to such flooding conditions due to their unique exposure to multiple flood hazards. The goal of this study is to identify the major flood drivers impacting metropolitan areas in large tidal estuaries and to quantify their impacts on compound flooding. Washington, DC, and the surrounding communities in Maryland and Virginia are used as an example, because this region is often exposed to various flood hazards that overlap spatially and temporally, leading to the potential of compound flooding conditions. Results from the historical data analysis (1931 to 2019) provided strong evidence that this region has four major types of floods: river, coastal, compound, and other floods from high wind and urban runoff. Compound flooding in the region can be caused by a combination of storm surge or high coastal water levels, riverine flow, local wind, and urban runoff.

Presenter(s)

Selina Sumi
Water Resources Engineer
AECOM

Selina Jahan Sumi has received a Bachelor of Science in Water Resources Engineering from Bangladesh University of Engineering Technology (BUET) in 2012. She joined the World University of Bangladesh as a lecturer in 2013 and worked there for six months. Selina completed her M.S. in Civil Engineering from the University of Louisiana at Lafayette on August 2015. Her M.S. research was funded by the Louisiana Sea Grant through the Coastal Science Assistantship Program (CSAP). As a part of this program, she joined an internship position in the regional office of the Louisiana Coastal Protection and Restoration Authority (CPRA) which is located in Lafayette, LA. She joined the Ph.D. program of the Civil, Environmental, and Infrastructure Engineering Department at George Mason University (GMU) in Fall-2016. She was awarded the 4-year Presidential Fellowship by GMU to complete her Ph.D. study.

Refining Local Hazard Mitigation Plans Through Enhanced Floodplain Manager Involvement

Time / Room

Day 2 (Nov 6): 9:;45 – 10:15am in Virtual Room 2

Presentation Summary

Floodplain Managers play a significant role in cultivating community resilience and mitigating hazard risk through their efforts enforcing floodplain management regulations, promoting National Flood Insurance Program (NFIP) and Community Rating System (CRS) participation, informing community land use and ordinances, and supporting post disaster flood response, recovery, and mitigation efforts. Yet, these key risk reduction practitioners often do not play a large role in the development of Local Hazard Mitigation Plans. Mitigation planning offers a unique, community-center, interdisciplinary platform through which Floodplain Managers and related professionals lend their expertise and involvement to bolster community NFIP outreach, advance a community's CRS status, increase mitigation investment, and spur communities to exceed NFIP requirements. To establish and implement more integrated and implementable land use, substantial damage, and local Hazard Mitigation Plans, it is essential for Floodplain Managers to play a larger role in the Planning Process. Conversely, Floodplain Managers can leverage professionally diverse Mitigation Planning Teams and the Planning Process to facilitate effective community engagement in floodplain management activities.

This presentation will explore how Floodplain Managers can best engage in the local Hazard Mitigation Planning Process while utilizing two new community technical assistance tools developed by FEMA Region III—the Risk Assessment and NFIP Guides. The Risk Assessment Guide employs plain language to describe the flood risk assessment process, identify the pros, cons, and needs associated with various risk analysis approaches, share notable resources and best practices, offer community self-evaluation considerations, make note of funding sources, and include examples of risk assessment GIS outputs. In a similar fashion, the NFIP Guide provides an overarching roadmap to the Floodplain Manager's and community's role within the NFIP, defines and lays out the connections between key NFIP terms and program elements, shares useful federal and state flood risk resources (such as each state's flood viewer), identifies nuances concerning levee and dam risk, includes worksheets to help communities self-assess their NFIP capabilities, highlights best practices, and provides information on funding opportunities. Ultimately, increased Floodplain Manager involvement in local Hazard Mitigation Planning better positions communities to develop the comprehensive land use and mitigation strategies essential to fostering community resilience.

Presenter(s)

Joshua Norris
Maryland FEMA Integration Team (FIT) Hazard Mitigation Planner
Federal Emergency Management Agency (FEMA)

Joshua Norris is a National Security professional that has advanced Hazard Mitigation at the state and federal level. Previously, as a Mitigation Specialist at the Maryland Emergency Management Agency (MEMA), Joshua administered Maryland's portfolio of Hazard Mitigation Assistance (HMA) projects and Hazard Mitigation Plans (HMPs), while providing technical assistance and outreach to local communities. Subsequently, he joined the Federal Emergency Management Agency (FEMA) as a HMA Program Specialist to provide cradle to grave oversight and technical assistance for all Delaware and District of Columbia Hazard Mitigation Grant Program (HMGP) awards.

Today, Joshua is the Maryland FEMA Integration Team (FIT) Hazard Mitigation Planner, embedded at MEMA to build state and local Hazard Mitigation Planning capacity, review HMPs, support disaster operations, and promote risk reduction efforts throughout Maryland.

Joseph Bucovetsky
Community Planner
Federal Emergency Management Agency (FEMA)

Joe Bucovetsky is a Community Planner at FEMA Region 3, based in Philadelphia. He started working for FEMA in 2017 after a long career in city planning and urban design in the private sector. For FEMA, he does Hazard Mitigation Plan reviews and training for all 6 states in the region, with primary technical assistance responsibilities for Maryland and the District of Columbia. He works regularly with FEMA's planning partners at the state, regional, county, and municipal level to promote mitigation and community resilience and sustainability. When there isn't a pandemic on, he meets frequently with the public. When deployed for disasters, he is a 406 Specialist, working with Public Assistance on mitigation measures in conjunction with the repair of disaster-damaged facilities.

Courses of Action to Support Current and Future Flood Risk Management at a US Naval Installation

Time / Room *Day 2 (Nov 6): 10:30 – 11:00am in Virtual Room 1*

Presentation Summary Understanding and mitigating the impacts of current and future flood risk at the site level calls for a concerted planning effort between agencies, facility management, installation resilience and water resources practitioners. The first step in this process is understanding the sources and extents of flooding under existing and projected future scenarios. The second step is the identification of potential courses of action that will address watershed hydrologic conditions, site hydraulic constraints, and the resulting combined (coastal and pluvial) flood risk. The third step is a techno-economic evaluation of the proposed courses of action to help identify the best path forward towards climate resilience.

This presentation will summarize a flood risk management courses of action study conducted by Dewberry for the USACE Baltimore District to support the US Navy. An XPSWMM 2D model was developed to study the combined flood risk due to rain fall based watershed runoff and existing and future (2100) SLR based tidal scenarios. The extent of urbanization and complex drainage features were utilized as opportunities to build upon and develop context sensitive solutions that will help effectively manage flood risk.

Three courses of action (sets of flood risk management strategies) were developed to address flooding due to existing tidal conditions. These were enhanced with additional sets of strategies necessary to manage future flood risk during the projected 2100 SLR based future tidal conditions. Improved conveyance, the first course of action was based on retrofits to existing drainage infrastructure that can help effectively convey site runoff and avoid localized overland flooding. Drainage network redesign, the second course of action was based on modifying the existing drainage network into subnetworks based on topography and site constraints to alleviate the demand on certain existing drainage features and vulnerable areas. Subsurface storage, the third course of action was based on subsurface detention measures that can capture runoff volume and address overland flooding issues. In order to address future SLR based flood risk, each course of action was accompanied by additional measures including a perimeter flood wall and pump station. Relative complexity of construction of each course of action and rough order of magnitude cost estimates were developed to facilitate decision making.

Leadership support, scientifically based vulnerability assessment, natural systems-based engineering approach for mitigation planning and techno-economic feasibility assessment have helped progress towards identifying a flood risk management solution. The solution would be a combination of the multiple components of the courses of action that are most impactful and cost-effective in establishing and maintaining resilience to climate change.

Presenter(s)

Sivaramakrishnan Sangameswaran, Ph D, P E, D.WRE, CFM
Project Manager
Dewberry Engineers, Inc.

Siva has over fourteen years of experience in climate change impact assessment and resiliency master planning, developing multi-dimensional hydrodynamic, hydrologic and hydraulic models for analyzing urban flooding, pollutant fate and transport modeling, low impact development design, water quality analysis and modeling, stream and habitat restoration. He aims at developing scientifically valid, statistically validated, comprehensive and effective climate change mitigation strategies by combining knowledge in engineering and the scientific disciplines. He serves as the technical lead on climate change resiliency projects for Federal, State, municipal and private sector clients across the nation. He is also an adjunct faculty in the Civil & Environmental Engineering Department at the George Mason University.

Matthew Breitenother
Community Planner
USACE, Baltimore District

Experienced Community Planner with a demonstrated history of working in the environmental science & policy field. Skilled in military funded technical services, environmental awareness, Chesapeake Bay TMDL implementation/compliance, water resource management, flood risk management, and emergency operations. Strong project management and technical services professional with a Master's Degree focused in Environmental Management from the University of Maryland University College.

Quantifying the Benefits of Natural and Nature-Based Features in Maryland's Chesapeake and Atlantic Coastal Bays to Inform Conservation and Management under Future Sea Level Rise Scenarios

Time / Room

Day 2 (Nov 6): 10:30 – 11:00am in Virtual Room 2

Presentation Summary

Maryland needs not only adapt to climate change, but also to the accelerating rate of climate change. With this acceleration, sea level rise (SLR), erosion, flooding, and saltwater intrusion are all projected to hasten the degradation of coastal environments. These coastal environments can significantly buffer people and infrastructure from coastal storms and help mitigate the effects of sea level rise. However, climate change threatens these important socio-ecological functions, and thus coastal managers are being called to action to facilitate coastal habitat adaptation to the accelerated effects of SLR. Though the State of Maryland is already developing plans to adapt to the expected two feet of SLR in the next 30 years, the state does not currently have the planning tools or projections necessary to inform the conservation of coastal habitats for the purpose of preserving flood protection or buffering services.

This presentation will describe a collaboration between George Mason University, Maryland Department of Natural Resources, and The Nature Conservancy that is quantifying the wave attenuation and flood reduction benefits of salt marshes, submerged aquatic vegetation (SAV) and other natural and nature-based features (NNBF) along the shores of Maryland's Chesapeake and Atlantic Coastal bays. Hydrodynamic and habitat data collected at targeted field sites and updated Sea Level Affecting Marsh Model (SLAMM) results will be integrated into coupled local and regional hydrodynamic and wave models (ADCIRC + SWAN, XBeach) to demonstrate the wave attenuation benefits of coastal habitats across the Maryland coastline now and into the future. Model results will be used to 1) calculate the economic value of the coastal protection benefits of NNBF via risk-reduction to infrastructure; 2) provide relatable, local examples to advance coastal preservation efforts by agencies throughout the state; 3) inform the state's management actions to maintain or enhance the ecosystem services of marshes; 4) support local outreach and identification of adaptation solutions to enhance coastal ecosystem and community resilience; 5) re-evaluate Chesapeake Bay SAV restoration goals; and 6) improve existing conservation prioritization tools. A Management Transition Advisory Group (MTAG) of federal, state and local

partners is being consulted to ensure study results support the project's management and adaptation planning goals. Collectively, this body of work aims to incentivize, prioritize, and streamline efforts to conserve coastal landscapes, and thus the people that rely on them, both now and into the future.

Presenter(s)

Jackie Specht
Coastal Science Program Manager
The Nature Conservancy

Jackie Specht is the Coastal Science Program Manager of The Nature Conservancy's Maryland/DC Chapter Resilient Coasts Program where she provides coastal resilience expertise, science leadership, and practical experience in collaborative coastal management. In this role, Ms. Specht leads efforts focused on building resilience for Maryland's coastal communities, developing strategies to facilitate marsh migration, and ensuring that scientific data is supporting coastal management decisions. Prior to her position with The Nature Conservancy, Ms. Specht was a NOAA Coastal Management Fellow with the Maryland Department of Natural Resources leading efforts to beneficially use dredged material to build coastal resilience. Ms. Specht holds a Masters in Oceanography from Rutgers University and a Bachelor of Arts in biology from Hamilton College.

Daniel Coleman, Ph D
Postdoctoral Fellow
George Mason University

Dr. Daniel J. Coleman is a Postdoctoral Fellow at George Mason University. Dr. Coleman completed his PhD in Marine Science at Virginia Institute of Marine Science (VIMS) at the College of William & Mary, where he studied sediment dynamics in coastal salt marshes. His work took him up and down the US East Coast and abroad to Australia. Prior to VIMS, Dr. Coleman earned his Bachelor of Science in Geology and Environmental Biology at Tulane University. It was at Tulane that he was first exposed to the societal importance and scientific intrigue of coastal wetlands. Dr. Coleman plans to continue researching coastal wetlands with the goal of becoming a professor. Deeply passionate about the environment, he hopes his research will contribute to the protection of crucial ecosystems to the benefit of society as a whole.

Leveraging Local Data for Better Planning and Flood Outreach

Time / Room

Day 2 (Nov 6): 11:00 – 11:30am in Virtual Room 1

Presentation Summary

As planning around hazards in our floodplains grows more and more complicated with new developments and climate change, municipalities have increasingly turned to data analytics to enable better floodplain management. For those communities, hazard modeling and analysis has the potential to enable both better planning and better resident engagement. While exposure data and predictive models can be immensely informative, they are often missing granular on-the-ground information measuring the local impacts of flooding. Accurate data around the built reality of a community's building stock has historically been difficult to come by at scale, but floodplain managers are uniquely positioned to collect it through permits like Elevation Certificates (ECs). When aggregated, information contained in ECs can be utilized to make better decisions around mitigation investment and land use planning or to enable more targeted outreach to residents.

This presentation will use case studies to outline potential applications of EC datasets for purposes ranging from planning to community risk education. We will share technical insights and discuss challenges to implementation as well as transferrable lessons learned.

Presenter(s) **Susanna Pho, CFM**
Co-Founder, COO
Forerunner

Susanna is a Co-Founder and the COO of Forerunner (www.withforerunner.com), a floodplain management software platform. Forerunner's mission is to help communities prepare for the impacts of severe weather and adapt to future conditions by easing floodplain management tasks and streamlining compliance workflows. Susanna's work has afforded her a unique lens into the flood data challenges faced by American municipalities. She is a Certified Floodplain Manager and holds a degree in Risk and Resilience from Harvard University as well as one in Architecture from MIT.

Generalizing Wave Attenuation from Living Shorelines

Time / Room *Day 2 (Nov 6): 11:00 – 11:30am in Virtual Room 2*

Presentation Summary How much wave attenuation can we expect to get from a small-scale vs. large-scale marsh or oyster bed restoration project? Are the dissipative effects of living shorelines observed in all wave environments, or just quiescent ones? These questions are explored through a spectral wave modeling parameter study. By idealizing various physical conditions using the Simulating WAves Nearshore (SWAN) model, we gain a broader picture of which wave environments are most effectively attenuated by various green engineering approaches. Through this broad analysis, the importance of large-scale, continuous restoration plans for shoreline resilience will be more clearly demonstrated. The results of the study aim to better inform coastal resilience planners and restoration specialists regarding optimal reef and wetland design.

Presenter(s) **Kristine Mosuela, EIT**
Water Resources Engineer
Wood PLC and Virginia Tech

Ms. Mosuela is a water resources engineer at Wood and a graduate student in the Civil and Environmental Engineering program at Virginia Polytechnic Institute and State University. In her academic work, she focuses on the hydraulic modeling of living shorelines. In her professional work, she develops both deterministic and probabilistic flood risk models and flood forecasts for various watersheds in the mid-Atlantic region. Her favorite projects to date have been at the intersections of technology, hydrology, and urban ecology.

Getting More Floodplain and Stormwater Managers to Reflect the Diversity of Communities We Serve

Time / Room *Day 2 (Nov 6): 11:30am – 12:00pm in Virtual Room 1*

Presentation Summary As floodplain and stormwater managers, we work with communities at risk from flooding and other hazards. However, the engineers and scientists in hazard mitigation often do not reflect the diversity of the communities we serve. This presentation will discuss one way to increase diverse students' interest in floodplain and stormwater management.

Research shows that we can increase diverse students' interest in engineering by showing them role models that they can relate to, highlighting the breadth of work they can do, and emphasizing the benefits of the engineering work. RePicture is putting this research into action through the RePicture.com website and RePicture Resume-Builder Program. The website and program address all types of science, technology, engineering, and math (STEM), including a large number of floodplain and stormwater managers and projects.

Through these role models and project write-ups (that emphasize the benefits of the project), students nationwide are learning about floodplain and stormwater management, as well as other STEM areas.

This presentation will discuss the RePicture Program and floodplain and stormwater management currently on the website. A student will then discuss her experiences adding a flood data analysis and other projects to the RePicture website during the RePicture Program, and how she is using RePicture to discover her talents and passion.

Presenter(s)

Lynn Mayo, PE
CEO
RePicture

After working for over 30 years as a professional civil engineer, Lynn Mayo dreamed of a better way to connect companies and STEM professionals, while helping students discover STEM careers. She co-founded RePicture, a Public Benefit Corporation. Prior to starting RePicture, Lynn was a Vice President at AECOM, where she was the North America Water Resources Technology Practice Director. She has a BS in civil engineering from Bucknell University and a MS in civil engineering from Stanford.

Noran Shahin
Civil Engineering Student
University of Houston

Noran is a senior undergraduate student at the University of Houston in Houston, Texas. Her intent is to pursue a master's degree in civil engineering with a structural engineering focus. Though she wishes to pursue a career in structural engineering, she is fascinated by all aspects of the civil engineering discipline and strives to learn more about it. She joined the RePicture Program in July 2020, where she found a platform not only to further explore engineering but to also be part of a community of STEM professionals and students that all contribute to the website's project database, allowing other students to learn about STEM projects and careers.

Climate Adaptation and Resiliency Planning for the City of Aberdeen

Time / Room

Day 2 (Nov 6): 11:30am – 12:00pm in Virtual Room 2

Presentation Summary

Planning for the resiliency of both the natural and built environment is becoming one of the paramount challenges of municipalities as the effects of climate change including sea level rise are becoming more defined by events around the globe and in the local area. The City of Aberdeen, Maryland has been proactive in assessing projected climate change risks and vulnerabilities associated with probable flooding from precipitation and sea level rise to create a plan for resiliency, by means of funding provided by the Maryland Department of Natural Resources Chesapeake and Coastal Grants Gateway. In the City of Aberdeen sea level rise from climate change and other factors, including land subsidence, is predicted to increase water levels 1.2 ft by 2050 and 6.9 ft by 2100. Additional impacts from storm events including a 10% increase in annual precipitation and 55% increase in heavy rain events by 2100, as well as increases in storm surge and wave action will result in both periodic and prolonged inland and coastal flooding. While the elevation of the City's wastewater treatment plant is sufficient to be unaffected by impacts in 2100, this scenario would create significant impacts to the tidal areas of Swan Creek.

A planning document recently completed by EA Engineering, Science, and Technology, Inc., PBC for the City of Aberdeen includes action items that could be considered even in the absence of climate change, as they are anticipated to generate environmental, economic, and in some cases, social benefits. All strategies included embrace the concept of Adaptive Management to address uncertainty using an iterative process of continuous monitoring and assessment. Strategies and measures fall into four categories: 1) city management preparations for adaptation and resilience, 2) monitoring and application of location predictions of climate change impacts, 3) enforcement and enhancement of regulatory measures affecting the built and natural environment, and 4) maintenance and protection of critical built infrastructure and natural resources. Within those categories, specific action items include, but are not limited to, designating a climate adaptation coordinator, reviewing emergency preparedness, exploring policy changes to increase or mandate wetland and floodplain buffers, developing protective flood walls, and ensuring state stream standards are applied to transportation crossings. This Plan was created as a living document, which can be updated on a regular basis as the projections of the impacts of climate change are re-evaluated over time.

Presenter(s) **Christopher L. Overcash, P.E., BCEE, ENV SP, LEED AP**
Deputy Director of Coastal Resilience and Senior Engineer
EA Engineering, Science, and Technology, Inc., PBC

Mr. Overcash is the Deputy Director of Coastal Resilience and a Senior Engineer with EA Engineering, Science and Technology, Inc. PBC in Hunt Valley, Maryland. He is a licensed professional engineer in 9 states, a Board-Certified Environmental Engineer, and is also credentialed by the Institute for Sustainable Infrastructure and the U.S. Green Building Council. He holds a Masters of Environmental Engineering from John Hopkins University where he is also an adjunct professor and an Associate of the Environment, Energy, Sustainability and Health Institute.

Nicole E. Williamson
Scientist
EA Engineering, Science, and Technology, Inc., PBC

Ms. Williamson is an Environmental Scientist with EA Engineering, Science and Technology, Inc., PBC in Hunt Valley, Maryland. She is experienced in climate change adaptation and resiliency, stream and floodplain studies, and utility protection and holds a Masters of Environmental Science and Policy from Johns Hopkins University.