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Department of Administration Purchasing Division 2019 Washington Street East Post Office Box 50130 Charleston, WV 25305-0130

# State of West Virginia Solicitation Response

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All offers subject to all terms and cond	ditions contained in this solicitation		

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Commodity Line Comments: Response to CEOI 0606 HSE 2100000001 for the West Virginia Division of Emergency Management to provide comprehensive FEMA Risk MAP Program Support Services.

#### **Extended Description:**

Architectural/Engineering Services





# Architectural/Engineering Services Expression of Interest

Riverine Flood Hazard Analyses, Mapping, and Associated Services

Solicitation No.: CEOI HSE2100000001

# TECHNICAL PROPOSAL

## ORIGINAL



Submitted to: West Virginia Division of Emergency Management Department of Administration, Purchasing Division 2019 Washington Street East Charleston, WV 25305-0130

Submitted by: Wood Environment & Infrastructure Solutions, Inc. 4795 Meadow Wood Lane, Suite 310 East Chantilly, VA 20151

January 21, 2021



Wood Environment & Infrastructure Solutions, Inc. 4795 Meadow Wood Lane, Suite 310 Chantilly, VA 20151 (703) 488-3700

www.woodplc.com

January 21, 2021

Ms. Tara Lyle Buyer Supervisor Department of Administration, Purchasing Division 2019 Washington Street East Charleston, WV 25305-0130

#### RE: CEOI HSE2100000001 – Engineering Services to West Virginia Division of Emergency Management

Dear Ms. Lyle,

In response to your request for Expression of Interest (EOI), Wood Environment & Infrastructure Solutions, Inc. (Wood) is pleased to submit our qualifications for providing Riverine Flood Hazard Analyses, Mapping, and Associated Services for the State of West Virginia in support of the Federal Emergency Management Agency (FEMA) Cooperating Technical Partner (CTP) Program. We have greatly valued our work with the West Virginia Division of Emergency Management (WVEM) over the past 18 years through both the FEMA regional contract and as the incumbent WVEM CTP Flood Hazard Analysis and Mapping contractor. We look forward to maintaining our successful partnerships with WVEM, FEMA Region III, and the WV GIS Technical Center (WVGISTC) to continue to advance the WV CTP Program as one of the premier programs in the nation.

Wood has established a national program to support FEMA and state CTP Programs by providing comprehensive Risk MAP services. Wood has concentrated our efforts towards providing specialized services to FEMA regions, states, and local governments in meeting FEMA's objectives using our technology and vision. These efforts have translated into highly successful partnerships with seventeen (17) CTP states, including West Virginia. More specifically, Wood has been supporting FEMA Region III and Region III CTPs for nearly two decades by providing comprehensive flood hazard mapping and risk communication services. Wood looks forward to leveraging our experience and relationships to continue our successful support of the WV CTP Program. Our Team includes Harned Surveying and Engineering, Inc. (HSE), a trusted provider of hydrographic field survey data in support of FEMA floodplain studies. Key differentiators for the Wood Team include the following:

- First to deliver Advisory Flood Height (AFH) data in WV; subsequently delivered enhanced approximate floodplain analyses in support of AFHs for 32 counties across the State covering over 7,000 stream miles;
- Performed post-disaster floodplain studies in six different WV counties and currently executing comprehensive Risk MAP studies in five different counties under the current WVEM CTP contract. In addition, produced updated flood studies and Digital Flood Insurance Rate Maps (DFIRMs) in 19 WV counties throughout the state under contract to FEMA Region III;
- Comprehensive and consistent team comprised of staff who have successfully supported the WV floodplain mapping program; five members of the dedicated project team offer over a decade of experience in FEMA Region III and more specifically on floodplain mapping projects in WV;
- Our team has worked closely with the WVGISTC from the time they were first introduced as a CTP in 2003 and has supported the development of the West Virginia Flood Hazard Determination Tool (WV Flood Tool) since its inception. We are a consistent advocate for the WV Flood Tool and AFH development process through presentations and outreach at national, state, and local floodplain conferences;

# wood.

- Our team has maintained strong relationships with FEMA Region III for nearly two decades, serving as their
  preferred Flood Hazard Mapping IDIQ contractor since 2001 and more recently transitioning to support
  state CTP programs within the Region. We have been successful in leveraging these relationships to help
  support CTPs in positioning for funding on an annual basis; and
- HSE is a small, woman-owned business who is currently supporting the WV CTP contract by providing field survey and data collection services. They have been a trusted teaming partner since 2003, when they first performed flood study field surveys in WV under the FEMA Region III IDIQ contract.

In total, Wood maintains a nationwide team of more than 200 water resources engineers and Geographic Information System (GIS) analysts dedicated to providing Risk MAP services across the United States. Our Chantilly, VA Team is committed to supporting flood risk assessment initiatives throughout FEMA Region III. Our performance in successfully providing these services to both FEMA Region III as well as local CTPs is evidenced through our projects, client testimonials, and references provided within this proposal.

We are committed to supporting the continued success and growth of the WV CTP program and are dedicating a consistent team as represented in our proposal. To summarize, the strengths of the Wood Team are our WV and FEMA Region III flood hazard mapping experience, our relationships with key Region III, CTP and WVGISTC staff, our ability to leverage our CTP experience across the country and region, and our proven ability to deliver. Our experience and expertise will continue benefit WVEM in the completion of the AFH initiative and the continued expansion of the comprehensive Risk MAP program. Please do not hesitate to contact us if you have any questions.

Sincerely, Wood Environment & Infrastructure Solutions, Inc.

Tucker Clevenger, PE, CFM Operations Manager tucker.clevenger@woodplc.com

Matchiel Mr

Matthew Breen, PE, CFM Water Resources Service Line Lead matt.breen@woodplc.com

# 1.0 Introduction







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## 1. Introduction

**Wood Environment & Infrastructure Solutions, Inc. (Wood)** is pleased to present our response to the Riverine Flood Hazard Analysis, Mapping and Associated Services Expression of Interest (EOI) HSE2100000001 in support of West Virginia's Division of Emergency Management (WVEM). Wood has supported the State of West Virginia's Federal Emergency Management Agency (FEMA) flood hazard analyses and mapping initiatives since 2003 through both FEMA Region III and the WV Cooperating Technical Partner (CTP) Program. In delivering more than 8,600 miles of updated flood risk analyses across the state, including more than 7,000 miles of Approximate Flood Height (AFH) development, Wood has developed unique knowledge of WV flood risk as well as longstanding relationships with WVEM, FEMA Region III, West Virginia University GIS Technical Center, and local floodplain managers which have been integral to the overall success of the program. We look forward to building on our existing partnerships to continue to promote the WV CTP program as one of the premier programs in the nation. The Wood Team also includes **Harned Surveying and Engineering, Inc.,** a trusted and proven provider of field survey services in support of flood hazard studies.

Over our rich, 160+-year multicompany heritage and through our shared values of care, courage, and commitment, Wood's path has steadily risen to global eminence and distinction in the delivery of project, engineering, and technical services in energy, industry, and the built environment. Today, Wood employs 60,000 skilled professionals in 400+

offices across 60 countries, boasts average annual revenues topping \$11 billion, and consistently achieves top placement in various Engineering News-Record rankings. We have evolved and diversified our technical service offerings to support any industry worldwide, and we bring value to our clients across the full asset life cycle from concept to decommissioning.

Within the greater Wood organization, our Environment and Infrastructure Solutions network comprises around 7,600 staff in 170+ offices across 11 countries. This business unit brings ingenuity, innovative technologies, and customer focus to bear while delivering 20,000+ projects annually to five key capabilities: environmental studies, permitting, and compliance; public infrastructure services; engineering and construction; environmental remediation; and geotechnical and materials.

Ranked the #1 International Design firm by Engineering News-Record in 2020

Wood's Chantilly, VA office houses more than 90 staff and serves as a center of excellence for FEMA flood hazard analyses and CTP program support. The Chantilly office maintains a long and successful track record of supporting the WV flood hazard mapping program, including five staff, each with more than a decade of direct WV experience.

# HSE

Harned Surveying & Engineering, Inc. (HSE) has been offering clients professional services in the fields of land surveying, route surveys, construction layout as-built surveys, civil engineering, and water resources engineering since 2002. HSE is a woman-owned business that provides

comprehensive, turn-key engineering and land surveying services for private, municipal, industrial, federal, commercial and corporate clients. From boundary, route or topographic surveys; hydrographic and bathymetric surveys; site grading and drainage plans; construction staking; easement plats and as-built surveys HSE can provide the services required to meet project needs. HSE has been a trusted partner in performing field survey in support of FEMA floodplain studies in partnership with Wood for over 18 years. They have supported Wood with cost-effective hydrographic survey data collection in West Virginia since 2003, including both the FEMA Region III and WV CTP contracts. HSE has implemented automated tools to enable maximum efficiency in field survey Data Capture Standard (DCS) compliance.

#### Wood's Support to FEMA Partners

In addition to supporting the West Virginia Floodplain Mapping program for nearly two decades, Wood has been a longstanding partner with FEMA to assist with implementation and management of the National Flood Insurance Program (NFIP). Wood has concentrated efforts to support FEMA Regions, states and local governments in meeting FEMA's objectives utilizing our national program experience, tools, and vision. In addition to our support of the West Virginia program, these efforts have translated into highly successful partnerships with FEMA Region III as well as in seventeen (17) other CTP states including Alabama, Arkansas, Colorado, Delaware, Florida, Iowa, Indiana, Kansas,

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Kentucky, Maryland, Missouri, Montana, North Carolina, Nebraska, South Dakota, Utah and Texas. Our bench of CTP clients has enabled us to leverage best practices and lessons learned across partners. In total, Wood maintains a nationwide team of more than 200 water resources engineers and Geographic Information System (GIS) analysts dedicated to Flood Insurance Study (FIS) development, Flood Insurance Rate Map (FIRM) production, and NFIP assistance across the United States. The team performs all work to a consistent process for effective program management and quality. While others have significant resources dedicated to supporting FEMA's national Production and Technical Services (PTS) Contract, Wood has focused on continuing to provide state CTPs with high level floodplain mapping services. CEOI HSE21 \*01 Architectural/Engineering Services West Virginia Division of Emergency Management



Wood has effectively supported the WV Floodplain Mapping program since 2003 through FEMA Region III. They have played a key role in pioneering the West Virginia Approximate Flood Height program in partnership with the Region, WVEM, the West Virginia GIS Technical Center and local municipalities. Wood to date has worked on 32 countywide projects for the WV approximate flood height program. They have continually demonstrated a thorough understanding of both the regulatory and technical aspects of the NFIP and have consistently delivered high quality products.

Robert Pierson, Senior Engineer, FEMA Region III



# 2.0 Qualifications, Experience and Past Performance





## 2. Qualifications, Experience, and Past Performance

#### 2.1 Qualifications

The Wood Team has unparalleled experience in delivering riverine flood hazard study data within the State of WV as well as throughout FEMA Region III. Through both FEMA Region III and WV CTP contracts, Wood has gained extensive knowledge associated with flood hazards in West Virginia and has developed critical working relationships with key federal, state, and local floodplain management staff that extend for more than a decade. Wood was instrumental in establishing West Virginia's first-of-its-kind Advisory Flood Height (AFH) process and supported the development of WV Flood Tool website data specifications. Wood was also the first to produce enhanced approximate floodplain models in support of AFHs in West Virginia. In addition to supporting the WV AFH initiative, Wood has delivered post-disaster flood studies and is currently executing multiple countywide Risk MAP studies under the current WV CTP contract.

Our skillsets and expertise align perfectly with WVEM's primary objectives as outlined in the EOI request for Flood Hazard, Analysis, Mapping and Associated Services, which includes comprehensive Risk MAP program services in addition to continuing the WV AFH initiative. The information below provides highlights of Wood's qualifications in West Virginia and throughout FEMA Region III, as well as nationwide Hazard Mitigation experience.

#### Wood West Virginia Qualification Highlights

- First to deliver AFH data in WV; subsequently delivered enhanced approximate floodplain analyses in support of AFHs for thirty-two (32) counties across the State;
- Delivered more than 8,600 miles of FEMA-approved detailed and enhanced approximate flood hazard analyses across West Virginia;
- Developed hydrologic and hydraulic modeling and mapping and water-surface and depth grid information to support the aforementioned flood hazard analyses;
- Implemented cost-effective automated hydraulic modeling and floodplain mapping tools enabling the large-scale delivery of enhanced approximate floodplain studies to support the WV AFH program;
- Partnered with the WVGISTC since 2003 on the continuous development and enhancement of the WV Flood Tool;
- Worked together with FEMA Region III, WVGISTC and WVEM on developing standards for floodplain modeling, mapping and water-surface depth and elevation grid submission and hosting on the WV Flood Tool website;
- Under contract to FEMA Region III, executed 19 West Virginia Countywide DFIRMs, encompassing 93 communities and more than 650 DFIRM panels, including updated flood studies for 107 miles of limited detailed reaches and 34 miles of detailed study reaches;
- Worked closely with WVEM, FEMA Region III and FEMA Headquarters to promote the acceptance of AFH data for use in support of Letter of Map Amendment (LOMA) applications;
- Continually providing technical support to West Virginia community officials and floodplain managers on the application and use of AFH data to promote resilient development;
- Acted as a liaison with FEMA Region III on the management of WV LiDAR topographic data delivery and supported WVEM on Risk MAP project reprioritization and FEMA Mapping Activity Statement (MAS) adjustment;
- Supported WVEM in developing annual WV FEMA CTP business plans, which define the future vision of the program and establish priorities for future flood risk updates. Comprehensive business plans are critical to position CTPs for FEMA Region III funding; and
- Wood Team Members Tucker Clevenger and Matthew Breen have presented at numerous technical conferences and training sessions, including the WV Floodplain Management Association Conference, the

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national Association of Floodplain Managers Conference, and the WV Society of Professional Surveyors Convention, to promote the use of the WV Flood Tool and provide instruction on its use.

The WVGISTC began partnering with Wood in 2010 to help the State of West Virginia implement and maintain the West Virginia Flood Tool (<u>www.MapWV.gov/flood</u>). Wood has provided model-backed Zone A depth and water surface elevation / Advisory Flood Height data for 32 West Virginia counties through 2020. They consistently stand behind their products with invaluable outreach and technical support to stakeholders and Flood Tool users. The success of the Flood Tool derives from an effective partnership of organizations striving in concert toward common goals. Wood's knowledge and expertise with the National Flood Insurance Program, flood hazard mapping and risk assessment, and their understanding of West Virginia's long-term vision for floodplain management are vital components of this success.

#### Eric Hopkins, GISP, CFM, West Virginia GIS Technical Center

*WV Advisory Flood Height Program Status Map:* AFH data is currently available for 35 of 55 WV counties through the WV Flood Tool. Wood has developed AFH information for 32 of the 35 referenced counties.







#### 2.2 Experience

#### Staff Qualifications

Wood has a wealth of qualified professionals capable of providing WVEM with exceptional services as required in the Riverine Flood Hazard Analysis, Mapping and Associated Services EOI. Continuity is the foundation of success for Wood's FEMA Region III flood hazard mapping program. Many of our key staff dedicated to the WV CTP program have successfully supported FEMA Region III and the West Virginia State CTP program for at least the past 10 years. A summary of the expertise of key personnel and support services is provided below to illustrate Wood's qualifications.

**Tucker Clevenger, PE, CFM** will serve as the **Principal-in-Charge and Client Manager** for the WV CTP Program. Mr. Clevenger currently serves at the Operations Manager for Wood's Chantilly, VA FEMA flood hazard analysis production center and has extensive experience in all aspects of flood hazard mapping in support of DFIRM production through final approval and community adoption. He has been directly involved in flood hazard mapping within FEMA Region III for the past 20 years and has worked closely with the WVEM, WVGISTC, and numerous WV communities over the course of the last 18 years. Mr. Clevenger has overseen the development of AFHs in thirty-two different West Virginia counties and presents at the West Virginia Association of Floodplain Managers annually on the AFH development process Mr. Clevenger also previously served as the Program Manager for Wood's (formerly Amec Foster Wheeler) five-year, \$40 million IDIQ contract with FEMA Region III.

**Matthew Breen, PE, CFM** will serve as the **Program Manager** for this project. Mr. Breen currently serves as the Service Line Lead for Wood's Water Resources and Engineering Team in Chantilly, VA. He has served as the Project Manager and Engineering Lead on the majority of Wood's floodplain study work throughout the state of West Virginia. Mr. Breen previously served as lead Riverine Hydrology and Hydraulics engineer for Wood's Map Modernization IDIQ contract with FEMA Region III and has been actively involved in the NFIP for the past 20 years. His main responsibility included the technical direction for thousands of miles of new floodplain development while also serving as a resource for other production elements. In addition to overseeing the Chantilly Water Resources team, he currently manages Wood's Region III State CTP Program.

**Stephen Noe** has over 35 years of experience performing all the services leading up to the production of a final DFIRMs and will serve as the **Quality Assurance/Quality Control (QA/QC) Lead**. Mr. Noe has managed the development of numerous Wood tools and facilitates the production of hydrology and hydraulic studies resulting in DFIRM production. He will draw on his experience as the Wood's national CTP Program Lead to develop and assure implementation of QA/QC procedures that exceed FEMA compliance accuracies and provide WVEM with the most accurate product the data can produce. Mr. Noe is not part of the Chantilly, VA reporting line, ensuring his ability to manage QA/QC independently.

**Troy Biggs, PE, PH, D.WRE** will serve as **Riverine Hydrologic and Hydraulic (H&H) Modeling Lead** for this project. Mr. Biggs is a Senior Civil/Water Resources Engineer / Project Manager with over 18 years of experience and is skilled in hydrologic and hydraulic modelling, watershed assessment, green infrastructure design, stream restoration, floodplain analysis, and water resources engineering design. He has served as project manager and design engineer in preparation of construction plans and specifications for a wide variety of water resources related projects. He currently serves as a Project Manager/Water Resources Engineer and technical lead specializing in H&H modelling and water resources design using HEC-RAS, HEC-HMS, AutoCAD, and GIS mapping tools.

Jason Sevanick Durant, GISP, CFM will serve as the Floodplain Mapping, FIRM and Data Management Lead for this project. Mr. Sevanick has extensive experience in floodplain mapping, FIRM development and GIS applications and will lead digital dataset development and GIS services associated with this project. Mr. Sevanick has been directly involved in the management and production of over 5,000 DFIRM and DFIRM database panels including multiple DFIRM projects throughout the state of WV. He currently manages a group of technical support staff responsible for DFIRM production under the FEMA Region III Contract and CTP contracts. In addition, Mr. Sevanick has previously provided the WVGISTC with training on DFIRM and floodplain digital dataset development. Mr. Sevanick is also responsible for coordination with FEMA's independent DFIRM database review contractor and has served as a valuable resource to both FEMA and the Production and Technical Services Contractor in this capacity.





**Yukun Xing, Ph. D., CFM** will serve as a **Senior GIS Analyst** for this program. Mr. Xing has over 12 years of experience working on FEMA projects in WV. He managed the FEMA Map Modernization projects for Tucker and Randolph Counties in West Virginia and participated at various capacities in many more West Virginia counties. He is well-versed in DFIRM production, FEMA specifications, standards, and processes, and GIS applications. Mr. Xing has also been keen to identify improvements in DFIRM workflows and opportunities to automate them with either standard or custom tools. This practice has resulted in increased productivity and improved quality of final deliverables.

**Thomas Williams, PE** will serve as the **Water Technology Lead** in support of the WV CTP Program. Mr. Williams has over 10 years combined experience in hydrologic and hydraulic modeling, geospatial analysis, and software engineering. In addition to developing HEC-RAS models for hundreds of miles of streams in West Virginia, Maryland, and Delaware, Mr. Williams worked as a software engineer. Mr. Williams' software engineering experience includes web interface development, server-side programming, database development, and server configuration management in support of modern web applications. As Water Technology Lead, Mr. Williams is directing software development efforts at Wood to automate FEMA H&H and GIS tasks, manage data, and improve quality through automated QC.

**Jennifer McGee, PE, CFM, GISP** will serve as a **Disaster Response Lead** for this program. Ms. McGee has over 11 years of experience in hydrologic and hydraulic modeling and geospatial analysis. She also has direct experience in supporting FEMA's Disaster Recovery Program for Public Assistance having deployed as a Data Analyst for Hurricane Sandy in New York to provide disaster level metrics reporting to FEMA management. In addition, she also managed the Public Assistance TAC subcontract and coordinated deployment of dozens of other staff on task orders across the country. She has developed HEC-RAS models for hundreds of miles of streams in West Virginia and other states and also focuses on software development and has built tools to automate FEMA workflows, perform spatial analysis, manage data and generate new products such as depth and water-surface grids.

**David Stroud, CFM** will serve as the **Hazard Mitigation Lead** for this project. Mr. Stroud has over 25 years of experience as a floodplain/hazard mitigation planner. Mr. Stroud's hazard mitigation planning experience includes both development of hazard mitigation plans and reviewing and scoring plans for FEMA. David has also worked for the Insurance Services Office (ISO) on behalf of FEMA's NFIP Community Rating System (CRS) Program as the lead hazard mitigation planner and Flood Training Coordinator for 19 years. Mr. Stroud has significant experience with the minimum regulations of the NFIP FEMA Grant programs and FEMA's Repetitive Loss Program. David works with communities, states, and FEMA Regional offices on all aspects of hazard mitigation planning and the FEMA's CRS Program.

**Jim Harned, PE, PLS** will serve as the **Field Survey Lead** for this program. Mr. Harned has over 32 years of experience as a land surveyor and water resources/civil engineer and has performed survey work in WV to support FEMA floodplain studies since 2003. Most recently, he has performed field survey and data collection in seven WV counties in support of the 2016 disaster response flood study updates. Mr. Harned is proficient with automated data collection formats in compliance with FEMA DCS.

Please refer to Section 4 - Resumes for additional details on Wood's flood hazard mapping qualifications. Applicable certifications for Wood staff can be found under the Certifications tab.



Robert Pierson	Eric Hopkins
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FEMA Region III	West Virginia University
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, and the second s	Email: Eric.Hopkins@mail.wvu.edu
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NFIP State Coordinator	Associate Director (Former FEMA RIII Branch Chief)
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Jennifer Pongratz	William Cain, PE, CFM
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Dept. Natural Resources and Environmental Control	Loudoun County Building and Development
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#### Proposed Staffing Plan and Program Availability

In supporting the West Virginia Floodplain Mapping Program for over 18 years, the Wood Team understands the amount of effort required to meet or exceed schedule expectations. The staff members assigned to this project have been selected not only based on their technical abilities and experience, but also on their availability over the project time frame. Each key member can commit the required time to this project. In addition to the key staff identified above, Wood's Chantilly office boasts a team of more than 40 additional engineering, GIS, and outreach staff specializing in providing Risk MAP services. Although not an anticipated need, the project team can call on more than 200 additional national staff that work closely with our 17 CTP States on a regular basis for additional support. We are proposing a dedicated team identified in the following organizational chart to continue to support the WV CTP Program:

This highly qualified team offers the following differentiators:

- Five members of the proposed project team (Tucker Clevenger, Matt Breen, Jason Sevanick Durant, Jenna McGee and Yukun Xing) have more than a decade of experience in FEMA Region III and more specifically with floodplain mapping projects in West Virginia;
- Our Chantilly, VA Production Center, which houses the dedicated WV CTP program staff, has successfully delivered AFH data in 32 West Virginia counties. In addition, we have produced updated flood studies and DFIRMs in 19 West Virginia counties throughout the state under contract to FEMA Region III;
- Our team has worked closely with the WVGISTC from the time they were first introduced as a CTP in 2003 and has supported the development of the WV Flood Hazard Tool since its inception;
- Wood typically meets annually in Morgantown, West Virginia (in non-COVID-19 environments) with WVEM, FEMA Region III, and WVGISTC staff to identify needs and opportunities for the upcoming year and collaborate on potential enhancements to the WV Flood Tool;
- Our team has maintained strong relationships with FEMA Region III for nearly two decades, serving as their preferred Flood Hazard Mapping IDIQ contractor since 2001 and more recently transitioning to support state CTP programs within the Region. We have been successful in leveraging these relationships to help support CTPs in positioning for funding on an annual basis; and
- HSE is small, woman-owned business who is a trusted provider of hydrographic survey data in support of FEMA floodplain studies. They have worked together with Wood since 2003, when they first performed flood study field surveys in WV under the FEMA Region III IDIQ contract.





#### CEOI HSE21 \*01 Architectural/Engineering Services West Virginia Division of Emergency Management

Wood has invested substantial resources in the West Virginia State CTP Program and will dedicate the resources required to deliver high quality products on schedule and within budget. As a company, we have focused on supporting FEMA's CTPs at a state and local level. This enables Wood to provide a higher level of service to CTPs as significant resources are not dedicated at a national level. To support this project, Wood is providing a consistent team which has successfully supported the West Virginia program for the last 18 years. Tucker Clevenger, who currently manages Wood's DC Operations, will serve as the Principal-in-Charge and Client Manager, and will assure that appropriate resources are dedicated to meet the needs of the program. Matthew Breen will serve as the Program Manager and will coordinate all project execution. Based on our experience working on the current West Virginia program, it is anticipated that all work will continue to be accommodated out of our local production center in Chantilly, VA. We have a flexible team in place that can quickly meet WVEM's program needs. However, Wood's national Risk MAP Team of over 200 H&H engineers, GIS specialists, and program support staff, will be available to assist the Chantilly team if necessary.



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#### 2.3 Past Performance

Wood's experience in delivering flood hazard analysis, mapping, and associated services is demonstrated by our extensive history of successful project delivery, within FEMA Region III and across the country. The following projects provide a representative cross section of our most applicable experience in providing these services.

#### West Virginia CTP Flood Hazard Mapping | Statewide West Virginia

#### Project Manager: Tucker Clevenger

**Client:** WV Division of Homeland Security and Emergency Management **POC:** Kevin Sneed | 304-957-2571 | kevin.l.sneed@wv.gov

**Description:** Through multiple federal and state contracts, Wood has supported the statewide WV FEMA CTP Flood Hazard Mapping Program since 2003, resulting in the development of nearly 8,600 miles of updated floodplain studies. Wood initially supported the WV program through the FEMA Region III IDIQ Flood Hazard Mapping contract which included detailed and approximate floodplain study updates in support of FEMA DFIRM production, as well as preliminary DFIRM issuance, post preliminary processing, LOMR/CLOMR support and outreach.

Following multiple FEMA disaster declarations due to flooding events, FEMA Region III, in collaboration with the State of WV initiated a first-of-its-kind flood risk modeling, mapping and communication program, called the West Virginia AFH program. The intent of the program was to cost-effectively develop updated and more comprehensive approximate flood risk across the state and make information available to stakeholders via a user-friendly website. Floodplain studies were performed where effective approximate flood hazards existed and also expanded into headwater areas, resulting in new floodplain analyses for thousands of stream miles - areas where prior to these flooding events, many homeowners were unaware of their risk. This program has currently been implemented in 35 of the the 55 counties across the state and continues to receive recognition through FEMA and across the country. Wood is currently serving as the FEMA CTP floodplain mapping contractor directly through WVEM and is responsible for continuing the WV AFH Program as well as performing comprehensive Risk MAP program services.

#### **Relevant Scope Services**

- Project Management **M** Risk Identification and Communication  $\mathbf{\nabla}$ **Field Survey/Reconnaissance M** Topographic Data Development  $\mathbf{\nabla}$ **Base Map Data Capture** H&H Modeling  $\mathbf{\Lambda}$ Floodplain Mapping  $\mathbf{\nabla}$ **FIRM Database**  $\mathbf{\nabla}$ **Preliminary FIRM Distribution** Post Preliminary FIRM Processing **Mon-Regulatory Product** Development General FEMA CTP Grant Support Services **Post Disaster Response and** Recovery Hazard Mitigation Planning AFH) Development  $\checkmark$ CFM Program Continuing **Education Training**
- Community Outreach Support

In response to the devastating flooding that occurred in 2016 resulting in disaster declarations across 18 WV counties, Wood was contracted to perform floodplain mapping updates in highly populated areas which were significantly impacted. These flood restudies encompassed over 60 miles of updated detailed flood studies in six different Counties including the towns of Rainelle, White Sulphur Springs, Alderson, Richwood, among many others. USGS provided an analysis of the event via Characteristics of Peak Streamflows and Extent of Inundation in Areas of West Virginia and Southwestern Virginia Affected by Flooding, June 2016. This document characterized the events of 2016 and, in certain locations, updated the 1% Annual Exceedance Probability discharges accordingly. Wood was able to use that information, where available, along with High Water Marks collected by USGS, to calibrate detailed Hydraulic models to the catastrophic event and subsequently update regulatory modeling, mapping and FIRM components. Hydrologic and Hydraulic models were reviewed by the USACE - Baltimore District. For these studies, Wood also worked with FEMA and FEMA's CERC contractor to prepare an enhanced outreach plan which included impact maps for school reconstruction projects as well as detailed 'Impact Assessment' summaries to both quantify the study results (e.g. # of buildings going in/out of the regulatory floodplains, and trends of increasing/decreasing flood flows, elevations, and extents) and contextualize the study in relation to ongoing recovery efforts (e.g. disaster assistance (individual/public) and flood insurance). Letters of Final Determination (LFDs) for 2 of the post-disaster studies are now on the near horizon (March 2021), with LFDs for the remaining post-disaster studies expected for Summer and Fall 2021.



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In addition to WV AFH program implementation and post-disaster flood studies, Wood is also performing multiple FEMA Risk MAP studies throughout the state. These comprehensive, countywide projects include full engineering analyses (survey, hydrology, and hydraulic modeling for 115 detailed study miles and 1,660 approximate study miles) and floodplain mapping, preliminary product development and post-prelimminary processing for 166 FIRM panels covering 19 communities. Wood worked hand-in-glove with WVEM and RIII in 2020 on reprioritization and overhaul of Mapping Activity Statements so that 4 new countywide regulatory studies that could advance in leiu of studies which were originally funded but stalled due to LiDAR delivery delays from the FEMA/USGS contractor. Wood has already advanced 85% of the scoped models through FEMA's Independent Technical Review, with zero or minimal review comments from the U.S. Army Corps of Engineers (on behalf of FEMA). Accordingly, multiple releases of Draft and Preliminary Data are scheduled for 2021, and Wood has been in regular communication with WVEM and the West Virginia University GIS Tech Center (WVGISTC) on status, data hosting, and related stakeholder engagement for these studies. Wood will also be developing non-regulatory datasets (including depth and water- surface elevation grids) for these studies which are planned for pairing with building inventory data that WVGISTC has been preparing throughout the state to produce refined Hazus-based flood loss estimates (consistent with Hazus results that WVGISTC has already published for a number of other counties).

#### Wood's WV Mapping Program Support since 2003

- ✓ Over **8,400** miles of approximate flood studies
- More than 180 miles of detailed flood studies
- ✓ Over **850** updated Regulatory DFIRM Panels

The WV Flood Tool (website and mobile application -<u>www.mapwv.gov/flood</u>) is the cornerstone of the flood risk communication and outreach aspects of the WV CTP Program. Developed and hosted by the West Virginia University GIS Tech Center (WVGISTC), the WV Flood Tool enables access to "advisory" flood depths and elevations available at the click of

a button, providing both community officials and stakeholders the information needed to make more informed floodplain management decisions. In addition, the website also houses all supporting engineering modeling and GIS information and enables data downloads to support future floodplain mapping enhancements. In addition to developing and delivering the modeling and mapping products necessary to represent flood risk, Wood has partnered with the WVGISTC since the inception of the website to help conceptualize enhancements to the site. These continual improvements are focused on the efficient dissemination of expanded flood risk information to stakeholders, while also maintaining a user-friendly interface for those investigating their risk for the first time.

While continuing to support flood risk data development and the evolution of the WV Flood Tool, Wood has also helped guide the overall mission and vision of the West Virginia CTP program through our engagement in annual WV CTP business plan development, leveraging knowledge and best practices gained from our experience with other FEMA Region III and nationwide CTP programs. In addition, Wood's longstanding relationships with FEMA Region III have helped raise the profile of the WV CTP program and position for FEMA funding to continue program growth. Wood plays a lead role in the West Virginia Floodplain Management Association and actively engages with floodplain administrators throughout the state to promote resilient flood risk management practices. We typically also support the state's floodplain management continuing education requirements by providing technical training sessions on an annual basis.

About Help Hom WV Flood Tool < / ₽ ∁ ■ 8 曲 ⊕ Expert Risk MAP Public Hundred, WV od Hazard Area: Location is WITHIN an isory floodplain but NOT a FEMA 100-yea active floodplain. More Info Q Q C lood Zone: Advisory A (Advisory Flood Heights available) Stream: N/A Watershed (HUC8) loper Ohi FEMA's Flood Map: 54103C0115C ± ± NFH Map Effecitve Date: 9/25/2009 Contacts Wetzel lood Height: About 1020 ft (AFH) Water Depth : About 4.5 ft (Source: HEC-RAS) EC-RAS Model: Null All Mo lood Profile: N/A mmunity : Town of Hundre CID: 540256 CRS Class: 10 (39.686874, -80.460586) cation (lat, long): ocation (UTM 17N): (4393142, 546254) N 1 1 External Viewers: Elevation: About 1010 ft (Source: SAMS 2003)

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#### MDE CTP - Maryland Statewide Flood Hazard Mapping Program | Statewide Maryland

**Client:** Maryland Department of the Environment (MDE) **POC:** David Guignet, PE, CFM | 410-537-3775 | <u>dave.guignet@maryland.gov</u>

**Description:** Wood has partnered with MDE for nearly two decades, helping to establish their CTP Program as one of the premier programs in the country. Wood has reinforced Maryland's resilience initiatives by providing comprehensive Map Mod and Risk MAP services through both FEMA Regional and State CTP contracts. With more than 40 task orders since contract inception, Wood's innovative and cost-effective technology has supported Maryland in becoming one of the first states to achieve statewide georeferenced, model-backed floodplain coverage. We have actively leveraged this Risk MAP data to develop partnerships at the Federal, State, and local levels, championing risk reduction, promoting effective floodplain management and hazard identification, and increasing public awareness and informed decision making.

At the onset of FEMA's Map Modernization Program, the MDE CTP project team championed a first-of-its-kind innovative flood study and data collection process in lieu of FEMA's standard DFIRM digital conversion approach. This cost-effective approach enabled Maryland to be among the first to achieve georeferenced and model-backed floodplain coverage, including more than 5,300 detailed and approximate stream miles. This visionary approach has positioned Maryland to capitalize on their established foundation of flood risk data to enhance and improve existing flood risk analyses. Wood's support of the MD CTP Program has included the development and delivery of all regulatory and non-regulatory risk map products.

Since 2003, Wood has supported the development of more than 1,800 DFIRM panels across 140 communities. All countywide studies have been carried through post-preliminary processing and map adoption, with minimum appeals. Depth, Water-Surface Elevation, and Percent-Annual-Chance (Annual and 30-year) grids, as well as Changes Since Last FIRM non-regulatory products have been produced for Risk MAP projects. Based on the USACE North Atlantic Comprehensive Study, we produced the first coastal Risk MAP products in the country through the MDE CTP program.

#### Wood's MD Mapping Program Highlights

- Over 5,300 miles of updated flood studies
- Over **1,800** updated DFIRM Panels
- More than **140** updated communities

Wood has also partnered with MDE on the development of the Flood Risk Application website, which serves as the cornerstone of the Maryland CTP risk communication program. The Maryland Flood Risk Application serves as an outreach tool providing both Risk Management and Floodplain Management guidance to stakeholders. State-hosted flood hazard information is transformed to look and feel like FEMA's National Flood

#### **Relevant Scope Services**

- Project Management
- Risk Identification and Communication
- Field Survey/Reconnaissance
- **M** Topographic Data Development
- Base Map Data Capture
- H&H Modeling
- Floodplain Mapping
- FIRM Database
- Preliminary FIRM Distribution
- Post Preliminary FIRM Processing
- Non-Regulatory Product Development
- General FEMA CTP Grant Support Services
- Post Disaster Response and Recovery
- Hazard Mitigation Planning
- AFH Development
- CFM Program Continuing
- Education Training
- Community Outreach Support



Maryland Statewide Enhanced Hazus Analysis. The project team leveraged partnerships and funding to deliver structure-specific flood risk and damage estimates.

Hazard Layer (NFHL) web service. Citizens, homeowners, lending institutions, realtors, engineers, land surveyors, and community officials use the site to get the latest risk information. The site, which has tracked more than 250,000 visits or hits for information, includes the option to download effective models for both detailed and approximate floodplains, georeferenced cross-section shapefiles, bridge and culvert data, flow estimates, and advisory water-surface elevations in Zone A locations.

Enhanced Hazus analyses produced by Wood through MDE's Risk MAP program were integrated into the 2016 Maryland Statewide Hazard Mitigation Plan (HMP). That effort culminated in a streamlined document that focused

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on new data, mapping, analysis, and opportunities. FEMA has approved the HMP and recommended mitigation actions are currently being implemented in lock step with the MDE CTP Program. The 2016 State HMP is among the first of its kind in leveraging information generated through the Risk MAP program and being supported through a partnership of multiple State agencies. The MDE Resiliency Partnership is enabling Federal and State funding,

resources, and knowledge to be leveraged to develop an enhanced and consistent hazard mitigation platform to be developed by Maryland Emergency Management Agency (MEMA) and MDE. Wood's comprehensive Risk MAP and Hazard Mitigation expertise has helped facilitate this partnership and enable its success.

**Past Performance** ... "We are currently working with Wood on full hazard restudies, preliminary map issuance and post preliminary work in additional Maryland Counties. Throughout these efforts, Wood has performed each of these services with the utmost care and professionalism and allowed us at the state to move this mapping process into a digital environment with foresight and vision." – Dave Guignet, Maryland State NFIP Coordinator





#### Delaware Flood and Coastal Hazard Analysis and Floodplain Mapping | Statewide Delaware

**Client:** Department of Natural Resources and Environmental Control (DNREC) **POC:** Jennifer Pongratz | (302) 739-9921 | jennifer.pongratz@state.de.us

Description: Since 2010, Wood has assisted DNREC with the identification and management of flood risk through their CTP with FEMA. Under two different contracts, Wood has supported 11 different Task Orders totaling \$800K. As part of the DNREC Statewide Riverine Scoping and Prioritization task order, we partnered with DNREC to systematically identify, categorize and prioritize flood prone riverine reaches throughout the State for varying levels of analyses. As part of their Risk MAP initiative, FEMA provided a framework (Discovery) and database tool (CNMS) by which to manage scoping and study prioritization efforts at a national level. Wood and DNREC used the nationally available processes and data as a starting point and refined results based on additional conditions, regional indicators, leveraged data from state and municipal stakeholders, economic and development trends, flooding history, etc. The exercise provides DNREC a tool for managing scopes and available funding - and was subsequently used to scope riverine modeling and mapping task orders for Kent and Sussex Counties; and separately, New Castle County. Costs for varying levels of hydrologic and hydraulic analyses in addition to map production costs are incorporated to project full (planning-level) costs of map updates.

As part of the Coastal Non-Regulatory Risk MAP Product Development task order, we produced Flood Risk Databases, Flood Risk Reports and Flood Risk



DNREC and Wood Staff at a volunteer cleanup and planting event at Prime Hook Wildlife Refuge

Re	levant Scope Services
$\mathbf{\nabla}$	Project Management
$\mathbf{\nabla}$	Risk Identification and
	Communication
$\mathbf{\nabla}$	Field Survey/Reconnaissance
$\mathbf{\nabla}$	Topographic Data Development
$\mathbf{\nabla}$	Base Map Data Capture
$\mathbf{\nabla}$	H&H Modeling
$\mathbf{\nabla}$	Floodplain Mapping
$\mathbf{\nabla}$	FIRM Database
$\mathbf{\nabla}$	Preliminary FIRM Distribution
$\mathbf{\nabla}$	Post Preliminary FIRM
	Processing
⊻	Non-Regulatory Product
_	Development
ш	General FEMA CTP Grant Support
_	Services
ш	Post Disaster Response and
_	Recovery
Ц	Hazard Mitigation Planning
$\overline{\mathbf{N}}$	AFH Development
M	CFM Program Continuing
_	Education Training
⊻	Community Outreach Support

Maps for New Castle, Kent and Sussex Counties. These products w

These products were constructed from Non-Regulatory Flood Risk Datasets including Changes Since Last FIRM (CSLF), Depth and Analysis Grids and a Hazus Flood Risk Assessment. We worked closely with the Region III QC contractor (USACE – Baltimore District) to develop delivery schedules and protocols that would serve as the model for Coastal Non-Regulatory products developed for other States. We created a website to host CSLF data as an outreach option for DNREC. A Hazus pilot study for seven communities along the Delaware Bay utilized more detailed building inventory data to complete a User Defined Facilities (UDF) level study with building specific attributes and spatial locations.

event at Prime Hook Wildlife Refuge Wood delivered the Brandywine-Christina/New Castle County Risk MAP Flood Study, including riverine hydrologic and hydraulic updates for approximately 100 miles of reach length throughout New Castle County. This study was issued effective on January 22, 2020. Wood and teaming partner HSE performed field reconnaissance for all limited detailed bridge/culvert collections and full survey of cross sections and road crossings for detailed streams. In addition to the updated hydrologic and hydraulic data, Wood was responsible for map production, outreach and Non-Regulatory product development. Wood continued to work with DNREC on reducing costs by taking advantage of State resources and leverage data, including Delaware Department of Transportation (DelDOT's) bridge and culvert inventories. Wood worked with County, State and Federal stakeholders on making sure the scope aligns with different objectives and mandates at the separate levels of government.





Under contract to DNREC, Wood has also provided training to DE state and local officials on the FEMA floodplain study process and the use of the Flood Planning Tool website. Wood reviewed the process for developing hydrologic and hydraulic studies to support FEMA FIRMs and provided instruction on how to leverage FEMA information for flood study upgrades at the local level. Additional floodplain management best practices were also covered in detail, including FEMA's LOMR/CLOMR, LOMA and Elevation Certificate requirement and processes. Delaware site specific floodplain management and permitting case studies were reviewed within the framework of the class and Professional Development Hours were awarded to participants.

Wood has supported DNREC on multiple LOMR submittals to help update regulatory data in areas with more up to date or detailed information available. In one recent study, emergency repairs at two flood control structures required a comprehensive



Wood provided training and Professional Development Hours for Delaware stakeholders

update of regulatory information for Clear Brook in Sussex County, DE. Several policy holders are within the impact area and a scheduled outreach meeting was postponed due to COVID-19 travel and gathering restrictions. Wood staff, including proposed WVDEM project manager Matt Breen, proposed a virtual outreach event and recorded a detailed presentation to be accessed on DNREC's Flood Planning Tool website. As the project has progressed through FEMA's MT-2 review process, outreach updates are provided to the website, keeping the community informed despite restrictions still in place.



Wood PM Matt Breen leads virtual outreach meeting for a flood study update after widespread COVID restrictions prevented inperson gathering





#### FEMA Region III IDIQ Riverine Flood Hazard Studies | DE, MD, PA, WV and VA

Client: Federal Emergency Management Agency Region III POC: Robert Pierson | 215-931-5650 | robert.pierson@fema.dhs.gov

**Description:** From 2001 through 2012, Wood supported FEMA Region III by providing complete Map Modernization services and Risk MAP Program support across 49 multi-county task orders, including analyzing flood hazards for select streams within a county, developing new flood hazard data (detailed, limited detailed, approximate) for entire counties, preliminary DFIRM development, DFIRM database creation, Post Preliminary processing, terrain data capture, GPS land surveys, CTP support and training, and various other support services. Wood is also the first to produce Risk MAP products in FEMA Region III for both Riverine and Coastal studies.

A primary goal of FEMA Region III during this time frame was to completely digitize their DFIRM inventory. As a result of Wood's creative use of GIS for flood hazard modeling and mapping (including many proprietary tools developed to maximize accuracy and efficiency – most notably our Approximate Floodplain Generator), We have produced more than 5,000 panels for FEMA Region III, covering 130 counties and more than 800 communities taken from preliminary to effective status, helping make Region III the first 'all-digital' FEMA Region. To date, Wood has performed hydrologic and hydraulic restudies and associated flood hazard mapping for over 15,000 stream miles with varying levels of complexity.

Beyond technical expertise, Wood has played an integral role supporting FEMA Region III at 110 community coordination and outreach meetings. Wood knows that municipal and public involvement in the flood mapping update process is critical to facilitate the efficient adoption of the new flood

**Relevant Scope Services** 

- Project Management
- Risk Identification and
- Communication
- Field Survey/Reconnaissance
- **Topographic Data Development**
- Base Map Data Capture
- H&H Modeling
- Floodplain Mapping
- FIRM Database
- Preliminary FIRM Distribution
- Post Preliminary FIRM Processing
- Non-Regulatory Product Development
- General FEMA CTP Grant Support Services
- Post Disaster Response and Recovery
- Hazard Mitigation Planning
- AFH Development
- CFM Program Continuing
- Education Training
- Community Outreach Support

hazard data and achieve stakeholder consensus. Thus, Wood has presented results of complex technical procedures to community officials and residents, facilitated the collection of applicable floodplain mapping data, and provided insight and direction on DFIRM development. This integrated approach has cultivated relationships with community officials that assist in expediting the map acceptance process for FEMA.

Under the FEMA Region III IDIQ contract, Wood was contracted to perform DFIRM production/flood hazard analysis for thirteen different counties in West Virginia. This included DFIRM development, preliminary issuance and post preliminary processing for 460 panels in Barbour, Cabell, Jackson, Kanawha, Lewis, McDowell, Monongalia, Pendleton, Raleigh, Randolph, Tucker, Upshur and Wyoming Counties. These countywide DFIRMs were delivered ahead of schedule and within budget. Included in these DFIRM updates were new flood studies for 107 miles of Limited Detailed analyses and 34 Miles of Detailed analyses. FEMA Region III also tasked Wood with providing technical assistance and independent QA/QC to WVUGISTC as a CTP. Wood provided technical guidance and training to WVU as they utilized FEMA's DFIRM tools administered through the Citrix server solution. Wood was able to assist WVU in the effective production of DFIRMs and laid the groundwork for a partnership on the WV Flood Tool initiative.

**Past Performance ...** "Wood has continuously worked with FEMA Region III, Risk Analysis Branch on our Map Modernization and Risk MAP programs since 2001. AMEC successfully completed many annual task orders to modernize our map products across the Region. They have lead or participated in the engineering, mapping and administration of over 100 countywide projects for Region III. AMEC staff have excelled at coordination with us as clients; with local & state government staff; and with other consultants as project partners".

Jon Janowicz, FEMA, Former FEMA Risk Analysis Branch Chief



#### North Carolina Risk MAP and Support Services | Statewide North Carolina

**Client:** NC Department of Public Safety, Division of Emergency Management **POC:** Chris Koltyk | 919-825-2310 | Chris.Koltyk@ncdps.gov

**Description:** Since 2004, Wood has performed floodplain studies for the North Carolina Floodplain Mapping Program. The project currently encompasses the acquisition of structure and channel data, compilation of digital base mapping, LiDAR acquisition, development of flood hazard areas in riverine and coastal areas, production of digital floodplain work maps, FEMA Flood Insurance Studies, and Digital Flood Insurance Rate Maps (FIRMs) for various counties within the state of North Carolina.

Wood has led the way in innovation to streamline processes to reduce overall cost for the State of North Carolina. Wood has shared its Automatic Floodplain Generator, Interactive Floodway Editor and is currently helping the State design a web-based QA/QC tool for hydraulic simulations. Wood has proposed innovative solutions for risk communication using web-based platforms, leveraging Aerial Imagery to generate statewide land cover data to aid hydrology, hydraulics and flood damage estimation and generation of profiles on the fly using custom ArcGIS based tools to streamline flood identification and mitigation efforts statewide.

- Wood has performed more than 1,700 miles of detailed studies, 800 miles of limited detail studies, and 200 miles of redelineation.
- Has prepared over 600 FIRM panels, flood profiles, summary of discharge tables, floodway data tables, and flood hazard data tables for five countywide FISs.
- Scoping an additional delivery order to prepare countywide FIRMs for seven counties consisting of 370 miles of hydrologic and hydraulic modeling.
- Preparing 720 miles coastal hazard analysis and mapping for nine counties, with around 1,000 transects have been utilized to model the coastal waves generated from storm surge.
- Support the State's evolution to a Risk MAP product, including



involvement in pilot projects to develop a fully digital deliverable.

Enhanced community

outreach products, and dam inundation analysis and mapping.

• Wood is also one of two contractors reviewing Statewide LOMC applications for the State of North Carolina.

Wood is also assisting with risk assessment projects in the State of North Carolina as part of the North Carolina's Integrated Hazard Risk Management Program. Through this initiative, Wood collected first floor elevations for over 30,000 buildings located along the coast of North Carolina using mobile land-based LIDAR. The first-floor elevations were used to compute flood damage estimates for buildings located within the 500-year floodplain.

#### **Relevant Scope Services**

- Project Management
- Risk Identification and Communication
- Field Survey/Reconnaissance
- **M** Topographic Data Development
- Base Map Data Capture
- H&H Modeling
- Floodplain Mapping
- FIRM Database
- Preliminary FIRM Distribution
- Post Preliminary FIRM
- Non-Regulatory Product Development
- General FEMA CTP Grant Support Services
- Post Disaster Response and Recovery
- □ Hazard Mitigation Planning
   ☑ AFH Development
- CFM Program Continuing Education Training
- Community Outreach Support





#### Missouri Risk MAP Services and Hazard Mitigation Support | Statewide Missouri

Client: Missouri State Emergency Management Agency (SEMA) POC: Ron Broxton, PE | 573.694.3062 | <u>ron.broxton@sema.dps.mo.gov</u>

**Description:** Wood is currently providing Risk MAP and Hazard Mitigation and Planning services to the State of Missouri Emergency Management Agency (SEMA). This long-term relationship and associated master-services agreement has resulted in over 40 task orders to assist the State with flood risk identification and management of the NFIP, and mitigation of multiple hazard impacts statewide. Throughout this program, impacts from multiple dams and over 400 miles of levee have been studied to determine level of risk to the local population. These risks were tied into the final mapping, databases, and reporting, Risk MAP and mitigating the impacts of multihazards statewide helping SEMA become one of the premier CTP programs in the nation as well as one of the premier Hazard Mitigation Programs.

- Paved the way for Missouri to be at the forefront of Base Level Engineering statewide with 2D modeling in a quasi- Map Maintenance mode.
- Hydrologic and Hydraulic studies have been performed by utilizing HEC-RAS Excess Rainfall on Grid methodologies for models in more than 40% of the state last year. Additionally, previous studies were performed using regional regression equations, statistical gage analysis, HEC-HMS, PCSWMM and both steady and unsteady flow 1D, coupled 1D and 2D HEC-RAS models throughout the state.

- **Relevant Scope Services**
- Project Management
- Risk Identification and Communication
- Field Survey/Reconnaissance
- **Topographic Data Development**
- Base Map Data Capture
- H&H Modeling
- Floodplain Mapping
- FIRM Database
- Preliminary FIRM Distribution
- Post Preliminary FIRM Processing
- Non-Regulatory Product Development
- General FEMA CTP Grant Support Services
- Post Disaster Response and Recovery
- Hazard Mitigation Planning
- AFH Development
- CFM Program Continuing
- Education Training
- Community Outreach Support
- Developed Riverine Survey Tool to aid onsite collection efforts allowing data to upload from the field using an app on tablets by multiple crews streaming into a central database. Additional tools export the field data, after QAQC, directly into HEC-RAS. These tools are shared with clients.
- Conducted **FEMA Risk MAP activities** statewide for Missouri, 113 counties plus the independent City of St. Louis have digital modernized floodplains either effective or Preliminary.
- Managed GIS large flood data sets through FEMA's MIP, FEMA's Map Service Center (MSC) and through SEMA's Outreach Website. Wood developed online websites which hosts project data for public and stakeholder viewing for the Risk MAP Program as well as for the State Hazard Mitigation Plan. Developed Mapping Activity Statements (MAS) for detailed scopes of work and project deliverables, Time & Cost (T&C) documents for budget and schedules, and statewide stakeholder engagement and communication plans.
- Utilized LiDAR datasets ancillary data in the classified point cloud to develop derivative datasets such as
- **building footprints for use in modeling.** These LiDAR derived building footprints are merged into the topographic Digital Elevation Models (DEMs) to further enhance event modeling base elevations as illustrated in the graphic in Figure 1.
- Created and conducted **Technical Guidance and Training** through hands-on computer workshops for local communities can utilize the geospatial data for floodplain management, planning and mitigation efforts. Workshops were also created and conducted free of charge which teach local engineering firms and state staff engineers how to utilize the new 2D models.



Figure 1: LiDAR Based Building Footprints merged into Terrain





- Managing the Business Plan from Discovery through post preliminary activities of the Risk MAP Program for the State of Missouri as a CTP with FEMA Region VII to merge SEMA, Region VII and FEMA HQ goals for a synergic combined strategy.
- Assisted in formulating guidelines that bridge the use of FEMA guidance documents to unique terrain throughout the state. These efforts ensure that the program is meeting the best intent of similar but different programs.
- Managed multiple annual large grants which produced Base Level Engineering (BLE) as well as Detailed Studies affecting 6.1 million citizens of the state in 955 communities in 114 counties.
- Performed over 31,000 miles of studies, over 1,000 panels, over 4,300 miles of new detailed studies (over 1,900 2D with FWs), over 500 miles of re-delineations and over 100 Flood Insurance Studies (FIS).
- Developed the Missouri State Enhanced Hazard Mitigation Plan utilizing Risk MAP program data to inform the Risk Assessments statewide, helping SEMA become one of the premier Hazard Mitigation Programs in the nation. SEMA received FEMA Best Practices on the methodologies utilized with the crosswalk of data between programs.
- Developed 10 Resilience on Command (ROC) **technical assistance (TA)** mitigation projects which utilized the new models for further analysis to inform specific mitigation solutions resulting in 80-100% flood risk reduction with numerous mitigation efforts such as channel and conveyance improvements as well as detention These project locations are shown in the map in Figure 2.
- Used cutting edge technology coupled with old school work ethics to manage project deliverables and schedules cradle to grave to achieve 95+% statewide coverage of at least Base Level Engineering (BLE) and detailed engineering in heavily populated areas with the wise use of limited funds as enumerated through a rolling 5 year Business Plan.

Wood is assisting the State of Missouri with flood risk identification; management of the NFIP and mitigation of multiple hazard impacts statewide. These efforts cross-walk data between programs and bring millions of additional dollars in disaster recovery and mitigation funds to the state. • Managed SEMA project production as a part of a **national program** which pulls more than 50 engineering and GIS staff from 13 offices across the nation with 5 large production excellence centers which allows nimble workload capacity adjustments to meet needs.

- Developed the initial Missouri State Disaster Logistics Plan and Standard Operating Guidelines in 2007 which made SEMA one of the first to obtain Emergency Management Accreditation Program (EMAP) certification in the Nation. This certification has brought millions of additional aid dollars to the state over the last 14 years and proves the highest standards of excellence are met.
- Developed the initial State Hazard Mitigation Plan, which was approved as an Enhanced Plan in 2007, resulting in millions of extra mitigation dollars to come to the state during Presidential Declared Disasters in the 14 years since.
- Conducted three annual updates to the State's Enhanced Hazard Mitigation Plan and has received FEMA Best Practices issued on these projects' methodologies as part of its 2018 Plan. Wood is responsible for both guiding the planning process, producing the updated document and the plan's risk assessment using HAZUS-MH, FEMA's loss estimation software. Risk MAP program data was cross-walked between programs an used as primary data inputs to directly inform flood risk assessments in enhanced level analysis resulting in more refined loss estimates. This analysis also made use of additional geospatial datasets to further refine exposure estimates.





#### HSE Map Modernization and Risk Map Services | State CTP and National PTS Projects

Client: Various State CTP and National PTS Regions III, IV, VIII & IX POC: Robert Pierson | 215-931-5650 | robert.pierson@fema.dhs.gov

**Description:** HSE's Project Manager Jim Harned has provided specialized experience in hydrographic survey, bathymetric survey, and geodetic survey for LiDAR QA/QC surveys on a number of CTP and PTS projects, many as a teaming partner with Wood.

#### West Virginia CTP

HSE has worked with Wood providing hydrographic survey services for the WV CTP project since 2016. Over the course of the last 4 years, HSE has collected data for a total of 211 structures in 7 counties spread across the state. These have ranged from Howard Creek which runs through Greenbrier Resort to major river bridges on the Greenbrier, New, Gauley, Elk, Cherry and Meadow Rivers.

#### **Region III IDIQ**

HSE provided project and local control and hydrographic surveys throughout the Mid-Atlantic region including four counties in WV, one in MD and one in VA totaling approximately 170 stream miles. One of the West Virginia counties was Kanawha County which includes the urban area Charleston in addition to some very steep, forested terrain. A county-wide control network was established to facilitate survey of 115 cross-sections and 61 structures for study of over 23 stream miles on nine separate stream systems.

Re	levant Scope Services
	Project Management
$\mathbf{\Lambda}$	<b>Risk Identification and</b>
	Communication
$\mathbf{\nabla}$	Field Survey/Reconnaissance
$\mathbf{\nabla}$	Topographic Data Development
$\mathbf{\nabla}$	Base Map Data Capture
$\mathbf{\nabla}$	H&H Modeling
$\mathbf{\nabla}$	Floodplain Mapping
$\mathbf{\nabla}$	FIRM Database
$\mathbf{\nabla}$	Preliminary FIRM Distribution
$\mathbf{\Lambda}$	Post Preliminary FIRM
_	Processing
Ш	Non-Regulatory Product
_	Development
Ш	General FEMA CTP Grant
_	Support Services
Ш	Post Disaster Response and
_	Recovery
Ц	Hazard Mitigation Planning
Ц	AFH Development
	CFM Program Continuing
_	Education Training
	Community Outreach Support

#### **Delaware CTP**

Over the course of the DE CTP Project with Wood, HSE's Project Manager, Jim Harned provided geodetic control and hydrographic surveys on two streams (Shell Pot and Little Mill Creeks) and a tributary (Matsun Run) in New Castle County totaling 10 structures. Both Shell Pot and Little Mill were tidally influenced by Delaware Bay complicating the data collection process. In addition, a majority of the structures were Amtrak, Norfolk Southern RR, CSX RR and I-95 crossings which required extensive access and safety coordination.

#### Kentucky CTP

Over the course of the three-year contract, HSE provided Wood geodetic control and hydrographic surveys in seven counties located in different regions of the state as well as a number of large bridges over the Kentucky River totaling approximately 75 stream miles and 10 Kentucky River bridges.

<u>Virginia CTP</u> HSE provided geodetic control and hydrographic surveys on 24 streams and tributaries in Loudoun County totaling over 60 stream miles and including 99 structures and 88 cross-sections. Project was in urbanized

areas requiring public and agency coordination and special work access permits.



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# 3.0 Goals and Objectives





## 3. Goals and Objectives

#### 3.1 Program Understanding

Through our experience in supporting the state's flood risk mapping initiatives since 2003, as well as our experience as the incumbent WV CTP contractor, Wood has developed unique insight regarding the overarching goals of the WV CTP Program. We have leveraged these insights, experience, FEMA relationships and overall Risk MAP program knowledge to help guide the vision of the WV CTP program and have played a key role in developing the initial WV State CTP Business Plan and subsequent plan updates. Comprehensive and realistic business plans are critical in positioning for FEMA Regional mapping funding. Wood helped to establish core program goals which have remained constant over the last decade in working towards achieving the vision of the program. The program vision and goals established by the WV CTP program have significant synergies with the overall FEMA Risk MAP Program goals:

- **Goal 1-Data Gaps**: Address gaps in flood hazard data to form a solid foundation for flood risk assessments, floodplain management, and actuarial soundness of the NFIP.
  - WV AFH initiative continues to serve as the cornerstone of the WV CTP Program and is progressing towards statewide coverage
  - Supported by statewide LiDAR data, WV is now prioritizing the delivery of comprehensive countywide Risk MAP projects
- Goal 2-Awareness and Understanding: Ensure that a measurable increase of public awareness and understanding of risk management results in a measurable reduction of current and future vulnerability to flooding.
  - WV Flood Tool outreach website and mobile application continue to serve as the primary resource for dissemination of flood risk information (over 750k total visits)
  - WV CTP's enhanced outreach program promotes use of the WV Flood Tool as well as sound floodplain management and resilient development practices
- **Goal 3-Mitigation Planning**: Lead and support states, communities, and tribes to effectively engage in riskbased mitigation planning resulting in sustainable actions that reduce or eliminate risks to life and property from natural hazards.
  - Risk MAP non-regulatory products are being leveraged to perform statewide enhanced hazus analyses (WVGISTC)
  - Hazus risk-based information published via the WV Flood Tool and accessed to support mitigation planning initiatives
- **Goal 4-Digital Platform**: Provide an enhanced digital platform that improves management of limited Risk MAP resources, stewards information produced by Risk MAP, and improves communication and sharing of risk data and related products to all levels of government and the public.
  - WV Flood Tool website and mobile platform serve as a repository for comprehensive flood risk information and enable real-time accessibility and data downloads
  - WV AFH program was among the first in the nation to enable the accessibility of flood elevation information in approximate areas and the WV Flood Tool remains a leader in flood risk data management and communication
- **Goal 5-Synergize Programs**: Align Risk Analysis programs and develop synergies to enhance decision-making capabilities through effective risk communication and management.
  - WV CTP program has championed the development of partnerships across West Virginia Floodplain Management and Hazard Mitigation programs to leverage best available data and improve risk communication and management practices.

While Wood played a key role in developing the vision and overarching goals of the WV CTP Program, we have also consistently identified program challenges and provided solutions that address these challenges. A summary of representative program challenges and Wood solutions is provided in the table below:





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WVEM Key Challenges	Wood Solution	WVEM Benefit	Representative Experience
Economically developing Statewide AFH data	Continued use of automated technology and alignment of AFH development with Risk MAP Projects.	Wood's automated modeling processes have reduced the AFH delivery by thousands of dollars per mile. Alignment of AFH and Risk MAP studies enables FEMA funding to be stretched further.	AFG has been the basis for the cost-effective delivery of 32 AFH Counties throughout the State of West Virginia. AFH data is currently being delivered as a standard product associated with WV Risk MAP studies.
Delivery of WV CTP Risk MAP project backlog due to LiDAR delivery delays	Wood provides a dedicated team of resources with WV CTP program experience with an extensive bench of additional company resources.	Timely delivery of a high volume of Risk MAP studies will comply with FEMA Region III metrics and better position for future CTP program funding.	Following the execution of the recent task order modification under the current contract, Wood has delivered on numerous Risk MAP project milestones and substantially improved MIP metrics.
Programmatic Support/Funding	Leverage established FEMA Region III relationships to position for additional funding. Proven high quality and timely AFH and Risk MAP project delivery.	Strategic positioning for future program funding to support the completion of statewide AFH coverage and the execution of comprehensive Risk MAP studies across the state.	Wood has helped position WV CTP program through strategic planning, study prioritization and leveraging FEMA regional relationships to build current backlog of funding. Currently supporting WVEM in managing FEMA Regional expectations for delivery due to LiDAR delays.
Management of variable LiDAR delivery schedules to maximize production efficiency and return on CTP Program funding	Proactively modify FEMA Risk MAP project prioritization to align with dynamic LiDAR delivery schedules.	Aligning Risk MAP project and AFH prioritization enables the use of the most up-to-date topographic data and maximizes return on CTP program funding.	Wood consistently monitors WV LiDAR delivery through FEMA RIII and supports WVEM in the reprioritization of studies and associated Mapping Activity Statement adjustments
CTP Program Alignment with FEMA transition to Risk Rating 2.0	Leverage overall Wood CTP program experience and national FEMA program knowledge to translate best practices to the WV program.	Wood will assure that the WV program vision aligns with the overall FEMA national transition to probabilistic risk and leverage best practices, providing cost savings.	Wood currently works with 17 different CTP states, including two other FEMA Region III CTP programs. We have assured that WV CTP strategic plan maintains synergy with regional and national program expectations.
WV Flood Tool and AFH Outreach	Consistent presence at conferences/workshops/ outreach meetings targeting WV Flood Tool stakeholders. Provide virtual training and outreach during COVID-19.	Increased awareness of WV Flood Tool; more integrated and proactive floodplain management, permitting and mitigation at a local level, ultimately reducing flood risk.	Wood presents annually as WVAFM and has supported WVEM in additional ASFPM and WV conferences. Wood has also provided multiple virtual continuing education trainings.
AFH acceptance for FEMA Letters of Map Amendment (LOMAs)	Continued collaboration with FEMA Region III and HQ and implementing a program for AFH acceptance for LOMAs	Reduced burden on property owners and expedited processing of LOMAs, ultimately saving WV residents money.	FEMA has approved the use of AFH data in support of LOMAs as well as eLOMAs and has reduced turnaround time on WV LOMAs. Wood provided continued technical guidance.

Wood's CTP team will continue to serve as an advocate for the WV CTP Program, assuring that the program vision aligns with the national Risk MAP Program and positioning WV for continued FEMA Regional CTP funding. Our FEMA relationships, national program knowledge, innovative technology, and ability to leverage best practices will continue to support WV as one of the nation's premier CTP Programs.





#### 3.2 Program Management and Technical Approach

The Wood Team's proven Technical and Program approach in providing comprehensive FEMA Risk MAP services has been developed, adapted and refined throughout more than two decades of service to FEMA regional and state CTP clients. Our national FEMA CTP program and connectivity through FEMA headquarters and individual FEMA regions enables our approach to adapt as the national FEMA program evolves. We are consistently engaged across various platforms on FEMA program changes and initiatives and are consistently enhancing our approach, both technically and programmatically, in lock step with the overall program.

#### 3.2.1 Program Management Approach

Wood's team is structured to provide a Program Manager (Matt Breen) who will lead the team and serve as the point of contact for this contract. Matt has extensive previous experience providing support to WVEM's CTP program. He will be accountable for contract performance and responsible for scoping, pricing and negotiating task orders. He will allocate staff resources, direct operations, and ensure effective and efficient execution of work. Matt will be supported by a local dedicated core group of engineers, GIS analysts and additional support staff responsible for executing the task orders issued by WVEM under this contract and the team will be supported by Wood's corporate team of contract specialists, procurement managers, floodplain modeling and mapping experts and technical services practice leads for support and additional expertise when needed throughout the life of the contract.

Wood's approach for managing the work assigned under this contract is based on our focus on quality project delivery. Each task is unique and requires the ability to bring in the right resources to get the job done in a cost-effective and efficient manner. Our team has the breadth of services needed to meet and exceed all WVEM's CTP program needs and the flexibility to tailor individual teams to the right tasks. Our approach incorporates the following principles:

- Project management: Leading an organized effort for project delivery to achieve objectives, respond rapidly to requests and handle multiple assignments.
- Scope of services: Understanding the work to be performed and project goals.
- Technical requirements: Providing a team with the requisite expertise to provide full-service civil engineering and support services.
- On-time project completion: Allocating resources to meet or exceed established schedules; ability to tap
  into available resources of the Engineering News Records #1 International design firm (2020) in the United
  States, Canada, and Latin America region.
- Cost Performance: Wood knows that FEMA Region III uses Earned Value Management (EVM) to assess
  performance of their CTPs and that Cost Performance Indices (CPIs) can impact future funding allotments.
  Wood uses robust project management software that creates accountability by allowing all projects
  components to be tracked on a weekly basis.
- Quality project delivery: By implementing WVEM and FEMA requirements, timely reviews, and Wood's established Quality Management Plan (QMP).
- Safety: By implementing Wood's Health and Safety requirements.

Our commitment to these principles will be documented in an overall contract Project Management Plan that will include Wood's required quality management, project delivery and health and safety (H&S) protocols as well requirements for contract management, task order coordination/work plan development, general workflow for design services and a matrix of required project reviews/approvals.

Upon receipt of a request for services under this contract, our first effort will be to carefully review the language of the request to ensure that we understand not only the project specifics but also the intent and purpose of the projects. We will communicate with WVEM project managers to clarify any questions we have and then proceed to develop a work plan consisting of project scope, schedule and budget; staffing and subcontracting plan; technical approach; and deliverables. We will then submit a technical and cost proposal to WVEM for review. Following this review and any required modifications on our part, we will await a Notice to Proceed. Upon Notice to Proceed, the Wood project manager will set up the project in our project management system, organize and hold a kickoff meeting, obtain final health and safety and QA/QC input, obtain any required logistics support, and initiate work.





#### **Communication Plan**

Through Wood's years of working with WVEM, FEMA Region III, WVGISTC and local West Virginia officials, we have developed a comprehensive network of relationships throughout the state which will help facilitate effective communication throughout the life of the contract. We are in consistent communication with WVEM, FEMA Region III, WVGISTC and local officials throughout the life of existing projects. At a minimum, individual project status reports will be provided on a monthly basis and supplemented by either in-person or web-based meetings with WVEM as necessary. A specific communication plan will be identified for each individual Task Order issued by the WVEM as part of the Project Management Plan. Standard components of these plans will typically include:

- Project Kickoff Meeting (in-person or web-based)
- Monthly status updates and invoicing
- Periodic status calls/web-meetings (frequency to be agreed upon with WVEM on a task order specific basis)
- FEMA Region III status/monitoring meetings
- Final task order wrap-up meeting
- Coordination call with WVGISTC on data delivery
- Community outreach/engagement demonstration

Specific project issues will be communicated immediately with the client and if necessary, Wood will also act as a liaison with FEMA Region III to resolve any Special Problem Reports (SPRs). Through our previous FEMA Region III, we have an extensive track record of proactively addressing SPRs to limit impacts to project budget and schedules. Through our various FEMA Region III CTP contracts, we have regular monitoring meetings with FEMA Region III staff to help convey state CTP project status and confirm alignment with FEMA Region III metrics and expectations. This communication is critical to better position for future funding. Furthermore, Wood's communication plan extends beyond standard project and task order communication. Through our experience, we understand that communication and outreach are critical to the success of the WV AFH initiative. As a result, we plan on providing continued and expanded outreach support to include (but not limited to) the following (where possible with consideration of COVID-19 constraints):

- West Virginia Association of Floodplain Presentations/Training
- West Virginia Surveyor's Conference Presentations/Support
- National Association of State Floodplain Managers Conference AFH Promotion
- Individual West Virginia County Outreach Meetings
- Continuing Education Webinars for WV floodplain administrators
- FEMA Region III AFH promotion

As a result of the WV AFH initiative, the state has received a significant amount of positive recognition from FEMA Region III, FEMA Headquarters and other FEMA CTP states. We have been proud to support the WV communication and outreach initiative and look forward to helping to continue to positive momentum to further advance the WV CTP Program.

#### Managing Projects in FEMA's Mapping Information Platform

FEMA's Mapping Information Platform (MIP) is a web-based EVM tool used as a digital warehouse for submitting and storing data resulting from flood hazard mapping projects. Wood's Risk MAP project deliverables are routinely uploaded directly to the MIP in a DCS compliant submittal package using the Data Development Tasks created during the Discovery phase of the project.

FEMA utilizes the MIP system to track deliverables on mapping projects through the required workflow and review stages of a project to ensure compliance with mapping standards and QA/QC requirements. Wood is extremely familiar with the MIP workflow and has significant experience in completing all required data deliverables in the MIP. Wood has successfully navigated over 500 counties through the MIP process using both producer and manager tasks.



Workbench > Studies Dashboard

## Studies Dashboard

Case # 🗍	Project Name 41	SPI ↓↑	CPI 🕴
21-03-00085	RM-FY18-WV-Summers-CW	0.97	0.98
21-03-00075	RM-FY18-WV-Monroe-CW	1.07	1.02
21-03-0003S	RM-FY16-WV-Pendleton County-CW	1.08	1.01
21-03-00025	RM-FY16-WV-Hardy County-CW	0.98	1.0
19-03-00285	RM-FY18-WV-Greenbrier County-CW	0.95	1.01
19-03-0002S	RM-FY17-WV-Post Disaster DR4273 Restudy and Mapping-O-PMR	0.93	1.01

#### **Current MIP Studies Dashboard for active Wood WV CTP Projects**

FEMA also has a comprehensive resource of Guidelines and Specifications which provide consistency of deliverables across the board. Additionally, there are several Procedural Memorandums which further clarify the guidance and a Key Decision Points (KDP) process intended to aid FEMA in making more informed and more deliberate decisions on where products are created. Wood is adept at interpreting the guidelines and implementing them to produce consistent and accurate products and leveraging the KDP process to assist in increasing awareness by communities and driving communications with communities to encourage action.

#### **Product Quality Control**

Wood Team members use industry-recognized quality control procedures and have developed a firm-wide quality assurance (QA) program for all engineering projects. Wood has established quality control (QC) plans for our FEMA Risk MAP Program that cover checking procedures, documentation, guidelines, design and document preparation checklists, guality control responsibilities and employee training requirements. Our internal process emphasizes that quality is not a "one time, it's fixed" commitment, but rather a continuous process of improvement by employees, managers, and subcontractors. Wood has designated Stephen Noe as our QA/QC Manager for this project.

The Wood Team has a long-standing corporate culture of commitment to quality, founded on the following elements:



- At project inception, developing a PMP which defines the project-specific scope, schedule and quality standards to be implemented on the project.
- As necessary, adjusting Project Specific Plans to incorporate Task Order Specific Requirements such as • milestone reviews to identify the need and resources for special technical reviews and to establish task order specific QC schedules and budgets.
- Performing detailed checks of computations and work using existing checklists established for our NFIP related work.
- Performing Independent Peer Reviews (IPR) to validate key assumptions, critical decisions, and overall project and client objectives.
- Conduct periodic in-process project reviews on major projects to ensure that quality assurance processes, project schedule, and financial performance are being fully implemented or adhered to by the project team.
- Apply metrics-based continuous process improvement systems to meet or exceed performance goals.





#### **Quality Control Program**

The Wood Team's members embrace and promote the idea that training of staff is paramount to staying at the forefront of the industry. Wood's project manager training and certification program covers all aspects of project management, emphasizing the importance of Quality Assurance and adherence to Wood's Technical Review Policy throughout the training.

Additionally, the Wood Team provides in-house web casts and on-site training in the use of NFIP-specific topics, such as the use of Wood's SMART and FIRM tools, meeting Data Capture Standards, use of the MIP, etc., as well as providing the opportunity to staff members to attend relevant conferences, such as the annual WVFMA and ASFPM conferences. These training programs include training for new staff, skills enhancement and maintenance training for experienced staff and a cross-training program.

#### **Quality Assurance/Quality Control Process**

While we do not rely on after action inspections to ensure quality products, and while we do strive through our quality assurance program to minimize human error, human error is unavoidable, which is why quality control plays a significant role in the quality assurance process.

The quality assurance process includes three phases of quality control review. The three phases are:

- Detail-Check (DC)
- Internal Peer Review (IPR)
- Internal Quality Audit

#### **Detailed-Checking**

The purpose of Detailed-Checking is to independently verify the correctness, completeness, and technical adequacy of information within the document to be checked. The Detailed Check involves two distinct levels of review, both of which are performed by personnel independent of the originator. Number crunching is checked by staff level personnel and is intended to find human error. The second level of the Detailed Check is completed by a senior engineer or team member as assigned by the QA/QC Manager. The Detailed Check is completed as the originator completes the model or document and before the IPR is conducted and before the results go forward to the next task in the project.

#### Formal Internal Peer Reviews

In addition to detail-checking outlined above, all exhibits, plans, reports, specifications, etc., will be formally reviewed before being released from our office. The formal review will be performed by the QA/QC Manager or someone else designated by the QA/QC Manager. All qualified reviewers will be independent from the origination of the activity or document under review and completely removed from the production team for that work product conduct the review.

Over the last five years, our experience has taught us some of the challenges that may arise with project reviewers within FEMA and also producing a quality product while maintaining project schedules. The following have been employed and are continually updated based on the changing needs of CWCB and the Risk MAP program:

- Specific check sheets have been developed for data development, hydrologic and hydraulic modeling, GIS data development and reporting. Each of these sheets will be signed off on by the modeler, the GIS professional, the person completing the QAQC, and the QAQC manager.
- Models and reports will be checked in groups or by types of information rather than on an individual basis for uniformity and consistency throughout the plans. The inter-relationship between modeling and model input items will be checked across design elements to ensure the accuracy of the project.

#### **Internal Audits**

The Project QA Manager, Mr. Stephen Noe, assisted by the Project Manager will be responsible for ensuring compliance with the Project QMP and will do so through periodic internal audits scheduled at regular intervals. As indicated on the project organization chart Mr. Noe is independent of the project team. In his role as QA/QC manager, he or his designee reviews procedures, conducts interviews with project staff and make observations and reviews records and results to determine adherence to the process and plan effectiveness.




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Wood uses the BST cost accounting system to provide routine project cost tracking and control. Wood's BST system is Web-based and available to Wood staff. This system is updated daily and provides a wide range of capabilities for producing on-line, real-time reports to track and manage individual as well multi-year, multi-task order programs. The Wood Project Manager sets internal budgets for the different departments and these budgets cannot be increased without approval from the Project Manager. This Wood policy is a tool to control costs when multiple offices are providing services. Subcontractor performance and expenses are updated weekly in the Wood BST system providing, on-line management reports to track and control subcontractor costs.

# Ability to Accommodate Various Workloads

Wood's Chantilly Water Resources Branch uses Microsoft's Power BI to monitor its capacity to perform this work throughout the period of performance. Power BI is a data analytics resource that supports workload leveling, project management, capacity analysis, resourcing, and more. Using an Office 365 solution allows Wood Team members, including subcontractors, to incorporate their staffing and forecasting data into a centralized platform, regardless of their internal accounting and project management software. This improves the tracking data, expedites the identification of staffing needs, and will accelerate our planning to address those needs. Microsoft Project Online, also part of the O365 application suite, is natively integrated with Power BI. This enables additional custom data visualization reports, which can filter data by Project Manager, discipline (H&H Engineering, GIS, Discovery, etc.), Fiscal Funding Year, etc. and also seamlessly integrates with earned value cost and schedule reporting requirements.

Wood will integrate its Earned Value tracking and reporting with MIP baselines, certified Project Managers will manage it closely. Wood has implemented an EVM system in compliance with FEMA requirements to ensure cost and schedule compliance. This system supplements FEMA's MIP EVM system and provides an additional tool to manage, monitor and report cost and schedule performance. Wood's outstanding performance with regards to schedule and budget is reflected in the EVM reporting and performance has been rewarded by our clients with additional contract work.

EVM integrates technical performance requirements, resource planning, with schedules, while taking risk into consideration. The process uses effective internal technical, cost and schedule management control systems for daily better management insight. The data results provide excellent indicators for future performance and trends. Ultimately, EVM allows effective management decisions to minimize the adverse impacts to the project.

In addition, Wood uses Microsoft Project and our corporate financial accounting software, BST®, as primary performance managers of schedule and costs. Costs, resources, and schedule are balanced across the Wood Team using these tools. These web-based tools provide daily updates for the PM and Study Team Leaders. Resultant reports mimic the MIP workflow and facilitate clear communications to the MIP.

# 3.2.2 Technical Approach

As referenced within Section 2.0 of this proposal, Wood provides extensive technical expertise in all requested service areas identified within the WVEM's *Flood Hazard Analysis, Mapping and Associated Services EOI*. This experience, both nationwide and within the state of WV, is supported by Wood's agile technical approach which constantly adapts alongside evolving technology. Our continuous process improvement and automated technology programs support the development of cost-effective "added value" products of exceptional quality. Wood's cost-effective technology has been successfully implemented throughout our support of the WV AFH initiative and has now also translated to the execution comprehensive Risk MAP projects.

# **Risk Identification and Communication**

Wood partnered with WVEM, WVGISTC and FEMA Region III to develop the AFH program throughout the State of West Virginia more than a decade ago. The AFH program emphasizes speed to market of modern, topographicallyaligned flood hazard data that is readily accessible, defensible, and digestible – made possible by the state-of-the-art outreach platform – the WV Flood Tool (www.mapwv.gov/flood). At the inception of the program, the State of West Virginia had thousands of miles of unmodeled Zone A Special Flood Hazard Areas mapped – complicating decisionmaking throughout the floodplain community. Updating the regulatory SFHA through the issuance of a community adopted FIRM update is costly and time-consuming. The core of the AFH program is widespread risk identification and enhanced communication of those risks through the flood tool. This solution was unique to the State of West





Virginia and its stakeholders and has been a standard bearer for similar programs nationally. Wood is proud to have played a role in this custom solution for the WV CTP.



In addition to providing thousands of miles of new riverine modeling, floodplain mapping and depth and water surface elevation grids, Wood provides support to the WVGISTC as they continue to add functionality and maintain the WV Flood Tool. Wood has developed and delivered seamless depth and water-surface elevation grid data for all newly developed flood hazards to be hosted on the site. Stakeholders now have 'advisory' flood

depths and elevations available at the click of a button, which provides community officials and stakeholders with information needed to make more informed floodplain management decisions.

The web application tool aligns with the Risk MAP communication and outreach vision. The availability of widespread depth/elevation data appeals to community officials, developers, and engineers, but also the planning community. The depth and elevation grid data can also easily be integrated into Hazus. Wood continues to work with WVU to develop enhancements to the site, aimed at efficiently disseminating data to those that rely on it, while also creating a user-friendly interface for those investigating their risk for the first time.

Wood provides similar services to Maryland Department of the Environment (MDE) – another State-level Region III CTP. A primary and critical objective of the MDE CTP program has been the communication of risk and dissemination of data to various stakeholders (surveyors, floodplain administrators, homeowners, etc.). We continue to work closely with MDE partner, Maryland Environmental Service (MES), on their outreach website, www.mdfloodmaps.com. In addition to providing input on site content and ease of use, MES and Wood built a technical workshop aimed at the broader floodplain community that stands to benefit from the availability and flexibility of the data supporting flood hazard determinations. The technical workshop was executed twice and recorded for those that were unable to attend. In addition, detailed class notes were prepared and are available to anybody interested in learning how to access and download and manipulate HEC-RAS models and their GIS building blocks. Example exercises include a bridge replacement project and a freeboard mapping project.

### **Innovative Project Highlight**

Wood successfully leveraged Risk MAP era hydraulic models (1 Dimensional, Steady Flow HEC-RAS models) in combination with the National Oceanic and the Atmospheric Administration (NOAA) National Water Model (NWM) streamflow forecast data to produce predictive flood inundation mapping. Ideally this flood forecasting pilot will improve emergency preparedness and response time for significant flooding events and be scalable beyond the pilot watershed. Pairing the forecast with detailed hydraulic models that are based on LiDAR data and include impoundments (bridges/culverts) allows for more targeted and accurate inundation forecasting.



Linking NOAA's National Water Model Forecasts to Risk MAP Models and Inundation Mapping

"The MD Flood Forecasting Tool is a great example of the applications that can be developed around the forecasts of the National Water Model." *Kevin Sampson, NOAA National Water Model Lead Developer* 



While FEMA's Risk MAP program transitions to Future of Flood Risk Data (FFRD) the focus will shift from binary to graduated risk analysis to increase understanding of risk and subsequent individual and community decisions. Widespread probabilistic analyses, including pluvial flood risks, can help drive action towards insuring and mitigating risk. FEMA's FFRD will help communities build resilience through improved datasets and access. As FEMA looks to roll out Risk Rating 2.0 to residential policy holders in 2021, WVEM can align their flood resilience goals with the evolving national program. Wood, in cooperation with WVEM and WVU can help usher in the next phase of



**Probabilistic Risk Communication** 

the NFIP to West Virginia residents and administrators.

# Field Survey Work

The Wood Team has performed data collection and field reconnaissance in support of FEMA flood studies throughout Region III. Survey teams use state-of-the-art Global Positioning System technology for all land survey efforts. They are trained in FEMA's DCS and are provided with data dictionaries to assist in this compliance. Detailed survey data will be collected in compliance with FEMA's Guidelines and Standards for Flood Risk Analysis and Mapping. The Team has extensive experience in the standard tasks associated with FEMA studies including: recovering National Geodetic Survey monumentation, project control network planning and development, aerial photo control establishment, field survey data collection, setting elevation reference marks (ERMs), photographing surveyed cross-sections and



Bathymetric survey collection by HSE

**Topographic Data Development** 

ation reference marks (ERMs), photographing surveyed cross-sections and structures, processing raw data files, producing point files in the proper coordinate system and datum, generating metadata, drawing ERM recovery cards and delivery of the entire package in digital format.

Wood teaming partner HSE has provided hydrographic surveys for over 600 stream miles across 11 states in support of FEMA's Map Modernization and Risk MAP programs, including supporting survey collection in West Virginia. In 2019, HSE provided geodetic control and hydrographic surveys for Wood in Summers, Monroe, and Pendleton Counties – supporting detailed Zone AE flood study development for 84 miles of reach length containing 127 hydraulic structures. Harned has supported study production in the state of West Virginia with field survey since 2003.

During the initial data collection for FIRM projects, the Wood Team places a large emphasis on obtaining the best available topographic data. Wood Team members review topographic datasets for acceptability according to FEMA's Guidelines and Standards and National Map Accuracy Standards. To assure that the most detailed topographic data is used in support of flood studies, often multiple topographic datasets in various formats need to be merged. Wood Team members will process datasets to compile a seamless coverage that represents the best topographic data for use in flood studies. QA and QC are extremely important to ensure that only verified data is used. The Wood Team has a significant investment in software designed to model and visualize digital terrain data to detect and flag errors for correction, such as data gaps, noise points, and other anomalies. Additionally, Wood's in-house geospatial technologies team is comprised of mapping professionals who possess a wide range of technical and managerial experience gained from many years of previous engagement with leading private sector mapping firms and government agencies.

Wood has been closely engaged with the WV statewide LiDAR topographic data collection project funded by FEMA Region III and being executed by the USGS. Wood was the first to utilize WV USGS LiDAR data delivered under this





program to support WV AFH development and comprehensive Risk MAP projects. Wood has also worked closely with WVEM and FEMA Region III on the reprioritization of Risk MAP studies based on LiDAR delivery schedule changes. These priority modifications have been critical to develop synergies between WV AFH development and Risk MAP projects, maximizing the return on FEMA's investment.

## Hello Mr. Xing,

Thank you for contacting USGS regarding the elevation error in the recently delivered Howard County QL2 Lidar data. Process error was discovered thanks to your inspection of the data, and the contractor is undertaking correction steps now.

USGS National Map Liaison

February 21, 2020 email from USGS after Chantilly's Yukun Xing, PhD reviewed a new LiDAR submittal funded by Region III and slated to be used for Risk MAP production

# **Base Map Data Capture**

Wood routinely acquires preliminary base map information as well as the best available digital orthophotos for a given County. With datasets constantly being updated, it can be challenging to identify the appropriate input sets to begin with. Wood works closely with State, Federal, and Community officials, as well as WVGISTC, to perform due diligence with respect to identifying and securing the best available data for the scope of work. Wood has performed similar tasks for 32 West Virginia AFH Counties, numerous WV countywide Map Modernization and Risk MAP projects, and more than 150 counties throughout Region III.

# Hydrologic and Hydraulic Modeling

# Hydrology

The discharge rates for specified hydrologic frequencies are determined using either one of the following general methodologies: statistical gage analysis on gaged streams, regionalized flood flow frequency analyses on ungaged streams, or detailed rainfall-runoff modeling. When historical or calibration data exists, Wood seeks to calibrate rainfall-runoff modeling to actual flooding events using one of a variety of methods which is most appropriate for the watershed and existing historical data.

In addition to commonly used software, HEC-1, HEC-HMS and SWMM, the Wood Team is experienced in many FEMAapproved hydrologic models, including TR-55, TR-20, HSPF, SWMM, XP-SWMM, PC-SWMM, XPstorm, Mike 11, PondPack, GSSHA, PRMS, StormCAD, FLO-2D, River FLO-2D, and FLDWAV.

Our team has a proven track record of success in using the above-mentioned hydrologic methodologies for both the creation of new hydrologic studies and the validation of existing FEMA studies. Our staff has produced more than 100 FEMA and State approved hydrologic studies in support of flood hazard mapping. Selecting the appropriate hydrologic method dependent on several factors and often needs to be customized accordingly. Our team frequently collaborates with municipal, state and federal stakeholders to recommend and implement methodologies consistent with risk identification goals, accessible funding, and available data.

# **Hydraulics**

The selection of a hydraulic model is also dependent on several criteria. While the majority of riverine studies performed in FEMA Region III are one-dimensional, steady flow HEC-RAS models, team staff are also well-versed in performing unsteady flow hydraulic analyses using a variety of computer models, including HEC-RAS (unsteady component), UNET, River FLO-2D, MIKE URBAN, WSPRO, QUICK-2, HY8, SWMM, FESWMS-2DH, RMA2 and XP-SWMM. Wood, in cooperation with State CTPs and FEMA regions, regularly identify reaches in need of a more sophisticated analysis and proceed accordingly.

The Wood Team uses automated hydrologic and hydraulic applications in all FEMA floodplain development projects. Wood recognizes value and efficiency that GIS-based modeling techniques have added and has fully integrated these tools into the floodplain modeling and mapping process. Wood uses the most recent versions of ESRI's automated H&H extensions to assist in GIS-based modeling development and floodplain mapping.

Because most riverine flood hazard analyses are conducted in HEC-RAS, Wood developed an array of in-house tools to automate common HEC-RAS model development tasks. Wood's Automated Floodplain Generator (AFG) and Stream Modeling and Automated Risk Tool (SMART) suite of tools automate many common hydrologic, hydraulic, and GIS





functions, allowing modelers to focus on engineering and analytical decision-making. An ecosystem of custom code helps Wood develop flood models, produce GIS outputs, and perform QA checks. Programming is an integral part of Wood's water resources branch culture; Wood's water resources engineers and GIS analysts write their own scripts to execute common tasks and produce replicable outputs, and Wood software engineers provide guidance and lead development of core programs. A small sample of Wood's custom toolset is listed below.

			_
Wood	Produc	ction "	Tools

٠	Automated Floodplain Generator (AFG)	٠	Flow Generator
٠	Stream Modeling and Automated Risk Tool (SMART)	•	Data Collection Dictionaries
٠	Floodplain Mapper	•	Curve Number Generator
٠	Floodway Optimizer	•	DFIRM Panel Generator
٠	HEC Utils	•	Floodway Data Table Developer
٠	FIS Profile Generator	•	HEC-RAS Runner
•	FIRM Auto-Annotation Tool	•	HEC-RAS Output Exporter
•	DFIRM Creator	•	Time of Concentration Calculator

Wood is also conducting advanced pilot projects to 1) run HEC-RAS models in the cloud using batch processing services and 2) create probabilistic flood risk analyses with HEC-RAS models. By leveraging compute job platforms such as Azure Batch, groups of HEC-RAS models can be queued to run on a dynamically sized pool of high-performance virtual machines. This processing paradigm provides rapid scalability for computationally demanding 2D



2D flooding and particle tracking super-imposed on effective 1D 1% annual chance floodplain (in red) in Loudoun County, VA

HEC-RAS modeling projects. It also enables probabilistic modeling projects, which can require many hundreds or thousands of randomized model runs. Engineers at Wood strongly believe in the value of probabilistic analysis and are actively writing code to automate probabilistic flood risk modeling with both 1D and 2D HEC-RAS models.

Wood's knowledge of open channel hydraulic modeling as it pertains to FEMA related flood studies has enabled the production of FEMA compliant hydraulic models that require little to no adjustment from FEMA reviewers. This is demonstrated by the large number of hydraulic studies that Wood has had approved by FEMA and CTPs in numerous states.

Wood proposes the use of 2D HEC-RAS for modeling complicated riverine areas and complex urban environments. As 2D modeling has become more prevalent, many of our competitors have simply accepted that while HEC-RAS 2D modeling is much more accurate than 1D modeling, there are certain

limitations to the modeling that limit their ability to have a perfectly calibrated model. While there is no such thing as a perfect flood plain model, at Wood we have refused to accept these limitations and have developed innovative solutions to push the envelope. Examples of these innovations include producing hydro-enforced Digital Elevation Models that attempt to simulate culvert capacity in the upper reaches of the watershed, and helping to make flow rates, response times, and water surface elevations upstream of county roads as accurate as possible. Another example of this is determining how to apply appropriate aerial reductions to point rainfalls for simulated rainfall events in the lower reaches of the watershed, while not inappropriately applying these reductions to the peak flow hydrograph in the upper reaches.

While we are proud of our 2D modeling innovations to create the most accurate watershed model possible, we pride ourselves even more in anticipating our client's future needs and understanding their potential future uses of the models, therefore building the model in a way that allows for the easiest and most seamless use of the model in the





future. When developing existing conditions models, we put 2D area location breaks at locations for potential mitigation projects such as dams, channel improvement sections, or other flood reduction mitigation activities. Our goal is to create a highly accurate existing conditions model, that allow for the easiest and most seamless integration of mitigation alternatives moving forward.

# Floodplain Mapping and Preliminary Map Production

Wood's GIS specialists can efficiently render and conflate riverine model outputs into FEMA-compliant floodplain boundaries, water-depth grids, and associated information. Together, Wood's proprietary toolset and experienced GIS professionals not only ensure that floodplain data is substantiated against topographic and other source data inputs (using a series of automated and manual checks), but also that areas of special concern or engineering complexity are brought to attention for further deliberation with respect to the impacts on communities and residents. This judiciousness and high-level of care in floodplain mapping have substantially minimized protests and appeals during the post-preliminary period and bolstered end-user confidence in the Map Modernization and Risk MAP products which Wood has produced.

Wood also continually reinforces the database and supporting project files with fully detailed, clearly defined metadata that conforms to the Federal Geographic Data Committee (FGDC) Content Standard for Digital Geospatial Metadata (CSDGM).

Wood has extensive experience producing FIRMs and Flood Insurance Study (FIS) Reports through FEMA and State CTP contracts. To date, Wood has been contracted to produce over 10,000 DFIRM panels and over 300 Countywide Flood Insurance Study reports. As a result, Wood has a significant track record of success and extensive experience in all facets of the FEMA Risk MAP production process. Our staff interacts frequently with FEMA Region III regarding project status, issues with the MIP, and technical issues. This has allowed us to develop working relationships with Region staff as well as their contractors.

Wood produces digital mapping products and data such as stream centerlines, cross-sections, BFEs, and floodplains with custom Wood mapping tools that were developed specifically for FEMA/FIRM production. These tools automate various components of the production process, such as automated generation of Floodway Data Tables and profiles. This minimizes errors and ensure quality and consistency of the maps and data produced.

New in January 2021, FEMA deployed an "Automated Map Production" (AMP) tool that is integrated into the MIP workflow and will cease all offline production of Flood Insurance Rate Maps (FIRM) panels for projects funded in Fiscal Year 2020 or later (with opt-in for any earlier projects). It is anticipated that AMP will achieve a cost-savings in FIRM panel production, although initial testing suggests the automated process produces some overprinting and other results that would be disallowed by manually refined map production. Nevertheless, Wood's expertise in navigating clean project submittals through the MIP workflow enables efficient processing and product development.

# **Post Preliminary FIRM Processing**

From serving different regions and state clients for over 20 years, Wood is very experienced in FIRM production workflows, resulting in a detailed hands-on understanding of every technical process in the FIRM Database phase of production. We are also experienced at researching the various data sources of FIRM files, from local municipalities to the latest nationwide datasets, to attain the best data for the study while adhering to relevant data standards.

Wood has successfully processed hundreds of FIRM projects through FEMA's independent FIRM review contractor, and previously worked with FEMA's national mapping contractors to improve the efficiency of these processes. Wood now closely communicates with FEMA's national Production and Technical Services (PTS) contractors to ensure efficient FIRM acceptance. In addition, Wood has provided training to FEMA's mapping partners in FIRM production processes and FIRM database creation.

# **Preparation of Public Notices and BFE Notices**

Navigating the post-preliminary process effectively requires a full understanding of the due process regulations and FEMA procedures. Wood adheres to FEMA's standard post-preliminary process schedule in accomplishing these activities but has also used an expedited adoption process where feasible. We understand that post-preliminary processing is a very important phase of the FIRM process. Finalizing the FIRM and FIS report after preliminary copies have been issued to community officials for review and comment are key steps leading to the map adoption by the





communities. Wood also engages in regular communication with local stakeholders to keep them abreast of project developments and to give them advance notice of what is coming next.

Wood staff routinely performs the following tasks in our FEMA floodplain mapping projects:

- **Publishing a proposed BFE determination notice (Proposed Rule) in the Federal Register:** We understand the legal ramifications of not properly publishing a Proposed Rule in a timely manner and our experience in preparing the proper notice will assist in meeting the requirements.
- Notifying the communities and sending a proposed BFE determination letter: Communities are contacted by telephone to confirm that the CEO information is accurate and updated in the Community Information System (CIS), since this has historically been difficult for smaller communities. Letters are sent via certified mail to ensure delivery.
- Publishing the proposed BFE determinations twice in a prominent local newspaper during the 10day period immediately following notification of the community CEO: We encourage use of a FEMA tool that enables BFE notices to be placed on the internet. This tool is a cost-effective measure as opposed to incurring excessive costs for lengthy newspaper publications. This approach has already resulted in significant cost savings on current projects in FEMA Region III.

# **Non-Regulatory Product Development**

Wood has successfully delivered Changes Since Last FIRM data, flood depth grids, flood risk analysis grids, enhanced flood risk assessment data and the Areas of Mitigation Interest dataset within the States of Colorado, Alabama, Florida, Kentucky, Kansas, Missouri, Delaware, Maryland and North Carolina. Wood has extensive knowledge of the preparation requirements associated with the flood risk datasets and corresponding Flood Risk Report / Map. Additionally, Wood has developed guidance and automated tools for CTPs to standardize their non-regulatory product development. Wood has been providing non-regulatory supplemental datasets as part of the AFH program for more than a decade – in advance of the requirement to do so. All AFH floodplains are derivatives of water-surface elevation grid and depth grid generation. The floodplain polygons displayed on the WV Flood Tool and the underlying grid information that can be queried via 'point-and-click', complement one another. Wood recognized that these datasets would provide valuable detail to multiple stakeholders and delivered them through the AFH program, several years before their delivery became standardized.

### **Changes Since Last FIRM**

The Changes Since Last FIRM (CSLF) non-regulatory product is produced as a complementary product to the revised FIRM and is intended to capture changes in the mapped floodplain and floodway boundaries as well as changes in flood zone designations. The Wood Team has extensive knowledge of the attributes required within the CSLF dataset as well as the optimum production schedule for capturing the required contributing engineering factors to ensure that the highest quality product is produced. This product makes it easy for communities and homeowners to identify the impacts of the new maps on the regulatory floodplain and can assist communities in prioritizing mitigation actions. FEMA Region III has deployed a CSLF Viewer to support future mapping projects that largely automates this product and makes it available as a streaming service. FEMA's viewer was used for recent Flood Risk Review Meetings in Greenbrier, Kanawha, Nicholas, Summers, Webster and Monroe Counties.

# **Flood Depth and Analysis Grids**

Wood has the experience and capability needed to produce nonregulatory flood risk datasets including flood depth grids and flood risk probability grids. Wood's proprietary modeling software automatically creates a water surface grid for each flooding source



Depth and Analysis Grid Queries





and digitally compares it to the topographic DEM, thus creating a depth grid for the 10%, 4%, 2%, 1% and 0.2% annual chance flood events.

Flood risk probability grids include a percent annual chance of flooding grid and a percent chance of flooding in a 30year period grid. Wood has developed an automated process to create these grids using the five water surface elevation grids as inputs and interpolating the percent annual chance of flooding for each grid cell located within the floodplain. This flood risk dataset has been used by Wood for community outreach and public education to communicate flooding risk to individual property owners within any given year. The percent chance of flooding in a 30-year period grid is developed using the percent annual chance grid as input. This flood risk dataset has also been used by Wood to communicate flooding risk to individual property owners within the timeframe of the typical 30-year mortgage.

## **Flood Risk Assessments**

A high-quality flood risk assessment is the fundamental building block of mitigation planning and mitigation actions. Additionally, the future of Risk MAP hinges on a solid understanding of flood risk and probability. Wood has considerable experience in preparing enhanced flood risk assessment data that follows flood risk product standards (FEMA Technical Reference and Guidance), Hazus 4.2, FEMA's multi-hazard loss estimation software, to support risk assessments in over 100 hazard mitigation plans and FEMA Risk MAP projects.

Wood has valuable experience in obtaining and applying locally supplied user defined facility (UDF) data to update Hazus default data with current actual values. The Wood created depth grids serve as the basis for applying the USACE depth-damage relationship curve to calculate the anticipated financial flooding loss per individual structure for each recurrence interval. An average annualized loss (AAL) can then be determined using the flood losses calculated for each individual storm event. Wood uses the risk assessment data to convey flood risk in dollar value loss to local community leaders. Community leaders can use this data to guide the home buyout process and to shape future development decisions.

# **General FEMA CTP Grant Support Services**

As the incumbent WV CTP Flood Hazard Analysis and Mapping contractor, Wood provides comprehensive FEMA CTP grant support services to WVEM. We recognize that accurate and timely grant management and reporting is critical to demonstrate the progress of the CTP program through quantifiable FEMA metrics. FEMA relies on accurate CTP grant reporting to validate CTP program performance and effectiveness within FEMA Region III and nationally. Under the current CTP contract, Wood has supported WVEM on the following grant management activities and will continue to provide these services:

- CTP Business Plan Updates
- FEMA Quarterly Reporting
- Annual Mapping Activity Statement (MAS) support
- MIP Reporting
- Program Management Plan development
- FEMA Performance Measure compliance

Annual CTP Business Plan updates are critical to assuring compliance with both FEMA Regional and National Program goals as well as communicating the overarching vision of the program. The CTP Business Plan also establishes the foundation for justification of future WV CTP Program funding. Additional grant management requirements are critical to demonstrate the progress and overall success of the CTP program through FEMA. Wood will consistently engage with the WVEM CTP Program Lead to assure compliance with FEMA grant guidelines and requirements.

# Post Disaster Response and Recovery

For every federally declared disaster, FEMA responds to support the State's efforts in immediate Response and longterm Recovery. Wood is well qualified to assist WVEM with floodplain mapping related to rapid disaster response and recovery. Wood provided disaster response modeling and mapping for six different counties following the devastating 2016 floods. These analyses were used as a basis for FEMA FIRM updates to represent updated flood risk and guide future development.





Wood has also provided post-disaster support for FEMA under the Hazard Mitigation Technical Assistance Program (HMTAP) Public Assistance and Technical Assistance Contract (PATAC). Wood has mobilized thirty-fix (35) staff to support sixteen (16) different Federal Disaster Declarations including several floods, severe storms, and Hurricanes Sandy, Harvey, Irma, Maria, and Lane. Services provided include:

- Project Management
- Data and Grant Management
- Levee Assessment
- Residential Damage Assessments
- FEMA Elevation Certificates
- Customer Service
- FEMA Hazard Mitigation Assistance Grant Applications
- Stormwater Infrastructure Damage Assessments
- Cost Estimating
- Construction Management
- Project Design

# Hazard Mitigation Planning

Since 2003, Wood has established an unparalleled nationwide Hazard Mitigation and Emergency Management (HM&EM) program including developing more than 200 Disaster Mitigation Act of 2000 (DMA) compliant mitigation plans in seven FEMA Regions including FEMA Region III. The scope of these mitigation plans range in size and complexity from single jurisdictional plans for small rural counties, to disaster resistant university plans for the University of Colorado, University of Tennessee and the Citadel, to an 11-county multi-jurisdictional plan covering 21,600 square miles with 176 participating local governments in the Northeast Colorado Region. Wood had also developed several state hazard mitigation plans across the country including the last two iterations for the State of Missouri. As one of the premier hazard mitigation planning consultants in the nation, the HM&EM program is built upon the expertise of management and staff that have extensive direct experience with FEMA and state and local emergency management agencies, planners, and local elected officials.

Our comprehensive mitigation planning experience includes helping multiple states and more than 2,000 local governments with their mitigation planning. Wood also has experience in developing and teaching FEMA's hazard mitigation planning courses, conducting detailed risk assessments, coordinating multi-jurisdictional, multi-disciplinary planning teams and stakeholders, aiding local communities in disaster response and recovery efforts. Wood's Hazard Mitigation and Emergency Management Program Team is based in three mitigation centers; Boulder, Colorado, Nashville, Tennessee and Raleigh, North Carolina and includes experienced staff with a proven ability to mobilize quickly to meet a myriad of hazard mitigation, resiliency planning and emergency management planning efforts.

Wood has been chosen by FEMA to lead Sector A (Western US) for the Hazard Mitigation and Technical Assistance (HMTAP) contract and was selected as subcontractor to CDM in Sector B (Eastern US) which includes West Virginia. Wood also has a current contract with the State of New Mexico to provide hazard mitigation technical assistance.

Wood is also a leader in developing CRS, FMA and DMA compliant flood mitigation planning projects and helping communities achieve higher CRS classifications. Communities call on Wood because of our direct experience working 18 years for the CRS Program and our continued involvement as a consultant to FEMA and ISO for the past 12 years helping to develop the 2013, 2017 and 2021 CRS Coordinator's Manuals. Wood is highly effective in helping communities achieve maximum credit for their flood mitigation plans, carefully following an integrated planning process that meets or exceeds multiple planning requirements, such as DMA, Flood Mitigation Assistance (FMA), and the National Flood Insurance Program (NFIP) Community Rating System (CRS) with one plan. Wood's proven planning process makes communities eligible for pre- and post-disaster FEMA hazard mitigation funding while reducing risk from hazards.





# Advisory Flood Height (AFH) Development

The WVEM CTP program is in a period of transition. Most data development over the past decade has been in support of the AFH program. FEMA Region III funded major LiDAR acquisition throughout the State of West Virginia, a project which is still ongoing. The availability of high-quality topographic data has helped to substantiate significant investment in full-scale FIRM production for multiple HUC 8 watersheds throughout the State. Wood is currently in production on 5 Countywide updates in Hardy, Pendleton, Greenbrier, Summers, and Monroe Counties. Despite this shift, there are still 19 Counties expected to benefit from AFH development following the delivery of LiDAR data (expected by the end 2021). As a result, the development of enhanced approximate 1% annual chance floodplain studies to support AFH data for thousands of stream miles in the State of West Virginia remains a primary focus. AFH data is not immediately incorporated into the regulatory FIRMs but is made available to communities to better manage flood risk and floodplain development via the WV Flood Tool (http://www.mapwv.gov/flood/map/). While the revised floodplain boundaries associated with AFH development are anticipated to be incorporated into future FIRMs as best available data, newly developed AFH boundaries will be different than the regulatory boundaries on current effective FIRMs. They serve as a supplemental resource for stakeholders to assess, communicate, and mitigate against the risk

of flooding. The development of AFH data and subsequent outreach website have stretched available funding to model as many unstudied flood prone reaches as possible, instead of covering costs associated with traditional FIRM production and map adoption. This vision made the most sense for the State and is an example of innovation at the State CTP level and continues to be supported by FEMA Region III.

AFH data is developed to replace existing Zone A floodplains as delineated on the effective FIRM for a given community or to provide new floodplain information in previous unmapped areas. Unfortunately, the scheduling of County DFIRM updates and the availability of funding for developing AFH data is not always aligned. WVEM, FEMA Region III, and several County partners have invested in AFH data development despite this disconnect, partially because of the existing platform for data dissemination, the WV Flood Tool. The Tool hosts regulatory information (effective DFIRM) and AFH data concurrently, allowing floodplain administrators



Example of AFH Data overlaid with Effective DFIRM

to make informed decisions while administering local flood ordinances. See Figure below—Example of AFH Data overlaid with Effective DFIRM below for an example of this scenario. The AFH data is displayed as a blue gradated depth grid and the regulatory approximate Zone A is hatched in red.

AFH data is developed to provide stakeholders (developers, surveyors, homeowners, floodplain managers, planners, engineers, etc.) with readily accessible flood elevations and depths in areas where that data is not currently available – typically in regulatory Zone A areas. The methodologies employed to develop AFH data are based on the best available terrain data and FEMA-approved hydrologic and hydraulic models. The approach does not support FEMA BFE placement on FIRMs but serves as best available data in Zone A areas. Wood has developed a proprietary, automated hydrologic and hydraulic modeling tool which enables the cost-effective development of AFH data. This FEMA Region III endorsed tool, AFG, has been successfully used in the development of AFH information in 32 West Virginia counties as well as more than 15,000 miles throughout the Region.





# **CFM Program Continuing Education Training**

The state training initiative is supported by legislation initiated by the WV State NFIP coordinator requiring that floodplain managers complete 6 training hours on floodplain management related topics annually. This legislation was introduced in 2012 and supports continual knowledge improvement of local floodplain management staff. This requirement facilitates additional opportunities for training and outreach activities on a variety of floodplain management topics, with a goal of improving local floodplain management practices. Additional details on the legislation are provided as follows:

# §15-5-20a. Floodplain manager training.

(a) Community participation in the National Flood Insurance Program is important to manage and mitigate the special flood hazard areas in West Virginia. Therefore, all state, county, municipality and local floodplain managers should be adequately trained in floodplain management.

(b) Commencing July 1, 2012, each floodplain manager in the state is required to complete six hours of training in floodplain management annually to maintain good standing with the West Virginia Division of Homeland Security.

(c) A governmental unit that has a floodplain manager who fails to obtain the required training shall suspend the floodplain manager from his or her floodplain management responsibilities until the training requirement is met.

(d) A governmental unit that has a floodplain manager who fails to obtain the required training shall transfer its floodplain management responsibilities and all associated fees to a governmental unit that has a floodplain manager in good standing.



Continuing Education Training conducted by Wood

Wood has conducted several webinars to contribute to the Continuing Education Training program. Key staff members Tucker Clevenger and Matt Breen have each led training sessions largely focusing on AFH hydrologic and hydraulic background, best practices, and limitations.

# **Community Outreach Support**

### **Flood Risk Review Meeting**

The Wood Team was one of the first in the nation to host Flood Risk Review and Resilience meetings which are an important part of the Risk MAP Outreach program and critical milestones for effective risk communication. The Flood Risk Review (FRR) meeting provides community officials with a technical overview of the study methodology and draft results, as well as an opportunity to review and provide comments on the proposed mapping changes prior to their distribution to the public in preliminary form. To facilitate this effort, Wood has created online Changes Since Last FIRM viewers (prior to FEMA's expanded hosting) that are customized specifically for each CTP to easily display and communicate mapping changes to community officials. Additionally, for WV Post-Disaster Study FRR meetings (in Greenbrier, Kanawha, Nicholas, Monroe, and Summers Counties), Wood also generated large-format workmaps and worked with FEMA / CERC to develop impact assessment summaries that helped to contextualize the study results with ongoing local recovery issues (such as individual/public disaster assistance, group flood insurance policies, buyouts, and reconstruction). More recently, as FEMA's data hosting has continued to struggle, Wood has worked with WVGISTC on the protocols for hosting Draft Data on the WV Flood Tool as a more reliable option (especially with a number of new countywide draft datasets coming in 2021 that will replace earlier AFH and advisory redelineation efforts).

# **Consultation Coordination Officer Meeting & Public Open House**

Wood has planned and executed over 300 Final Consultation Coordination Officer (CCO) Meetings, a community engagement milestone required by FEMA once revised flood maps have been issued Preliminary. Wood has also organized public Open Houses for citizens affected by changes to the FEMA flood maps. These meetings serve as an opportunity to initiate flood risk discussions within the community and build flood risk awareness at the local level. As





discussed elsewhere in this in proposal, Wood's winning formula for presentations and outreach style aid the CTPs in turning these milestone and important pieces of the Risk MAP program into positive events.

# **Attendance and Presentation at Community Meetings**

The Wood Team not only specializes in the development of new flood hazard information, but also helps FEMA and CTPs in communicating the results of the new Flood Insurance Studies to municipalities and citizens. Wood realizes that municipal and public involvement in the flood mapping update process is critical to facilitate the efficient adoption of the new FIRMs. As a result, Wood has played an integral role in supporting FEMA in the presentation of new flooding information to communities and citizens throughout Region III.

FEMA has tasked Wood with various roles to facilitate stakeholder consensus on mapping results. Among others, Wood has presented results of complex detailed hydrologic and hydraulic studies at Town Council meetings, provided informational sessions on Wood's automated floodplain mapping procedures to community officials, facilitated the collection of applicable floodplain mapping data, and provided insight and direction on FIRM development. The Wood Team's Water Resources Engineers and GIS Analysts regularly work with municipalities to educate community officials on the FIRM mapping process and to collect and utilize the best available information. This integrated approach has cultivated relationships with community officials that assist in expediting the map acceptance process for FEMA.



# 4.0 Resumes





# Tucker Clevenger, PE, CFM

Principal-in-Charge/Client Manager

# **Years of Experience** 22 (18 with Wood)

### Education

• BS/1998/ Civil Engineering – Penn State University

# **Professional Registrations**

- Professional Engineer: VA, MD
- Certified Floodplain Manager
- Wood Certified Principal Project Manager

# **Professional Associations**

- Association of State Floodplain Managers
- West Virginia Floodplain Managers Association
- Virginia Floodplain Managers Association
- Maryland Association of Floodplain Managers

# **Professional Summary**

Mr. Clevenger has more than 22 years of experience in the water resources engineering field with a concentration in hydrology, hydraulics, flood hazard identification, stormwater management and mitigation design. Mr. Clevenger currently serves as Wood's Northern Virginia, Maryland and the District of Columbia Operations Manager overseeing more than 100 water resources, environmental, Program/Construction Management and Asset Management professionals. Wood's Chantilly, VA Office is home to more than 80 staff. He has supported FEMA Region III Map Modernization and Risk MAP programs for more than 20 years through both FEMA regional contracts as well as state CTP programs. Formerly the Wood Water Resources Branch Manager, Mr. Clevenger's experience includes hydrologic and hydraulic modeling, floodplain studies, DFIRM development, risk-based analyses, watershed planning, stormwater permitting and compliance, stormwater design, and stream restoration.

# **Project Experience**

# West Virginia CTP Floodplain Mapping Program

**Program/Client Manager** responsible for the statewide development of updated enhanced approximate flood hazard analyses, post-disaster flood hazard restudies, DFIRM updates, and countywide Risk MAP studies. West Virginia's Advisory Flood Height (AFH) program has included updated flood hazard modeling and mapping for more than 7,000 stream miles covering 32 WV counties. Delivered postdisaster flood map updates for six counties following the devastating 2016 floods and are currently performing watershed-based Risk MAP projects across five different counties. All updated flood risk information, including water-surface elevation and depth grid data and hydraulic modeling is hosted on the West Virginia Flood Hazard Determination Tool (website and mobile application) and utilized to support resilient floodplain management and permitting decisions. Wood has supported the West Virginia GIS Tech Center (WVGISTC) for over a decade on the development and enhancement of the West Virginia Flood Hazard Determination Tool and have supported the development of specifications for data delivery for hosting on the website.

# Maryland CTP Statewide Flood Hazard Mapping Program, MD

**Program/Client Manager** supporting the MD floodplain modeling and mapping initiative, which resulted in the establishment of statewide GIS-based, model-backed floodplain and FIRM coverage for more than 5,300 stream miles and 1,800 panels across 140 communities. Facilitated the development of the web/mobile-enabled Flood Risk Application, enabling immediate stakeholder access to detailed flood risk information and supporting Risk MAP datasets used for comprehensive flood risk communication and future updates. Developed flood depth and elevation grids to support MDE and FEMA Region III Risk MAP efforts throughout the state to support flood risk communication through the Maryland Flood Risk Application website. Performed the Maryland State Hazard Mitigation Plan update, including the development of an enhanced, structure specific, Hazus risk analysis.

# DNREC Flood, Coastal Hazard Analysis and Floodplain Map Production CTP Contract

**Program/Client Manager** for Wood's previous Risk MAP flood hazard analysis and floodplain mapping CTP contracts for the state of Delaware. Our team has supported DNREC and FEMA Region III by providing Risk MAP scoping and discovery services throughout the entire state. We were also the first contractor to develop FEMA Risk MAP coastal non-regulatory products to support DNREC. Currently, we are preforming a Risk MAP project for the Brandywine-Christina Watershed which includes hydraulic updates for 100 stream miles, FIRM production and the development of non-regulatory products.

# FEMA Region III Flood Hazard Mapping IDIQ Contract, Statewide VA, WV, MD, DE, PA

**Program and Client Manager** for hydrologic and hydraulic restudies and DFIRM production in more than 130 different counties throughout FEMA Region III. These county-wide floodplain restudies include revised floodplain development for more than 15,000 stream miles and DFIRM development for over 5,000 panels. Performed independent hydrologic and hydraulic and DFIRM submittal quality reviews for multiple FEMA mapping partners. Currently, supporting FEMA's Risk MAP program to support the identification, communication, and mitigation of flood risk throughout FEMA Region III. Wood was the first to produce Risk MAP non-regulatory products in FEMA Region III.

# Matthew Breen, PE, CFM



# Program Manager

Years of Experience 20 (15 with Wood)

### **Education**

 BS/2000/Civil Engineering – Virginia Tech

#### **Professional Registrations**

- Professional Engineer: VA, MD
- Certified Floodplain Manager
- Wood Certified Principal Project Manager

#### **Professional Associations**

- Association of State Floodplain Managers
- West Virginia Floodplain Managers Association
- Virginia Floodplain Managers Association
- Maryland Association of Floodplain Managers

# **Professional Summary**

Mr. Breen has over 20 years of experience in the water resources engineering field. He is currently serving as the Water Resources Service Line Manager in Wood's Chantilly office. The service line consists of a Stormwater Planning group, a Civil Design group, a Hydrology/Hydraulics group, and a Water Technology group. In total there are 40 engineers, GIS analysts and planners in the branch supporting dozens of municipalities with MS4 Program Planning, Chesapeake Bay TMDL Compliance, Stormwater Utility feasibility assessments and implementation, Stormwater design, Stream Restoration design, Floodplain modeling and mapping and Flood Control and Mitigation design. Mr. Breen has also focused on NFIP program implementation, including Map Modernization and Risk MAP, predominantly focused in FEMA Region III. As the lead CTP provider for FEMA Region III, Mr. Breen and the Chantilly Water Resources Service Line currently help State CTPs in West Virginia, Maryland and Delaware with Risk MAP delivery – including program funding, discovery, data development preliminary processing and post-preliminary processing.

NOO

# **Project Experience**

# West Virginia CTP AFH Program

**Project Manager** for the development of updated enhanced approximate flood hazard analyses in 32 West Virginia counties covering more than 7,000 stream miles. This work was performed as part of disaster recovery initiatives under contract to FEMA Region III as well as through the West Virginia State CTP Floodplain Mapping Program. These updated Advisory Flood Heights (AFHs) are hosted on the West Virginia Flood Hazard Determination Tool and utilized to derive approximate 1% annual chance water-surface elevations to support floodplain management and permitting decisions. AFH water-surface elevation and depth grid data along with hydraulic modeling are delivered to the West Virginia Geographic Information System Tech Center (WVGISTC) to support this initiative. We have also worked together with the WVGISTC for the past decade on the development and enhancement of the West Virginia Flood Hazard Determination Tool and have developed the specifications for data delivery for hosting on the website.

### West Virginia Risk MAP Studies

**Project Manager** for multiple FEMA Risk MAP studies in Greenbrier, Hardy, Pendleton, Summers and Monroe Counties. Wood worked hand-in-glove with WVDEM and RIII on reprioritization and overhaul of Mapping Activity Statements so that new countywide studies could advance in leiu of studies which were originally funded but stalled due to LiDAR delivery delays from the FEMA/USGS contractor. These comprehensive projects include full engineering analyses (survey, hydrology, and hydraulic modeling for 115 detailed study miles and 1,660 approximate study miles) and floodplain mapping, preliminary product development and post-preliminary processing for 166 FIRM panels covering 19 communities.

## West Virginia Physical Map Revisions (PMRs)

Engineering Lead In response to the devastating flooding that occurred in 2016 resulting in disaster declarations across 18 WV counties, Wood was contracted to perform floodplain mapping updates in highly populated areas which were significantly impacted. These flood restudies encompassed over 60 miles of updated detailed flood studies in six different counties including the towns of Rainelle, White Sulphur Springs, Alderson, Richwood, among many others. USGS provided an analysis of the event via Characteristics of Peak Streamflows and Extent of Inundation in Areas of West Virginia and Southwestern Virginia Affected by Flooding, June 2016. This document characterized the events of 2016 and in certain locations updated the 1% Annual Exceedance Probability discharges accordingly. Wood was able to use that information, where available, along with High Water Marks collected by USGS, to calibrate detailed Hydraulic models to the catastrophic event and subsequently update regulatory modeling, mapping and FIRM components. Hydrologic and Hydraulic models were reviewed by the USACE – Baltimore District. For these studies, Wood also worked with FEMA and FEMA's CERC contractor to prepare an enhanced outreach plan which included impact maps for school reconstruction projects as well as detailed 'Impact Assessment' summaries to both quantify the study results (e.g. # of buildings going in/out of the regulatory floodplains, and trends of increasing/decreasing flood flows, elevations, and extents) and contextualize the study in relation to ongoing recovery efforts (e.g. disaster assistance (individual/public) and flood insurance). Letters of Final Determination are now on the near horizon.

## Maryland CTP Statewide Flood Hazard Mapping Program, MD

**Project Manager** for Maryland's statewide flood risk identification and mapping initiative in partnership with MDE, MES and FEMA Region III. Under this program, Wood has completed H&H floodplain restudies for more than 1,100 stream miles throughout the state and has produced over 400 DFIRM panels. Wood has also produced FEMA Risk MAP non-regulatory products in support of both coastal and riverine flood hazards throughout the state. Wood has also supported the development of a web-enabled, flood risk communication tool to enable stakeholders, residents and community officials to access and utilize the most recent flood risk information. Performed the Maryland State Hazard Mitigation Plan update, including the development of an enhanced, structure specific, Hazus risk analysis.

# FEMA Region III Flood Hazard Mapping IDIQ Contract

**Lead Riverine Hydrology/Hydraulics Engineer** for H&H restudies and DFIRM production in more than 130 different counties throughout FEMA Region III. These countywide floodplain restudies include revised floodplain development for more than 15,000 stream miles and DFIRM development for over 5,000 panels. Performed independent hydrologic and hydraulic and DFIRM submittal quality reviews for multiple FEMA mapping partners. Currently, supporting FEMA's Risk MAP program to support the identification, communication, and mitigation of flood risk throughout FEMA Region III. This project included flood study updates and DFIRM development in numerous West Virginia counties.

# Brandywine-Christina/New Castle County Risk MAP Flood Studies

**Project Manager** for completed flood hazard study which includes riverine hydrologic and hydraulic updates for approximately 100 miles of reach length throughout New Castle County, DE. Wood performed field reconnaissance for all limited detailed bridge/culvert collections and performed full survey of cross sections and road crossings for detailed streams. In addition to the updated hydrologic and hydraulic data, Wood was responsible for all map production, outreach and Non-Regulatory product development. Wood continues to work with DNREC on reducing costs by taking advantage of State resources and leverage data, including DelDOTs bridge and culvert inventories. Wood is working with County, State and Federal stakeholders on making sure the scope aligns with different objectives and mandates at the separate levels of government.





# **Stephen Noe**

Quality Assurance/Quality Control (QA/QC) Lead

## Years of Experience

35 (31 with Wood)

### Education

- BS/1984/Agricultural Engineering, University of Kentucky, Agricultural Engineering
- 27 Additional hours of Water Resource Related Courses

## **Professional Registrations**

- Professional Engineer: expired
- Certified Floodplain Manager

## **Professional Associations**

- Association of State Floodplain Managers
- Missouri Floodplain Managers
  Association
- Kansas Floodplain Managers
  Association
- Oklahoma Floodplain Managers Association
- Indiana Floodplain Managers
  Association
- Kentucky Association of Mitigation Managers
- American Society of Civil Engineers

# **Professional Summary**

Mr. Noe has over 35 years of experience on a wide range of water resource and hydraulic design projects that encompass watershed management/ master plans, storm water regulatory compliance, hydraulic/scour analysis, secondary drainage studies/ designs and risks analysis. He has successfully lead cities and states through the NPDES process, Bridge Scour Analysis and Assessment, FEMA Map Modernization/Risk MAP, Hazard Mitigation Plans, Dam Accreditation and Levee Certification processes. Stephen initiated and directed the company's:

• FEMA Risk MAP Program - 17 states 275,000 miles of stream models, and personally over 600 public meetings.

• H & H Analysis Process Improvements – Tools for modeling parameter development, automated QC reports/graphics, analytics results and visual tools for stakeholder communications.

- Active group participant in process of FEMA transition from 1D to 2D within a statutory 1D regulatory program.
- FHWA Bridge Scour Program 14,000 plus bridges
- FEMA Levee Certification Program 30 systems nationally

Mr. Noe has provided Direction and/or Managed these processes in AL, AR, CO, KS, KY, MD, NC, WV and various large cities.

# **Project Experience**

# FEMA Region VII Mitigation Technical Assistance – Resilience on Command (ROC) Program

**Project Manager** for initialization of ROC program in KS and MO. The Program provide opportunities for flood risk alternative analysis with Risk MAP projects to identify, quantify and recommend funding sources for areas of needed flood risk reductions. Implemented for 11 counites across both states including buyouts, channel/structure conveyance improvements, detention and flood protection control systems.

State Emergency Management Agency - Flood Risk Services, Statewide, MO Program Manager for statewide implementation of the Risk MAP program including standard Mapping Activity Statement (MAS) services, Program Management (PM) Services and Communication Outreach Management Services (COMs). All work is being performed in accordance with ever changing FEMA's Guidelines and Specifications for Risk Map Partners. Project tasks include business plan updates, policy development, quality control plans, county scoping, managing other consultant services, Discovery, public meetings, FEMA coordination, data capture standard process development and panel production. Presented at more than 400 meetings for Scoping, Discovery, CNMS, FSR, PDCC and Open Houses across Missouri. As a quick summary, the cradle to grave services of 33 Paper Inventory Reduction counties, 15 data development counties, 8 pre- & post- preliminary counties, 2D modeling training workshops, Risk MAP/Mitigation Action Workshops, Business Plan updates, CNMS updates and 8 technical assistance projects. MO SEMA's program is on schedule to be 90% NVUE



compliant by 2022. As Program Manager for statewide implementation of the Map Modernization and then the Risk MAP program he has:

- Developed rolling **5-year** business plans that has positioned MO to be **100% map maintenance** in 2022 with detailed flood risk defined for all communities with NFIP flood risk.
- Provided leadership and technical guidance to assist MO's transition to **100% 2D** flood risk data development starting in 2016 and realized in 2018.
- Directed the "Front Porch" conversation MO Outreach Web Portal that has received State and FEMA Best Practice Awards.
- Developed presentation templates, mentored others and lead the implementation through execution of over 1000 FEMA public meetings.

# Levee Certification of the Wichita Valley Center Local Flood Control Project

**Project Manager/ Technical Advisor** for the evaluation of approximately 100 miles of levee system to determine compliance with FEMA's Section 65.10 criteria. Project consists of a multidisciplinary evaluation of flood control system including a visual inspection, hydrologic and hydraulic investigation of both riverine and internal drainage areas, geotechnical analysis, and the development of "as-is" plans and updating the O&M Manual. H&H Analyses consist of HEC-RAS steady and unsteady flow modeling, and FLO-2D two-dimensional hydraulic modeling. Website development for the Historical Documentary on the Flood Control Project which included archival data research. Numerous public meetings for this work including coordinating interviews with former Levee Managers and Scoping Meetings, coordinated the inclusion of Existing Leverage data from Levee Certification Package, a USACE study and a PMR with new Hydrology and Hydraulics studies countywide utilizing the newest Guidance and Specifications for FEMA's RiskMAP projects.

# DFIRM & RiskMAP Development for Kansas, FEMA

**Program Director** for the development and management of DFIRM and RiskMAP tasks. Oversaw for various management tasks of DFIRM deliverables, schedule, and the performance of detailed rural and urban riverine hydrologic and hydraulic studies utilizing HEC-HMS, XP-SWMM 1D/2D, HEC-1, HEC-2, PC-SWMM 1D/2D, and HEC-RAS 1D/2D. Project Director and Technical Lead for data collection, validation, hydrology, hydraulics, flood hazard boundary delineation, panel production, database development, and FIS production. Assisted Kansas DWR in developing a process to comply with FEMA Region VII and NSP principles and guidelines using the county and regional data sets of Kansas. Provide technical assistance, review, and management for detailed hydrologic and hydraulic studies.

# NC Dept. of Transportation - I-40/I-95 Flood Resilience Feasibility Study, Statewide, NC

**Technical Director** for the geospatial analyses and mapping efforts associated with NCDOT's Flood Resiliency Feasibility study for Interstates 40 & 95 in North Carolina. This project was a direct response from NCDOT to the extensive flooding that occurred on both interstates during Hurricanes Matthew in 2016 and Florence in 2018 which shut down large sections of both highways for days due to flooding, causing some cities and towns to be completely isolated for days. Wood contracted with NCDOT to conduct a feasibility study to conduct cost estimations and construction improvement recommendations for several sections of both interstates and some surrounding secondary routes. The report required collaboration of both NCDOT and Wood engineers and GIS analysts to produce the final report which will be viewed and considered by NCDOT leadership and likely the NC General Assembly and Governor.

# State of Arkansas, Dept of Emergency Management (ADEM) – Hazard Mitigation Plans

**Program Manager.** Hazard Mitigation State Administrative Plan is to establish organization, policies and procedures to be used by ADEM in administering and managing the Section 404, Hazard Mitigation Grant Program (HMGP).

### North Carolina Risk Map and Support Services, Statewide North Carolina

**Program Manager.** Map Modernization services for river basins throughout the State of North Carolina. He led DFIRM tool modifications to meet NCFMP specific requirements. Riverine and Coastal Analysis tools were enhanced as well as the resultant mapping tools. Hydrologic analysis is performed using ArcHydro in combination with State regression and gage analysis, while the hydraulic analysis is performed using HEC-RAS.

# Troy Biggs, PE, PH, D.WRE

Riverine H&H Modeling Lead

# Years of Experience

19 (15 with Wood)

### Education

- MS/2004/Hydrosystems
  Engineering Virginia Tech
- BS/2000/Civil Engineering Virginia Tech

### **Professional Registrations**

- Professional Engineer (WV, VA, DC)
- Professional Hydrologist-American Institute of Hydrology (AIH)
- Water Resources Diplomate (D.WRE) American Academy of Water Resources Engineers (AAWRE)

# **Trainings/Certifications**

- HEC-RAS 2D Water Modelling Australian Water School
- Rosgen Level I, II, III, & IV
- NC State University Stream Assessment and Natural Channel Design Restoration
- Natural Resource Conservation Service (NRCS) Stream Bank Stabilization and Restoration Workshop
- NC State RC 302 HEC-RAS for Stream Restoration
- NC State RC 401 Construction Practices for Stream Restoration

### **Professional Associations**

 Virginia Lakes and Watersheds Association

# **Professional Summary**

Mr. Biggs is a Senior Water Resources Engineer with 19 years of experience in Stormwater Management design, stream restoration, site grading, roadway design, erosion and sediment control, earthwork quantities, utility design, dam breach analysis, adequate outfall analysis, floodplain analysis and hydraulic/hydrologic watershed analysis. Mr. Biggs has served as both a project manager and design engineer in preparation of construction documents for stormwater management facilities. He also has experience working with county agencies, private developers, and local citizens to aid and ultimately obtain plan approval.

WOO

# **Project Experience**

# West Virginia NRCS Stream Restoration (seven sites in Grant and Hardy Counties)

Lead Design Engineer responsible for initial planning, site visit, trip report, and development of field notes for seven sites. Projects included the development of site survey and base map, Stream Visual Assessment Protocol (SVAP), sediment gradation determination from pebble counts and bar analysis, and preliminary design (geomorphic stream assessment, H&H analysis, preliminary site plan, and construction drawings). Deliverables included preliminary construction specifications, construction quantities, design report, QA plan, operations, inspection and maintenance plan, and internal quality control reviews.

# Selma Estates Floodplain Analysis and Mitigation Alternatives Assessment, Loudoun County, Virginia

**Engineer of Record** for detailed flood study and mitigation alternatives assessment for over a dozen homes that have experienced multiple significant flooding events in the last 5 years. Wood developed a detailed HEC-RAS 2D hydraulic model to better simulate the multidirectional flooding. We also investigated mitigation alternatives, including a berm, a storage pond, upsized culverts, and a buyout plan of the affected properties. Wood also facilitated the collection of LiDAR data, field survey, Lowest Adjacent Grade data collection, and a geophysical survey. Results were delivered in the form of a comprehensive technical report and were presented to the County Board of Supervisors in a meeting and to the affected homeowners. A LOMR submittal to establish more accurate regulatory water surface elevations and allow residents to pay premiums more closely aligned with their risk went effective December 28, 2020.

# Independent Technical Review Maryland Flood Hazard Mapping Program

**Water Resources Engineer** responsible for reviewing 167 different hydraulic models for streams in Wicomico, Howard, Dorchester, and Somerset Counties, MD, for the USACE. Eighty-nine of the 167 models were detailed studies, the remaining 78 were approximate studies. Discharge data was verified, and the CHECK-RAS program was executed on each of the individual streams, and cross section location, discharge location, and floodplain limits were analyzed using the provided GIS data. Created a summary report with comments for general modeling issues and stream specific issues.



# Jason Sevanick Durant, GISP, CFM

Floodplain Mapping FIRM and Data Management Lead

# Years of Experience

18 (17 with Wood)

# Education

• BA/2003/Geography – George Mason University

# **Professional Registrations**

- GISCI Certified GIS Professional (GISP)
- Certified Floodplain Manager
- Wood Certified Project Manager

# **Professional Associations**

- Association of State Floodplain Managers
- Maryland Association of Floodplain Managers (Chairman 2017-2020)

# **Professional Summary**

Mr. Sevanick has 18 years of professional experience using Geographic Information Systems (GIS) in direct support of water resources and infrastructure projects. He leads a team of GIS Specialists who share a focus on quality and bring innovative technical solutions to multi-hazard analysis and mapping, emergency management, environmental monitoring and compliance, and a range of other engineering projects. Between 2017 and 2020, he served two terms as chairman of the Maryland Association of Floodplain and Stormwater Managers (MAFSM), during which time he led its growth from 155 to 227 members and increased outreach activities in less-served corners of the state.

# **Project Experience**

# West Virginia CTP Floodplain Mapping Program

**GIS Project Manager/Technical Lead** for Risk MAP studies (countywide and post-disaster Partial Map Revisions) and supporting the development of Advisory Flood Height (AFH) data for risk communication and informed local floodplain management. Mr. Sevanick directly performs stakeholder coordination, development of flood hazard data from revised engineering analyses, conflation of municipal and state source data into regulatory FEMA products, development of reports and FGDC-compliant metadata, data uploads, retrievals, and monthly reporting via FEMA's Mapping Information Platform, implementation of FEMA Technical References, Procedure Memos, and other program-level changes into the production workflow. Along with legacy support to the West Virginia Geographic Information System Tech Center (WVGISTC), Mr. Sevanick has also recently coordinated with WVGISTC on protocols for hosting Draft Data as a significant number of new countywide restudies are beginning to publish.

# Maryland CTP Statewide Flood Hazard Mapping Program

GIS Project Manager/Technical Lead for the MD floodplain modeling and mapping initiative, with direct and supporting roles in the development of over 1,000 FIRM Panels for over 150 communities. In addition to similar stakeholder coordination, flood data development, and related services for the WV CTP Program, Mr. Sevanick also performed a lead role in Maryland for enhanced countywide flood risk assessments using FEMA's Hazus-MH loss estimation software. These assessments leverage state tax data and local building footprints to create refined inventories which are analyzed in conjunction with flood depth grids (which are developed as part of regulatory map updates). The results provide site-specific loss estimates that are more refined and actionable, in terms of location and dollar values, than census-block level analyses which is commonly performed. Starting with FEMA templates, new data tables and other value-added customizations were introduced for this effort, including "degree of damage" summaries that list out the number of buildings within a community that fall within different expected damage ranges (as a function of 1% annual chance flooding against the building/contents value). The countywide products also include detailed summaries for at-risk critical facilities, general government/stateowned assets, and expected debris and sheltering needs. The initial phase of 10 counties in Maryland was completed in January 2020.

### FEMA Region III Flood Map Modernization and Risk MAP (nationwide)

**GIS Analyst / Project Manager** for over 100 countywide Digital Flood Insurance Rate Maps and flood studies in Maryland, North Carolina, Pennsylvania, Virginia, and West Virginia. Mr. Sevanick has led the development of flood hazard data from revised hydrologic and hydraulic analysis and Letters of Map Change (LOMCs), incorporation of updated orthophotography and planimetrics from local, state, and federal sources, field data collection of bridges/culverts as inputs into hydraulic models, redelineation of coastal floodplains and over 1,800 riverine flood hazards based on updated topography, coordination and processing of Provisionally Accredited Levees (PALs), application of FEMA graphics and database specifications, identification and resolution of special problem areas, and production of Flood Insurance Study (FIS) reports and XML-based metadata.

## New Castle County Risk MAP Flood Study, New Castle, DE

**GIS Project Manager/Technical Lead** for approximately 100 miles of riverine hydrologic and hydraulic study updates, including development of preliminary/effective maps (over 60 map panels), field reconnaissance of additional bridges/culverts using ArcGIS Collector for input into hydraulic models, delivery of FEMA-compliant study submittals to the Mapping Information Platform at respective project stages, identification and resolution of discrepancies within effective/unrevised study locations, enhanced outreach for the public "Open House" (automated generation of customized invitations for over 6,000 affected property owners which included property specific comparisons of effective vs. proposed flood data), efficient resolution of comments and appeals, completion of non-regulatory datasets and Hazus analysis for inclusion in the Brandywine-Christina Watershed Flood Risk Products, and successful delivery of products through independent review to the FEMA Map Service Center.

## FEMA Repetitive Loss Area Analysis, City of Alexandria, VA

**GIS Manager** for the repetitive loss area analysis (RLAA) for the City of Alexandria, VA. Wood was tasked by the City of Alexandria to identify and confirm that status of existing repetitive loss properties from flooding using criteria outlined in FEMA's CRS (Community Rating System) manual and work with the city to develop mitigation measures compliant with FEMA's CRS program. Project responsibilities include spatially identifying repetitive loss areas and properties using community parcel data, FEMA repetitive loss records, and orthophotography; develop maps of repetitive loss areas for field visits and reports, conduct site visits of repetitive loss areas, and deliver all geospatial repetitive loss data in a centralized geodatabase.

# Dam Inundation Mapping for USACE Modeling, Mapping, and Consequence (MMC) Program

**GIS Specialist** supporting the USACE MMC Production Center to create map series to show flooding inundation below dams under various scenarios, and the estimation of economic impacts and at-risk populations. Mr. Sevanick performed QA/QC and aided in development of processes and standards for the MMC map series, requiring data compilation and conversion from various nationwide and local sources.

# Yukun Xing, PhD, CFM

wood.



# Senior GIS Analyst

Years of Experience 14 (14 with Wood)

### Education

- PhD/2006/Earth Sciences and Geo-Information Systems – George Mason University
- MS/2003/Computational Sciences and Informatics – George Mason University
- BS/1998/Electronic Engineering
   Tsinghua University (Beijing)

#### **Professional Registrations**

• Certified Floodplain Manager

### **Professional Associations**

 Association of State Floodplain Managers

# **Professional Summary**

Mr. Xing has 14 years of experience in providing and leading mapping and postprocessing effort for FEMA Map Modernization and Risk Map programs both through FEMA Region III as well as state CTP contracts. Mr. Xing currently serves as the GIS Technical Lead of Woods's Northern Virginia office and his expertise includes GIS data processing and management, mobile data collection solutions, and application development. Being familiar with hydrologic and hydraulic modeling process allowed Mr. Xing to be able to closely coordinate engineering and mapping effort and make projects progress smoothly on the technical level. Mr. Xing has been an early advocate of developing automated tools to streamline workflows, increase efficiency, and improve quality. By continued innovation, he has helped to ensured numerous on time and on budget deliveries to the Federal and state CTP clients.

# **Project Experience**

# West Virginia CTP Floodplain Mapping Program

**GIS Technical Lead** responsible for the development of updated Risk MAP products in several West Virginia counties, as well as the Advisory Flood Hazard products for a dozen more. Acquired topographic information in various format from different sources, processed the source data and converted it into Digital Elevation Models (DEM) for both the hydrologic and hydraulic modeling processes. Conditioned the hydrologic DEM and computed drainage area and flow for the scope flood recurrence intervals. Created flood depth and water surface elevation grids and vector floodplain boundaries from hydraulic models output. Produced flood profiles based on model output, populated Flood Insurance Rate Map (FIRM) databases and created FIRM maps.

# Maryland CTP Statewide Flood Hazard Mapping Program

**Senior GIS Analyst** providing GIS expertise for Maryland's flood risk identification and mapping projects. Under this program, Wood FEMA Risk MAP non-regulatory products in support of both coastal and riverine flooding scenarios throughout the state, in addition to the standard suite of regulatory products. The non-regulatory included spatial layers such as Change Since Last FIRM (CSLF) and flood depth grids, loss analysis and reports. Mr. Xing has been an early practitioner in developing and refining procedures used to create these products. Wood has also supported the development of a web-based flood risk communication tool to enable stakeholders, residents and community officials to access and utilize the most recent flood risk information.

# DNREC Flood, Coastal Hazard Analysis and Floodplain Map Production CTP Contract

**Mobile Solution Engineer** in addition to providing routine GIS support for Risk MAP flood hazard analysis and floodplain mapping. Designed and deployed a Collector and ArcGIS Online based mobile data collection solution to support the stream crossing field data inventory effort of the project. Responsibilities included geodatabase and map design, map and feature service publication, staff training, and data quality review.

# FEMA Region III Flood Hazard Mapping IDIQ Contract, Statewide VA, WV, MD, DE, PA

**GIS analyst** supporting comprehensive Map Mod and Risk MAP services, including developing new and updated flood hazard analyses (both AE and A) and mapping, creating Flood Insurance Study reports and flood profiles, FIRM databases, and FIRM maps, and Post-Preliminary processing in over 20 counties which included more than 4,000 stream miles and more than 500 FIRM map panels.



# Thomas Williams, PE

Water Technology Lead

## **Years of Experience**

11 (7 with Wood)

#### Education

- BS/2009/ Civil & Environmental Engineering – Virginia Tech
- Graduate Certificate/2015/ Water Quality Management – Virginia Tech

### **Professional Registrations**

• Professional Engineer: VA

### **Areas of Expertise**

- Hydrology & Hydraulics
- Software Engineering
- GIS

### **Programming Languages**

- Python
- JavaScript
- Java
- Bash

#### Databases

- Elasticsearch
- MongoDB
- Redis
- PostgreSQL

### **Additional Programming Skills**

- Git
- Vim
- Docker
- Linux
- Azure Pipelines
- Gitlab CI
- Jenkins
- Ansible
- SaltStack
- Azure
- AWS

# Civil Engineering & GIS Software

- ArcGIS
- QGIS
- GDAL
- HEC-RAS
- HEC-HMS
- EPA-SWMM
- FLO-2D

# Professional Summary

With experience in both water resources engineering and software engineering, Mr. Williams brings a unique blend of skills and knowledge to the Wood team. During previous employment at Wood, Mr. Williams specialized in hydrology, hydraulics, GIS, and water resources planning. As a software engineer, he worked on Agile teams using open-source libraries to develop modern web applications for multiple federal clients and served as technical lead for a high-priority financial tracking application. In his current role as Senior Water Resources Engineer & Technology Lead at Wood, he is organizing Wood software development efforts related to flood risk modeling and water resources engineering.

# **Project Experience**

# Water Resources Technology

**Group Lead** After leaving for a career in software engineering in 2015, Mr. Williams returned to Wood in 2019 to lead software development and programming-related efforts in the Chantilly office, especially on projects pertaining to Wood's water resources engineering business. This involves writing new software to help water resources engineers and GIS analysts improve efficiency, bringing legacy internal software up to modern standards, instituting best practices for software development, providing guidance and mentorship for other programmers, and identifying opportunities to use cloud services rather than on-premises infrastructure.

# West Virginia CTP Floodplain Mapping Program

**Water Resources Engineer** Conducted hydrologic and hydraulic riverine flood analyses in multiple West Virginia counties. Used custom Wood software to automate HEC-RAS model setup and GIS analysis. Developed new tools to help GIS analysts automatically generate and quickly edit seamless floodplain depth and water surface elevation grids at county scale. Created Python modules to read/write HEC-RAS ASCII files, perform automated QA/QC tasks on HEC-RAS models, and export HEC-RAS data into GIS formats.

# Maryland CTP Statewide Flood Hazard Mapping Program, MD

**Water Resources Engineer** Provided water resources engineering and GIS services as part of Wood's Flood Risk Mapping contract with the State of Maryland via Maryland Department of the Environment and Maryland Environmental Service. Conducted hydrologic and hydraulic analyses for flood risk studies in multiple counties spanning multiple geologic regions across the state and hundreds of stream miles. Programmed new software to automate common flood risk modeling, GIS analysis, data management, mapping, and quality control tasks. Contributed to the professional growth of the Wood team by providing mentorship, guidance, and technical review for junior engineers.

# DNREC Flood, Coastal Hazard Analysis and Floodplain Map Production CTP Contract

**Water Resources Engineer** In addition to providing flood risk-related water resources engineering and GIS services, Mr. Williams conducted precise GIS-based scoping analyses to identify and rank high-priority areas for new riverine modeling and mapping across in state of Delaware. This detailed prioritization saved money for the Delaware Department of Natural Resources and Environmental Control and became the basis for Wood's follow-on hydrologic and hydraulic analyses in across the state.

## City of Alexandria, Virginia – Flood Risk Modeling Support

**Water Resources Engineer** Analyzed multiple development scenarios in downtown Alexandria, Virginia using a twodimensional FLO-2D hydraulic model. Identified areas of likely 100-year flood water surface elevation and velocity changes increase due to planned developments along a flood-prone corridor downstream of an undersized culvert.

## **TMDL Compliance and Watershed Management Planning**

**Water Resources Engineer** Mr. Williams worked directly with municipal stormwater clients to estimate future stormwater project needs to achieve compliance with the Chesapeake Bay TMDL. He designed and programmed a set of ArcGIS-based tools to help municipalities plan, evaluate, and track stormwater treatment projects for compliance with TMDLs. In addition to developing TMDL compliance tools, he also devised automated GIS-based techniques for mapping complicated storm sewer drainage boundaries and created storm sewer drainage maps for multiple municipal clients.



# Jennifer McGee, PE, CFM, GISP

**Disaster Response Lead** 

# Years of Experience

15 (14 with Wood)

# Education

- Graduate Certificate GIS/2008/University of Colorado
- MS/2005/Civil Engineering West Virginia University
- BS/2003/Civil Engineering West Virginia University

# **Professional Registrations**

- Professional Engineer: TN
- Certified Floodplain Manager
- GIS Professional
- Wood Certified Project
  Manager

## **Professional Associations**

- Association of State Floodplain Managers
- Maryland Association of Floodplain Managers
- Virginia Floodplain Managers Association

# **Professional Summary**

Ms. McGee is a Professional Engineer with over fifteen (15) years of experience. The majority of project work is associated with the FEMA NFIP Program (7 years) and the FEMA Public Assistance Program (5 years). She has an interdisciplinary background that includes GIS, database design and computer programming. Career focus is on optimizing data analysis processes to support water resources and other engineering projects.

# **Project Experience - Technology Solutions**

# City of Chattanooga, National Water Model Flood Forecasting Pilot Study (2020-2021)

**Project Manager & Developer** using the NOAA National Water Model (NWM) streamflow forecast, automated an analysis process with python to acquire and classify all Short Range and Medium Range forecasts for streams in the City of Chattanooga, Tennessee. Then using existing HEC-RAS models the forecasts are represented by the existing flood inundation grids for the respective flow profiles.

# MDE/MES, Maryland Flood Forecasting Pilot Study (2019)

**Project Manager & Developer** using the NOAA National Water Model (NWM) streamflow forecast, automated an analysis process with python to acquire and classify all Short Range and Medium Range forecasts for streams in the Whitemarsh Run Watershed (Baltimore County, Maryland). Then using the FEMA RiskMAP HEC-RAS models the forecasts are represented by the existing flood inundation grids for the respective flow profiles.

# Wood E&I/TCS Office 365 User Group Team/Meetings (2019 – present)

**Coordinator/Trainer** for an internal Microsoft Teams based group that meets monthly to share project examples of how the Offer 365 platform is being used to manage and deliver project across the business. In 2019 we had a Level 101 series (5 sessions) to introduce staff to the platform. Also started in 2019 is the Super Users series for more advanced uses to cross-train. New in 2020 is the Level 201 series focusing on live demos for building business solutions.

# **Project Experience - FEMA Public Assistance (Recovery)**

FEMA/CCPRS, Public Assistance TAC, DR-4332-TX (Harvey), DR-4337-FL (Irma), DR-4339-PR (Maria), DR-4399-FL (Michael), DR-4402-WI, + (2017 to present)

**Project Manager** as a subcontractor on the CCPRS Team, I am the lead project manager for all Task Orders and support resource staffing and associated security badging for Wood staff. To date we have deployed multiple staff since Fall 2017, including support for Disaster Recovery in Texas (Site Inspectors & EHP), Florida (Program Delivery Managers), Puerto Rico (Data Analyst & EHP) and more.



### FEMA Region 2/CCPRS, Public Assistance TAC, Hurricane Sandy (DR-4085-NY) (2014-2018)

**Data Analyst & Reports Specialist** for a project that started in the Sandy Recovery Office (SRO) and transitioned to the FEMA Region 2 office in March 2016. Continuously the role included a wide range of reporting services for the project teams and management from the SRO, FEMA Region 2 and FEMA Headquarters. To facilitate efficient and accurate reporting our team was tasked with designing a SharePoint solution for tracking staffing workloads and project status. In addition, we integrated the use of Microsoft Access databases and Excel spreadsheets (including the use of Power Query) to support data QAQC, data management and design reports.

#### FEMA HQ/PwC, Public Assistance Re-Engineering, Washington DC (2017)

**SharePoint Application Developer** as part of FEMA's New Delivery Model for the Public Assistance Program. The managers at FEMA Headquarters wanted a way to receive input back from the field staff on the implementation of the new model. Therefore, we started with an existing concept for a 'Change Control Tool' and built a full SharePoint interface for submitting, reviewing and addressing change requests coming in from the field. We also built interactive reports for the management teams to effectively receive their respective requests and seamlessly interact with SharePoint to post resolutions and confirmations back to the field.

#### FEMA Region 7/CCPRS, Public Assistance TAC, DR-4238 Missouri Severe Storms (2016)

**Data Management Developer** for a short duration project to set-up a data management system to automate Applicant and PW data compilation from EMMIE and EDW and generate rapidly refreshable Excel based reports for distribution to Team Leaders and Disaster Management. This used a mix of Microsoft Excel, Access and SharePoint. Limited automation was programmed in VBA. The system was designed in collaboration with Region 7 staff who was simultaneously trained how to use the system and then transitioned to act as lead operator.

### **Project Experience - FEMA DFIRM / Risk MAP**

### FEMA CTPs, Hazus Level 2 Flood Study, Multiples in Alabama, Delaware & Maryland (2011-2014)

**Task Manager and Primary Analyst** using FEMA's Hazus-MH software and ESRI ArcGIS, multiple riverine and coastal flood studies were completed with engineered depth grids. Some studies used the default Hazus building inventory (GBS by census block) and other studies included updated building specific data (UDF) for the analysis. The project results provided estimated structure and content losses by building or census block.

### FEMA CTPs, Coordinated Needs Management Strategy (CNMS), Multiple States (2008-2012)

**Task Manager and Tool Developer** for work consisting of a Pilot Study (AL, KY, MO) to determine feasibility for FEMA and was followed by continued analysis in AL, MO, KS & NE. Process methodologies and analysis tools were developed to validate Zone AE streams based on 7 critical elements and 10 secondary elements established by FEMA. Seamless data integration techniques were used between the ArcGIS databases, Excel Applications and HEC-FFA for data entry, analysis, documentation and review. The final product was a multi-relational ESRI database that catalogues the status for every FEMA floodplain and supporting engineering models. This database is used to determine FEMA's NVUE compliance metrics for effective floodplain studies and studies currently in progress. Presentation on feasibility for FEMA HQ, FEMA Regional Offices and Contractors. May 7, 2009.

### FEMA CTPs & Region III, Digital Flood Insurance Rate Maps (DFIRM), Multiple States (2007-2013)

**Production Engineer** using ArcGIS 9.x/10.x, HEC-RAS and AMEC's Automated Floodplain Generator (AFG) the following DFIRM tasks have been completed for one or more client: Zone A hydrology, Zone A hydraulics, Zone AE re-delineations, floodplain mapping, database development, annotation and panel production.



# David Stroud, CFM

Hazard Mitigation Planner

## Years of Experience

30 (12 with Wood)

### Education

- MURP/1990/Urban and Regional Planning, Ball State University
- BS/1985/Urban and Regional Studies, Ball State University

## **Professional Registrations**

• Certified Floodplain Manager

# **Professional Associations**

- American Planning Association
- North Carolina Chapter of the American Planning Association
- Association of State Floodplain Managers (ASFPM)
- Natural Hazards Mitigation Association – on Planning Committee
- North Carolina Association of Floodplain Managers
- Kentucky Association of Mitigation Managers
- North Carolina Licensed Real Estate Agent
- FEMA Region IV HAZUS Users Group
- Georgia Association of Floodplain Managers
- Florida Floodplain Manager's Association
- Association of Floodplain Managers of Mississippi
- South Carolina Association of Hazard Mitigation

# **Professional Summary**

Mr. Stroud has over 28 years' experience as a hazard mitigation planner. His expertise includes both development of hazard mitigation plans and reviewing and scoring plans for FEMA. David worked for the Insurance Services Office (ISO) on behalf or FEMA's National Flood Insurance Program's (NFIP) Community Rating System (CRS) Program as the lead hazard mitigation planner and Flood Training Coordinator for 18 years. He assisted in the development of the 2007, 2013, and 2017 CRS Coordinator's Manual. David has worked directly with FEMA Headquarter staff in crafting the local multi-hazard mitigation planning guidance 44CFR 201.6 to be consistent with the CRS 10-Step Planning criteria including the five-year update guidance (Blue Book). Mr. Stroud has significant experience with the minimum regulations of the National Flood Insurance Program (NFIP), FEMA Grant programs and FEMA's Repetitive Loss Program. David works with communities, states and FEMA Regional offices on all aspects of hazard mitigation planning and the CRS Program. With ISO, he was responsible for internal staff training on the CRS Program, Hazard Mitigation Planning and Repetitive Loss. Additionally, David taught week-long classes on the CRS at FEMA's Emergency Management Institute (EMI). Over the years, he has provided numerous planning and CRS workshops by invitation from states, FEMA Regional Offices, and various state floodplain associations. David conducts seminars, workshops and presentations, one was for the West Virginia Association of Floodplain Managers, "The Community Rating System (CRS) –Reducing Risk & Saving Money."

# **Project Experience**

# **CRS Program Application, Town of Oxford, MD**

**CRS Project Lead** in the development of a CRS program application for the Town of Oxford, MD. This project included all activity documentation and necessary forms for the application. The Town was rated as a CRS classification 7 and 15% reduction in flood insurance premiums.

# City of Alexandria - Repetitive Loss Area Analysis, Department of Transportation and Environmental Services, VA

**Senior CRS Technical Manager** on development of a Repetitive Area Analysis (RLAA) for the City of Alexandria. This RLAA was developed according to the criteria in the new 2013 CRS Coordinator's Manual. The RLLA developed for Alexandria will be used as a national model for the CRS Program. Mr. Stroud also assisted the City of Alexandria with CRS Program assistance and support and helped the City move from a CRS Classification 7 to a CRS Classification.

**Cumberland Hoke Counties - Regional Hazard Mitigation Plan, NC Project Manager and Senior Hazard Mitigation Planner** in the update of this multi-hazard mitigation plan which covered two counties and 10 incorporated municipalities. The plan complied with FEMA's DMA planning requirements and the CRS 10-step planning process. This plan received no comments from the FEMA review and was completed on time and within budget.

**Community Rating System (CRS) Plan Review, FEMA/ISO, Washington, DC CRS Technical Lead** on this current contract with FEMA's CRS Program to provide plan review support for local mitigation plans submitted under the CRS Program.

The review process follows FEMA's Local Multi-Hazard Mitigation Planning Requirements (44 CFR 201.6) and FEMA's CRS 10 CRS Planning Steps and those creditable elements under each CRS planning Steps. The review also ensures that the plans meet the minimum requirements for addressing repetitive loss properties. Under this contract, Mr. Stroud provides ongoing technical support to the FEMA's CRS Program including development of the planning criteria in the 2013 CRS Coordinator's Manual.

# Multi-Hazard Mitigation Plan Update for the City of Sacramento and Sacramento County, CA

**CRS Technical Lead** for the update to the Sacramento County Multi-Jurisdictional Multi-Hazard Mitigation Plan. Mr. Stroud was responsible for public meeting facilitation, risk assessment, and CRS Planning requirements. Mr. Stroud was also involved in supporting Sacramento County in an update to its Watershed master plan. This plan received a high under the CRS Program and resulted in Sacramento County reaching a CRS Classification 3.

# Lexington County, SC Public Works Department: SC Flood Recovery Work

**Lead Trainer** of FEMA's Substantial Damage Estimator (SDE) Software, assisted in identifying and providing data to support Public Assistance (PA) projects, as well as, working with the floodplain administrator with NFIP and other support functions. Lexington County had 151 damaged Roads, 363 flooded buildings and 7 breached dams.

# Flood Mitigation Plan, Repetitive Loss Area Analysis and Natural Floodplain Functions Plan for the City of Savannah, GA

**Project Manager** in the development of a CRS and DMA qualified flood mitigation plan which included a repetitive loss area analysis and a natural floodplain functions plan. The plan identified flood hazards, assessed flood risk, and provided mitigation actions for the City. This project prioritized a list of floodplain management activities to improve Savannah's CRS Rating.

# Arkansas State Hazard Mitigation Plan, Department of Water Resources

**NFIP Technical Advisor** on the plan update and was solely responsible for the development of the Repetitive Loss Strategy as a requirement for State Enhanced Plan status. Mr. Stroud was also involved in the development of the mitigation strategy and meeting facilitation for the planning effort.

**Enhanced Multi-Hazard Mitigation Plan, State of Missouri Emergency Management, Jefferson City, MO Quality Assurance and Quality Control** for the 2010 updated Enhanced Missouri State Hazard Mitigation Plan to ensure that each section of the plan met FEMA's criteria for 44 CFR 201.4 and 201.5 for standard and enhance mitigation plans. The review also followed FEMA's enhanced state mitigation crosswalk.

**State of Georgia – Land use Planning/Hazard Mitigation Plan, Department of Community Affairs, Atlanta, GA Hazard Mitigation Lead** for a project which looked at combing comprehensive land use planning with hazard mitigation plan. This project required detailed review of multi-hazard mitigation plans, local comprehensive plans and regional comprehensive plans for 20 counties and 93 cities. The analyses and results were presented in 3 state-wide workshops for the GA Department of Community Affairs – Community Planning Institutes. The project also included development of a Best Practices Guide.

# Northern Colorado 10 County Regional Hazard Mitigation Plan Update

**Quality Assurance and Quality Control** for this was a 10 county regional Plan update. Mr. Stroud provided on the planning effort primarily to make sure the plan complied with the FEMA's requirements in the July 2008 Guidance "Blue Book."

Wake County Hazard Mitigation Plan Update (Sub to Atkins), Department of Emergency Management, NC CRS Technical Lead on the project to update the Wake County Multi-Jurisdictional Hazard Mitigation Plan according to the requirements of the new 2013 CRS Coordinator's Manual. The plan complied with FEMA's DMA planning requirements and has been approved by the State of North Carolina

# Liberty County Hazard Mitigation Plan, Liberty County, GA

**Project Manager and Senior Hazard Mitigation Planner** in the update of this multi-hazard mitigation plan which covered the County and 7 incorporated municipalities. The plan complied with FEMA's DMA planning requirements and the CRS 10-step planning process. This plan incorporated new critical facilities which had not been captured in the past and an update to the Georgia Information Management System was completed.

# James A. Harned, PE, PLS





# Field Survey Lead

## **Years of Experience**

### 32

### Education

- MS/1988/Agricultural Engineering – University of Kentucky
- BS/1986/Agricultural Engineering – University of Kentucky

### **Professional Registrations**

- Professional Engineer: FL, KY, IN, GA, WV, OH, ND, MT, WY
- Professional Land Surveyor: KY, ND

# **Professional Summary**

Mr. Harned has over 32 years of experience as a land surveyor and water resources/civil engineer. His work experience includes projects involving topographic/hydrographic/cadastral/route/as-built surveys, pipeline easement and alignment exhibits, pad/site/roadway/utility design, watershed management, hydrologic and hydraulic modeling of pipe and open channel systems, and design of drainage structures and stormwater quality/quantity management systems.

# **Project Experience**

# West Virginia CTP State-wide Risk Map

**Project Manager/Data Collection Team Member** for hydrographic survey of approximately 37 river and creek systems spread over 7 counties throughout the state totaling 211 structures. The stream systems varied from large river crossing on the New, Gauley and Greenbrier rivers to smaller creek systems such as Howard Creek which flows the famous Greenbrier Resort and Golf Courses.

# Hydrographic Surveys – FEMA Region III

**Project Manager** of both conventional and GPS surveys of stream cross-section and structures to support FEMA restudies in the Mid-Atlantic region. Responsible for monument recovery, project control survey (horizontal and vertical), survey of stream cross-sections and structures, collection of digital photography of crosssections and structures, structure sketches, data reduction, exporting point data in the appropriate state plane coordinate and vertical datum system, preparing Elevation Reference Mark recovery cards using CAD, and delivery in required DCS digital formats. Services provided for six counties spanning three states, four in West Virginia, including nine stream systems in Kanawha County.

# Missouri CTP – State Emergency Management Agency

**Project Manager and Data Collection Team Member** for hydrographic survey data collection at over 3100 structures in 39 counties to support over 840 miles of new detailed studies. In addition, over 280 LiDAR QA/QC points were also collected in 3 counties.

# Delaware CTP – New Castle County Risk Map

**Project Manager** for geodetic control and hydrographic surveys on two streams (Shell Pot and Little Mill Creeks) and a tributary (Matsun Run) in New Castle County totaling 10 structures. Both Shell Pot and Little Mill were tidally influenced by Delaware Bay complicating the data collection process. In addition, a majority of the structures were Amtrak, Norfolk Southern RR, CSX RR and I-95 crossings which required extensive access and safety coordination.

# Kansas CTP – Departmental of Agriculture

**Project Manager** for hydrographic survey portion of Risk Map services. Managed and participated in field data collection in 11 counties at a total of 889 structure locations.



# **Dam Inundation Mapping – KY Finance Cabinet**

**Project Manager and Field Data Collection Team Leader** for collecting downstream hydrographic survey data and real time bathymetric data to support dam breach modeling and inundation mapping for Willisburg Lake in central Kentucky, Bert T. Combs Lake in eastern Kentucky and Bullock Pen Lake in north central Kentucky. Hydrographic surveys conducted using both GPS and conventional equipment.

#### Kentucky CTP Map Modernization Project - KDOW State-wide, KY

QA/QC Manager and Field Data Collection Team Member for collecting hydrographic survey data on structures and cross-sections to support hydraulic model development for DFIRM production. Task required review of hydrographic survey data, digital photography, and structure sketches using both Trimble Geomatics Office software and manual procedures to produce final project digital and hard copy deliverables for eight (8) counties and a number of large bridges over the Kentucky River totaling approximately 75 stream miles.

### Virginia CTP – Loudoun County Risk Map

QA/QC Manager and Field Data Collection Team Member for collecting hydrographic survey data on structures and cross-sections to support hydraulic model development for DFIRM production. Task required review of hydrographic survey data, digital photography, and structure sketches using Trimble Business Center software to produce final project digital deliverables 24 streams and tributaries totaling over 60 stream miles and including 99 structures and 88 cross-sections.

# Swetha Konduru, PE, CFM

WOO



# Water Resources Engineer

#### **Years of Experience**

12 (4 with Wood)

#### Education

- MS/2008/ Civil Engineering University of Memphis
- BS/2004/Civil Engineering India

#### **Professional Registrations**

- Professional Engineer: MD
- Certified Floodplain Manager

#### **Professional Associations**

 Association of State Floodplain Management

# **Professional Summary**

Ms. Konduru has more than 12 years of experience in the water resources engineering field with a concentration in hydrology, hydraulics, and flood hazard identification. Ms. Konduru currently serves as Wood's Senior Engineer managing a few projects in WV. Ms. Konduru's experience includes hydrologic and hydraulic modeling and floodplain studies. Her primary task is to utilize modeling and GIS tools to develop FEMA floodplain maps in several states. She has managed, assisted and trained co-workers in floodplain studies in West Virginia, Missouri and Maryland.

# **Project Experience**

## West Virginia CTP Floodplain Mapping Program

**Senior Engineer/Project Manager** responsible for the development of updated enhanced approximate flood hazard analyses, post-disaster flood hazard restudies /DFIRM updates, and countywide Risk MAP studies. West Virginia's Advisory Flood Height (AFH) program has included updated flood hazard modeling and mapping for more than 5,000 stream miles covering 24 WV counties. Worked on and assisted post-disaster flood map updates for 6 counties following the devastating 2016 floods and currently performing watershed-based Risk MAP projects across 6 different counties. All updated flood risk information, including water-surface elevation and depth grid data and hydraulic modeling is hosted on the West Virginia Flood Hazard Determination Tool (website and mobile application) and utilized to support resilient floodplain management and permitting decisions. AFH water-surface elevation and depth grid data along with hydraulic modeling are delivered to the West Virginia Geographic Information System Tech Center (WVGISTC) to support this initiative.

# Maryland CTP Statewide Flood Hazard Mapping Program, MD

Senior Engineer/Project Manager supporting the MD floodplain modeling and mapping initiative, which resulted in the establishment of statewide GIS-based, model-backed floodplain and FIRM coverage for more than 1,000 stream miles. Responsible for completion of project, perform quality checks, assist, and assign work to staff and perform hydraulic analysis. WOOD has also produced FEMA Risk MAP non-regulatory products in support of both coastal and riverine flood hazards throughout the state. WOOD has also supported the development of a web-enabled, flood risk communication tool to enable stakeholders, residents, and community officials to access and utilize the most recent flood risk information.

# DNREC Flood, Coastal Hazard Analysis and Floodplain Map Production CTP Contract

**Senior Engineer** Served as Hydrologic and Hydraulic Engineer for Wood's flood hazard analysis and floodplain mapping for Hyde Run and assisted in the review of Clear Brook River in the state of Delaware. As part of the contract, wood has completed the H&H floodplain restudy for Hyde Run and the Clear Brook River.

# Pratik Pathak, PE, CFM



# Water Resources Engineer

**Years of Experience** 

4 (2 with Wood)

#### Education

- MS/(ongoing)/Computer Science – Georgia Tech
- MS/2016/Civil Engineering Southern Illinois University Carbondale
- BS/2013/Civil Engineering Institute of Engineering

### **Professional Registrations**

- Professional Engineer
- Certified Floodplain Manager

#### **Professional Associations**

 Association of State Floodplain Managers

#### **Areas of Expertise**

- Water Resources Engineering (Hydrology and Hydraulics)
- Civil Design
- Programming (Python)

#### Software

- HEC-RAS, HEC-HMS, GEO-HECRAS
- EPA-SWMM, PC-SWMM
- AutoCAD, Civil3D
- ArcGIS, GRASS, QGIS
- PEAK-FQ, HEC-SSP
- Python

# **Professional Summary**

Mr. Pathak has more than 4 years of experience in the Water Resources Engineering. Mr. Pathak's Water Resources experience include Hydrologic and Hydraulic Analyses, Flood Hazard Studies, and Flood Control Planning and Design. He specialized in application of a variety of Surface Water Modeling techniques including 1-dimensional Steady / Unsteady Hydraulic Modeling (HEC-RAS), Rainfall-Runoff Modeling (HEC-HMS, HydroCAD and TR-20), and applying ArcGIS to a variety of Hydrologic and Hydraulic Analysis, Water Resources & Civil Design Projects.

# **Project Experience**

### West Virginia CTP Floodplain Mapping Program

Water Resources Engineer responsible for the development of updated enhanced approximate flood hazard analyses in four (4) West Virginia counties covering more than 500 stream miles. My duties include preparing base data required to carry out the Hydrologic and Hydraulic analyses and enforcing through internal QC process. This work was performed as part of disaster recovery initiatives under contract to FEMA Region III as well as through the West Virginia State CTP Floodplain Mapping Program. These updated Advisory Flood Heights (AFHs) are hosted on the West Virginia Flood Hazard Determination Tool and utilized to derive approximate 1% annual chance water-surface elevations to support floodplain management and permitting decisions. AFH water-surface elevation and depth grid data along with hydraulic modeling are delivered to the West Virginia Geographic Information System Tech Center (WVGISTC) to support this initiative.

# Maryland CTP Statewide Flood Hazard Mapping Program, MD

**Hydraulic Engineer** for Maryland's statewide flood risk identification and mapping initiative in partnership with MDE, MES and FEMA Region III. Under this program, WOOD has completed H&H floodplain restudies for more than 1,100 stream miles throughout the state and has produced over 200 DFIRM panels. WOOD has also produced FEMA Risk MAP non-regulatory products in support of both coastal and riverine flood hazards throughout the state. WOOD has also supported the development of a web-enabled, flood risk communication tool to enable stakeholders, residents and community officials to access and utilize the most recent flood risk information.

# DNREC Flood, Coastal Hazard Analysis and Floodplain Map Production CTP Contract

**Hydrologic and Hydraulic Engineer** for Wood's flood hazard analysis and floodplain mapping for Clear Brook River in the state of Delaware. As part of the contract, wood has completed the H&H floodplain restudy for the Clear Brook River. I will be participating in the Flood Risk Review meetings involving the communities impacted along with the FEMA representatives.

### Seven Bridges Solar Site, Mecklenburg County, Virginia

**Design Engineer** providing civil design and permitting services for the proposed seven bridges solar site in Mecklenburg County, Virginia.

# Golbahar Mirhosseini, Ph.D.

Water Resources Engineer

# Years of Experience

8 (2 with Wood)

### Education

- Ph.D./2013/Civil & Environmental Engineering – Auburn University
- MS/2008/Civil & Environmental Engineering – Tehran Polytechnic
- BS/2005/Civil Engineering Ferdowsi University of Mashhad

### **Professional Registrations**

 Wood Certified Project Manager

### **Professional Associations**

- American Society of Civil Engineers (ASCE)
- Environmental and Water Resources Institute (EWRI)

# **Professional Summary**

Ms. Mirhosseini has more than 8 years of experience in the water resources engineering field with a concentration in hydrologic and hydraulic modeling. She has supported Federal Emergency Management Agency's (FEMA) flood risk assessment and mapping program at the national, State, and local level. Currently she is the project manager leading Summers County (West Virginia), Pendleton County (West Virginia) and St. Mary's, (Maryland) countywide Risk MAP studies. She was the project manager for Hampshire County Advisory Flood Height (AFH) study and task lead for Greenbrier (West Virginia) countywide Risk MAP study that were completed recently. She has been responsible for completion of hydrologic and hydraulic analysis (H&H) for riverine studies using methods consistent with FEMA guidelines and specifications under both FEMA Cooperating Technical Partners Program (CTP) and FEMA Production and Technical Services (PTS). She has been responsible for quality assurance/quality control (QA/QC) of H&H analysis and floodplain mapping, in addition to preparing technical reports and ensure FEMA guidelines and specifications are upheld throughout the project. Prior to joining Wood, she was responsible for technical and administrative reviews of hydrologic and hydraulic models on behalf of FEMA under MT-2 Program, for region IX, (AZ, CA, HI, NV). She reviewed revisions to ensure that the analyses are technically accurate and that the revisions comply with FEMA National Flood Insurance Program (NFIP) regulations.

# **Project Experience**

# West Virginia CTP Floodplain Mapping Program

**Project Manager** for Summers County and Pendleton County, Risk MAP studies for development of updated enhanced approximate and detailed flood hazard analyses. She served as technical task lead for Greenbrier countywide Risk MAP study. She has been responsible for quality assurance/quality control (QA/QC) of H&H analysis and floodplain mapping. Also responsible for preparing technical reports and ensuring hydrologic and hydraulic modeling and floodplain mapping products are following FEMA Guidelines and Specifications. She prepared hydrology submittal to Mapping Information Platform (MIP) for WV post-disaster flood hazard restudies in compliance with FEMA's Data Capture Technical Reference. She led the effort to perform the hydrologic and hydraulic analysis for Advisory Flood Height (AFH) studies in Pendleton and Hampshire Counties.

Maryland CTP Statewide Flood Hazard Mapping Program, MD

**Project Manager** for floodplain modeling and mapping products for FEMA regulatory floodplains in St. Mary's County. This countywide Risk MAP study will result in updated hydrologic and hydraulic modeling and floodplain mapping products that will be with in compliance with state's and FEMA Guidelines and Specifications. She also led the effort for hydrology MIP submittal for Baltimore and Montgomery Counties in compliance with FEMA's Data Capture Technical Reference.

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## FEMA Production and Technical Services (PTS) Contract, FEMA Region III

**Technical Task Lead** for production of large approximate flood hazard analyses for Carbon County, Monroe County, Pike County and Wayne County, PA. Performed detailed and approximate analysis of streams to determine water surface elevation and the extent of flooding for multiple return periods. She was responsible for quality assurance/quality control (QA/QC) of H&H analysis and floodplain mapping and for resolving technical issues, preparing technical reports, and ensuring FEMA Guidelines and Specifications are upheld throughout the project.

### FEMA Coordinated Needs Management Study (CNMS)

**Project Engineer** working on validation of current effective mapping as part of the Coordinated Needs Management Study (CNMS) FEMA contract for region IX.

## FEMA MT-2 Program

**Reviewer** performing technical and administrative reviews of H&H analysis on behalf of FEMA. Reviewed revisions to ensure that the analyses are technically accurate and that the revisions comply with FEMA National Flood Insurance Program (NFIP) regulations.

## Loudoun County, VA Floodplain Review

**LOMR Submittal Lead** for Selma State Floodplain Analysis and Mitigation Alternative Assessment for Loudoun County, VA. The result of this 2-D H&H analysis was submitted to FEMA as a LOMR submittal in order to update the effective National Flood Hazard Layer (NFHL) with more detailed data.
### Kristine Mosuela, EIT



#### Water Resources Engineer

#### Years of Experience

6 (3 with Wood)

#### Education

- MS/on-going/Civil Engineering

   Virginia Polytechnic Institute
   and State University
- BS/2017/Civil and Infrastructure Engineering – George Mason University
- BA/2011/International Relations

   College of William and Mary

#### **Professional Registrations**

Engineer-in-Training: VA

#### **Professional Associations**

- American Society of Civil Engineers – Student Member
- American Water Resources Association – National Capital Region Section
- Maryland Association of Floodplain and Stormwater Management

#### Professional Summary

Ms. Mosuela has worked on hydrologic and hydraulic modeling of riverine floodplains for various clients such as Maryland Department of the Environment (MDE) and West Virginia Department of Emergency Management (WVDEM) for the past 3 years. In addition to regression-based flow development, she is familiar with Bulletin 17C methods and has updated gage analyses for several counties. Her hydrologic analyses have included considerations for karst, regulation, and record augmentation. Her experience with 1D steady flow models spans several hundred miles of Detailed (AE), Approximate (A), and Advisory Flood Height (AFH) studies, in not only rural but heavily urbanized regions. She is trained in 2D unsteady flow modeling and has worked on models with various contexts including dam break analyses, stream restoration, and residential development.

#### **Project Experience**

#### West Virginia CTP Floodplain Mapping Program

**Hydraulic and Hydrologic Task Lead** Conducted detailed hydrologic and hydraulics studies of selected disaster-impacted reaches in WV across 5 different counties. Hydrologic analyses included advanced 17C methods including record augmentation using HEC-SSP. Analyzed hydrology for the most heavily karstic region in the state. Hydraulic analyses included model calibration and update after historic 2016 flood disaster. Conducted investigation on a USGS rating curve which resulted in a Special Problem Report analysis. Was instrumental in authoring and updating several standard operating procedures and QAQC workflows for streamlining tasks, training new hires, and maintaining institutional knowledge. Designated Task Lead and Hydrology Specialist for 3 counties.

#### Maryland CTP Statewide Flood Hazard Mapping Program

**Hydraulic and Hydrologic Task Lead** Developed enhanced approximate and detailed H&H models for 3 counties using HEC-RAS, RASMapper, and ArcGIS. Modeled multiple types of bridges, culverts, in-line structures, obstructions, and ineffective flow areas for high-impact areas based on survey data, photographs, and aerial imagery. Developed hydrologic analysis for watersheds in multiple regression equation regions. Currently updating hydrologic methodology to account for future urban development and non-stationary trends. Designated Task Lead for county that has experienced historic urban flooding.

**MDE Flood Forecasting Pilot Study, Whitemarsh Watershed Maryland Technical Assistant** Developed logic for, tested, and edited a tool to leverage National Water Model forecasts in 1D steady hydraulic models for hourly flood forecast mapping in a pilot watershed in Baltimore County, Maryland. Collaborators included USACE, USGS, and Maryland Environmental Service. Currently adapting process to other geographies in the United States.

NCFMP Dam Breach Inundation Modeling, Multiple North Carolina Counties Hydraulic and Hydrologic Modeler Developed 2D unsteady models for 5 dam breach scenarios in Cumberland and Harnett Counties, North Carolina.

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### **Brandon Cramer**

**GIS** Analyst

Years of Experience 8 (6 with Wood)

#### Education

- Graduate Certificate/2012/GIS University of Connecticut
- MA/2008/Geography University of Connecticut
- BA/2006/ Geography University of Wisconsin-Eau Claire

#### **Professional Summary**

Mr. Cramer has more than 8 years of experience in using GIS for flood hazard and environmental analyses. He serves as a Senior GIS Analyst and project manager for Wood's Northern Virginia Office. Mr. Cramer has worked extensively on GIS aspects of FEMA flood hazard analyses for many states including West Virginia, Delaware, and Virginia. He has also worked on using GIS-based analyses and mapping for environmental and stormwater management projects.

#### **Project Experience**

#### West Virginia CTP Floodplain Mapping Program

**GIS Analyst** responsible for the GIS-based analyses, floodplain mapping, and reports for updated approximate flood hazard analyses, post-disaster flood hazard restudies /DFIRM updates, and countywide Risk MAP studies. He has been responsible for delivery of flood models, flood depth and water surface grids, and reports to WVU GIS Tech Center and the State of West Virginia.

#### Maryland CTP Statewide Flood Hazard Mapping Program

**GIS Analyst** providing support and development of updated flood hazard mapping and related DFIRM products. Created flood depth and water surface grids for Risk MAP projects across the State of Maryland. Used Hazus to produce Flood Risk Products that estimated the impacts and financial losses from coastal and riverine flooding for numerous counties throughout the state.

### DNREC Flood, Coastal Hazard Analysis and Floodplain Map Production CTP Contract

**GIS Analyst** supporting flood risk analyses and FIRM updates for the State of Delaware. Responsible for Hazus analysis and creation of Riverine Flood Risk products in New Castle County.

#### FEMA Region III Flood Hazard Mapping IDIQ Contract

**GIS Analyst** involved with the development, production, and delivery of Flood Insurance Rate Maps (FIRMs), associated spatial data (DFIRMs), and Flood Insurance Study (FIS) Reports for many counties across FEMA Region III. This includes creating, modifying, and assessing map annotation, floodplains, cross sections, political areas, transportation lines, and other spatial data for FIRMs and DFIRMs. He also worked on the production of stream profiles and text in the FIS reports.

#### Maryland FEMA Coastal Flood Risk MAP Product Development

**GIS Analyst** working extensively on the development of Coastal Flood Risk Products for counties in MD on the Chesapeake Bay and Atlantic Ocean. This included acquiring elevation, building footprint, and parcel data for creation of a user-defined facilities (UDF) dataset in each county. Also responsible for running Hazus software to estimate flood losses and producing depth grids, Flood Risk Maps (FRM), Flood Risk Databases (FRD), and Flood Risk Reports (FRR) for each county. These products were submitted to FEMA for hosting and sent to local communities for mitigation planning.

### David Lowman, GISP, CFM



**GIS Analyst** 

Years of Experience

2 (2 with Wood)

#### Education

 BS/2018/Geography – George Mason University

#### **Professional Summary**

Mr. Lowman has 2 years of professional experience using Geographic Information Systems (GIS) in direct support of water resources and infrastructure projects. He is part of a team of GIS Specialists who share a focus on quality and bring innovative technical solutions to multi-hazard analysis and mapping, emergency management, environmental monitoring and compliance, and a range of other engineering projects.

#### **Project Experience**

#### West Virginia CTP Floodplain Mapping Program

**GIS Analyst** for Risk MAP studies (countywide and post-disaster Partial Map Revisions) and supporting the development of Advisory Flood Height (AFH) data for risk communication and informed local floodplain management. Mr. Lowman is involved in development of flood hazard data from revised engineering analyses, conflation of municipal and state source data into regulatory FEMA products, development of reports and FGDC-compliant metadata, data uploads, retrievals, implementation of FEMA Technical References, Procedure Memos, and other program-level changes into the production workflow.

#### Maryland CTP Statewide Flood Hazard Mapping Program

GIS Analyst for the MD floodplain modeling and mapping initiative, with direct and supporting roles in the development FIRM Panels. In addition to similar flood data development and related services for the WV CTP Program, Mr. Lowman also assisted in Maryland for enhanced countywide flood risk assessments using FEMA's Hazus-MH loss estimation software. These assessments leverage state tax data and local building footprints to create refined inventories which are analyzed in conjunction with flood depth grids (which are developed as part of regulatory map updates). The results provide site-specific loss estimates that are more refined and actionable, in terms of location and dollar values, than census-block level analyses which is commonly performed. Starting with FEMA templates, new data tables and other value-added customizations were introduced for this effort, including "degree of damage" summaries that list out the number of buildings within a community that fall within different expected damage ranges (as a function of 1% annual chance flooding against the building/contents value). The countywide products also include detailed summaries for at-risk critical facilities, general government/state-owned assets, and expected debris and sheltering needs. The initial phase of 10 counties in Maryland was completed in January 2020.

## Appendix 1 Forms





Department of Administration Purchasing Division 2019 Washington Street East Post Office Box 50130 Charleston, WV 25305-0130

#### State of West Virginia Centralized Expression of Interest Architect/Engr

Proc Folder:	825717		Reason for Modification:
Doc Description:	Architectural/Engineering Se		
Proc Type:	Central Contract - Fixed Am	t	
Date Issued	Solicitation Closes	Solicitation No	Version
2021-01-04	2021-01-21 13:30	CEOI 0606 HSE2100000001	1

#### **BID RECEIVING LOCATION BID CLERK** DEPARTMENT OF ADMINISTRATION PURCHASING DIVISION 2019 WASHINGTON ST E CHARLESTON WV 25305 US VENDOR Vendor Customer Code: 000000230384 Vendor Name : Wood Environment & Infrastructure Solutions, Inc. Address : 4795 Meadow Wood Lane, Suite 310E, Chantilly, Virginia 20151 Street: 4795 Meadow Wood Lane, Suite 310E City: Chantilly State : Virginia **Country :** United State of America **Zip**: 20151

**Principal Contact :** Tucker Clevenger, PE, CFM, Principal-in-Charge/DC Operations Manager

Vendor Contact Phone: (703) 209-6394

Extension:

FOR INFORMATION CONTACT THE BUYER Tara Lyle (304) 558-2544 tara.l.lyle@wv.gov

Vendor Signature X Junh Imp

FEIN# 91-1641772

DATE January 21, 2021

All offers subject to all terms and conditions contained in this solicitation

**DESIGNATED CONTACT:** Vendor appoints the individual identified in this Section as the Contract Administrator and the initial point of contact for matters relating to this Contract.

	- /	
Juch	-f un	Principal-in-Charge, DC Operations Manager
(Name,	Title)	
Tucker (	Clevenger, PE, CFM, Prin	cipal-in-Charge/DC Operations Manager
(Printe	d Name and Title)	
4795 M	eadow Wood Lane, Suite	e 310E, Chantilly, Virginia 20151
(Addre	ss)	
(703) 20	9-6394 / (703) 488-370	1
(Phone	Number) / (Fax Num	nber)
tucker.c	levenger@woodplc.com	1
(E-mai	address)	

**CERTIFICATION AND SIGNATURE:** By signing below, or submitting documentation through wvOASIS, I certify that I have reviewed this Solicitation in its entirety; that I understand the requirements, terms and conditions, and other information contained herein; that this bid, offer or proposal constitutes an offer to the State that cannot be unilaterally withdrawn; that the product or service proposed meets the mandatory requirements contained in the Solicitation for that product or service, unless otherwise stated herein; that the Vendor accepts the terms and conditions contained in the Solicitation, unless otherwise stated herein; that I am submitting this bid, offer or proposal for review and consideration; that I am authorized by the vendor to execute and submit this bid, offer, or proposal, or any documents related thereto on vendor's behalf; that I am authorized to bind the vendor in a contractual relationship; and that to the best of my knowledge, the vendor has properly registered with any State agency that may require registration.

Wood Environment & Infrastructure Solutions, Inc. (Company) Tucker Clevenger, PE, CFM, Principal-in-Charge/DC Operations Manager (Authorized Signature) (Representative Name, Title)

<u>Tucker Clevenger, PE, CFM, Principal-in-Charge/DC Operations Manager</u> (Printed Name and Title of Authorized Representative)

January 21, 2021 (Date)

(703) 209-6394 / (703) 488-3701 (Phone Number) (Fax Number)

#### STATE OF WEST VIRGINIA Purchasing Division PURCHASING AFFIDAVIT

**CONSTRUCTION CONTRACTS:** Under W. Va. Code § 5-22-1(i), the contracting public entity shall not award a construction contract to any bidder that is known to be in default on any monetary obligation owed to the state or a political subdivision of the state, including, but not limited to, obligations related to payroll taxes, property taxes, sales and use taxes, fire service fees, or other fines or fees.

**ALL CONTRACTS:** Under W. Va. Code §5A-3-10a, no contract or renewal of any contract may be awarded by the state or any of its political subdivisions to any vendor or prospective vendor when the vendor or prospective vendor or a related party to the vendor or prospective vendor is a debtor and: (1) the debt owed is an amount greater than one thousand dollars in the aggregate; or (2) the debtor is in employer default.

**EXCEPTION:** The prohibition listed above does not apply where a vendor has contested any tax administered pursuant to chapter eleven of the W. Va. Code, workers' compensation premium, permit fee or environmental fee or assessment and the matter has not become final or where the vendor has entered into a payment plan or agreement and the vendor is not in default of any of the provisions of such plan or agreement.

#### **DEFINITIONS:**

"Debt" means any assessment, premium, penalty, fine, tax or other amount of money owed to the state or any of its political subdivisions because of a judgment, fine, permit violation, license assessment, defaulted workers' compensation premium, penalty or other assessment presently delinquent or due and required to be paid to the state or any of its political subdivisions, including any interest or additional penalties accrued thereon.

"Employer default" means having an outstanding balance or liability to the old fund or to the uninsured employers' fund or being in policy default, as defined in W. Va. Code § 23-2c-2, failure to maintain mandatory workers' compensation coverage, or failure to fully meet its obligations as a workers' compensation self-insured employer. An employer is not in employer default if it has entered into a repayment agreement with the Insurance Commissioner and remains in compliance with the obligations under the repayment agreement.

"Related party" means a party, whether an individual, corporation, partnership, association, limited liability company or any other form or business association or other entity whatsoever, related to any vendor by blood, marriage, ownership or contract through which the party has a relationship of ownership or other interest with the vendor so that the party will actually or by effect receive or control a portion of the benefit, profit or other consideration from performance of a vendor contract with the party receiving an amount that meets or exceed five percent of the total contract amount.

AFFIRMATION: By signing this form, the vendor's authorized signer affirms and acknowledges under penalty of law for false swearing (*W. Va. Code* §61-5-3) that: (1) for construction contracts, the vendor is not in default on any monetary obligation owed to the state or a political subdivision of the state, and (2) for all other contracts, that neither vendor nor any related party owe a debt as defined above and that neither vendor nor any related party are in employer default as defined above, unless the debt or employer default is permitted under the exception above.

#### WITNESS THE FOLLOWING SIGNATURE:

Vendor's Name: Wood En	vironment & Infrastructure Solutio	ons, Inc.	
Authorized Signature:	ker Clevenger, PE, CFM, Principal-in	Date: January 21, 2021 n-Charge/DC Operations Manager	
State of Virginia			
County of <u>Fairfax</u>	, to-wit:		
Taken, subscribed, and sw	orn to before me this <u>21st</u> day of <u>J</u>	January , 20 <u>21 .</u>	
My Commission expires Ja	anuary 31	_, 20 <u>22</u> .	
AFFIX SEAL HERE	LISA KAYE WEISERT NO NOTARY PUBLIC REGISTRATION # 7787346 COMMONWEALTH OF VIRGINIA MY COMMISSION EXPIRES JANUARY 31, 2022	TARY PUBLIC Markaye Weisert Usa Kaye Weisert Purchasing Affidavit (Revised (	 01/19/2018)

West Virginia Ethics Commission



### **Disclosure of Interested Parties to Contracts**

Pursuant to *W. Va. Code* § 6D-1-2, a state agency may not enter into a contract, or a series of related contracts, that has/have an actual or estimated value of \$1 million or more until the business entity submits to the contracting state agency a Disclosure of Interested Parties to the applicable contract. In addition, the business entity awarded a contract is obligated to submit a supplemental Disclosure of Interested Parties reflecting any new or differing interested parties to the contract within 30 days following the completion or termination of the applicable contract.

For purposes of complying with these requirements, the following definitions apply:

"Business entity" means any entity recognized by law through which business is conducted, including a sole proprietorship, partnership or corporation, but does not include publicly traded companies listed on a national or international stock exchange.

"Interested party" or "Interested parties" means:

- (1) A business entity performing work or service pursuant to, or in furtherance of, the applicable contract, including specifically sub-contractors;
- (2) the person(s) who have an ownership interest equal to or greater than 25% in the business entity performing work or service pursuant to, or in furtherance of, the applicable contract. (This subdivision does not apply to a publicly traded company); and
- (3) the person or business entity, if any, that served as a compensated broker or intermediary to actively facilitate the applicable contract or negotiated the terms of the applicable contract with the state agency. (This subdivision does not apply to persons or business entities performing legal services related to the negotiation or drafting of the applicable contract.)

*"State agency"* means a board, commission, office, department or other agency in the executive, judicial or legislative branch of state government, including publicly funded institutions of higher education: Provided, that for purposes of W. Va. Code § 6D-1-2, the West Virginia Investment Management Board shall not be deemed a state agency nor subject to the requirements of that provision.

The contracting business entity must complete this form and submit it to the contracting state agency prior to contract award and to complete another form within 30 days of contract completion or termination.

This form was created by the State of West Virginia Ethics Commission, 210 Brooks Street, Suite 300, Charleston, WV 25301-1804. Telephone: (304)558-0664; fax: (304)558-2169; e-mail: <u>ethics@wv.gov</u>; website: <u>www.ethics.wv.gov</u>.

#### West Virginia Ethics Commission Disclosure of Interested Parties to Contracts

(Required by W. Va. Code § 6D-1-2)

Name of Contracting Business Entity: Wood Environmen Infrastructure Solu	Address: <u>1105 Lakewood Parkway, Suite 300</u>	
	Alpharetta, Georgia 30009	
Name of Authorized Agent: <u>Tucker Clevenger, PE, CFM</u>	Address: <u>4795 Meadow Wood Lane, Suite 310E</u> Chantilly, Virginia 20151	
Contract Number: <u>CEOI HSE2100000001</u>	Contract Description: Architectural/Engineering Services	

Governmental agency awarding contract: Department of Administration, Purchasing Division

□ Check here if this is a Supplemental Disclosure

List the Names of Interested Parties to the contract which are known or reasonably anticipated by the contracting business entity for each category below (attach additional pages if necessary):

- 1. Subcontractors or other entities performing work or service under the Contract ☐ Check here if none, otherwise list entity/individual names below.
- Any person or entity who owns 25% or more of contracting entity (not applicable to publicly traded entities)
   ☑ Check here if none, otherwise list entity/individual names below.
- 3. Any person or entity that facilitated, or negotiated the terms of, the applicable contract (excluding legal services related to the negotiation or drafting of the applicable contract)

Check here if none, otherwise list entity/individual names below.

	-	_	1				
Signature:	1	nh	in	$\sim$	Date Signed:	January 21, 2021	
•	Tucke	r Cleven	ger, PE, C	FM, Principal-in-Charge/DC (	Operations Manager		- Person Dá

#### **Notary Verification**

State of Virginia

\_\_\_\_\_, County of <u>Fairfax</u>

I, <u>Tucker Clevenger, PE, CFM, Principal-in-Charge/DC Operations Manager</u>, the authorized agent of the contracting business entity listed above, being duly sworn, acknowledge that the Disclosure herein is being made under oath and under the penalty of perjury.

Taken, sworn to and subscribed before me th	is 21st 💉	day of January	, <u>2021</u> .
	MA	Naise Alesert.	
	1	/ Notary Public's Sign	ature LISA KAYE WEISERT
To be completed by State Agency:		, ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	REGISTRATION # 7787346
Date Received by State Agency:			COMMONWEALTH OF VIRGINIA
Date submitted to Ethics Commission:			JANUARY 31, 2022
Governmental agency submitting Disclosure:			And the state of the section of the

CERTIFICATE OF uthorizatio STATE BOARD OF REGISTRATION FOR PROFESSIONAL ENGINEERS The West Virginia State Board of Registration for Professional Engineers having verified the person in responsible charge is registered in West Virginia as a professional engineer for the noted firm, hereby certifies **WOOD ENVIRONMENT & INFRASTRUCTURE** SOLUTIONS, INC. C01211-00 Engineer in Responsible Charge: CHRISTOPHER J. RAMSEY - WV PE 016164 has complied with section \$30-13-17 of the West Virginia Code governing the issuance of a Certificate of Authorization. The Board hereby notifies you of its certification with issuance of this Certification of Authorization for the period of January 1, 2020 - December 31, 2021 providing for the practice of engineering services in the State of West Virginia. IF YOU ARE REQUIRED TO REGISTER WITH THE SECRETARY OF STATE'S OFFICE. PLEASE SUBMIT THIS CERTIFICATE WITH YOUR APPLICATION. IN TESTIMONY WHEREOF, THE WEST VIRGINIA STATE BOARD OI REGISTRATION FOR PROFESSIONAL ENGINEERS HAS ISSUED THIS COA UNDER ITS SEAL, AND SIGNED BY THE PRESIDENT OF SAID BOARD BOARD PRESIDENT



# **CONTRACTOR LICENSE**

Authorized by the

### West Virginia Contractor Licensing Board

Number:

WV052705

**Classification:** 

GENERAL ENGINEERING

WOOD ENVIR & INFRASRCT SOLU INC DBA WOOD ENVIR & INFRASRCT SOLU INC 1105 LAKEWOOD PARKWAY SUITE 300 ALPHARETTA, GA 30009

**Date Issued Expiration Date** NOVEMBER 21, 2020 NOVEMBER 21, 2021

Authorized Company Signature

Chair, West Virginia Contractor Licensing Board

This license, or a copy thereof, must be posted in a conspicuous place at every construction site where work is being performed. This license number must appear in all advertisements, on all bid submissions and on all fulfy executed and binding contracts. This license cannot be assigned or transferred by licensee. Issued under provisions of West Virginia Code, Chapter 21, Article 11.

## WEST VIRGINIA STATE TAX DEPARTMENT BUSINESS REGISTRATION CERTIFICATE

ISSUED TO: AMEC FOSTER WHEELER ENVIRONMENT & INFRASTRUCTURE, INC. 1105 LAKEWOOD PKWY 300 ALPHARETTA, GA 30009-7625

BUSINESS REGISTRATION ACCOUNT NUMBER:

1052-6069

This certificate is issued on: 02/4/2015

This certificate is issued by the West Virginia State Tax Commissioner in accordance with Chapter 11, Article 12, of the West Virginia Code

The person or organization identified on this certificate is registered to conduct business in the State of West Virginia at the location above.

This certificate is not transferrable and must be displayed at the location for which issued

This certificate shall be permanent until cessation of the business for which the certificate of registration was granted or until it is suspended, revoked or cancelled by the Tax Commissioner.

Change in name or change of location shall be considered a cessation of the business and a new certificate shall be required.

TRAVELING/STREET VENDORS: Must carry a copy of this certificate in every vehicle operated by them. CONTRACTORS, DRILLING OPERATORS, TIMBER/LOGGING OPERATIONS: Must have a copy of this certificate displayed at every job site within West Virginia.

TI

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#### **CERTIFICATE OF LIABILITY INSURANCE**

DATE(MM/DD/YYYY) 06/29/2020

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AFFIRMATIVELY OR NEGATIVELY AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW. THIS CERTIFICATE OF INSURANCE DOES NOT CONSTITUTE A CONTRACT BETWEEN THE ISSUING INSURER(S), AUTHORIZED REPRESENTATIVE OR PRODUCER, AND THE CERTIFICATE HOLDER.

IMPORTANT: If the certificate holder is an ADDITIONAL INSURED, the policy(ies) must have ADDITIONAL INSURED provisions or be endorsed. If SUBROGATION IS WAIVED, subject to the terms and conditions of the policy, certain policies may require an endorsement. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsement(s).

RODUCER			CONTAC NAME	т			
n Risk Services Southwest, In	•		PHONE (866) 283-7122 FAX (A/C, No.). (800) 363-0105				3-0105
55 San Felipe			E-MAIL	SS-		(ACC. NO.).	
uston TX 77056 USA			INSURER(S) AFFORDING COVERAGE				NAIC #
URED			INSURFI	RA Zuri	ch Americar	Ins Co	16535
GUSA Holdings, Inc.			INSUREI	RB: Amer	ican Guarar	ntee & Liability Ins Co	26247
d its Subsidiaries and Affilia 325 Katy Freeway	tes		INSUREI	RC: ACE	American Ir	isurance Company	22667
iston TX 77084 ÚSA			INSUREI	RD: AIG	Specialty 1	Insurance Company	26883
			INSUREI	RE: Amer	ican Interr	national Group UK Ltd	AA1120187
			INSUREI	R F:			
OVERAGES C	ERTIFIC	ATE NUMBER: 57008	32643603		RI	EVISION NUMBER:	
THIS IS TO CERTIFY THAT THE POLIC NDICATED. NOTWITHSTANDING ANY CERTIFICATE MAY BE ISSUED OR M EXCLUSIONS AND CONDITIONS OF S	IES OF IN REQUIRE AY PERTA JCH POLI	NSURANCE LISTED BELO EMENT, TERM OR CONE AIN, THE INSURANCE AI ICIES. LIMITS SHOWN M	ow have bee Dition of any Fforded by Ay have been	N ISSUED TO CONTRACT THE POLICIE REDUCED B	OR OTHER INSURI OR OTHER I S DESCRIBE Y PAID CLAIN	ED NAMED ABOVE FOR THE DOCUMENT WITH RESPECT D HEREIN IS SUBJECT TO / MS. Limits show	POLICY PERIOD TO WHICH THIS ALL THE TERMS, In are as requested
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		GL0484608500		07/01/2020	07/01/2021	EACH OCCURRENCE	\$5,000,00
CLAIMS-MADE X OCCUR						PREMISES (Ea occurrence)	\$100,00
	_					MED EXP (Any one person)	\$5,00
	_					PERSONAL & ADV INJURY	\$5,000,00
GEN'L AGGREGATE LIMIT APPLIES PER:						GENERAL AGGREGATE	\$5,000,00
OTHER:						PRODUCTS - COMP/OP AGG	\$5,000,00
AUTOMOBILE LIABILITY		ISA H25301900		07/01/2020	07/01/2021	COMBINED SINGLE LIMIT (Ea accident)	\$2,000,00
X ANY AUTO						BODILY INJURY (Per person)	
OWNED SCHEDULED						BODILY INJURY (Per accident)	
AUTOS ONLY HIRED AUTOS NON-OWNED AUTOS ONLY						PROPERTY DAMAGE (Per accident)	
X UMBRELLA LIAB X OCCUR		AUC484608600	n policy ton	07/01/2020	07/01/2021	EACH OCCURRENCE	\$5,000,00
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DED X RETENTION							
WORKERS COMPENSATION AND EMPLOYERS' LIABILITY		WLRC67455708		07/01/2020	07/01/2021	X PER STATUTE OTH- ER	
ANY PROPRIETOR / PARTNER / EXECUTIVE	N N/A	SCEC67455745		07/01/2020	07/01/2021	E.L. EACH ACCIDENT	\$1,000,00
(Mandatory in NH)		Work Comp- WI		. , . ,	- , - , -	E.L. DISEASE-EA EMPLOYEE	\$1,000,00
DESCRIPTION OF OPERATIONS below						E.L. DISEASE-POLICY LIMIT	\$1,000,00
Archit&Eng Prof		PSDEF2000726 Claims Made- Pi STR applies pei	rof. Liab. r policy ter	07/01/2020 ms & condi	07/01/2021	Aggreagate Limit Any One Claim	\$5,000,00 \$5,000,00
SCRIPTION OF OPERATIONS / LOCATIONS / VI	HICLES (AC	CORD 101, Additional Remarks	Schedule, may be Idendum for A	attached if more	space is require Named Insu	d) red Wood companies.	
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JWGUSA Holdings, Inc. and its Subsidiaries and	Affilia	ates	AUTHORIZED R	EPRESENTATIV	E		
17325 Park Row Houston TX 77084 USA				la P	19	ing Southwart .	T

Aon Risk Services Southwest Inc.

©1988-2015 ACORD CORPORATION. All rights reserved. The ACORD name and logo are registered marks of ACORD

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AGENCY CUSTOMER ID: 57000021966

			LOC #:	
ACORD	ADDITIONAI	L REM	IARKS SCHEDULE	Page _ of _
AGENCY			NAMED INSURED	
Aon Risk Services Southwest	:, Inc.		JWGUSA Holdings, Inc.	
POLICY NUMBER See Certificate Number: 570	082643603			
CARRIER	002013003	NAIC CODE		
See Certificate Number: 570	082643603	101000002	EFFECTIVE DATE:	
ADDITIONAL REMARKS				
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JWGUSA Holdings, Inc. Wood Group USA, Inc. Wood Environment & Infrastr AMEC Ede, P.C. AMEC Engineering and Consul Amec Foster wheeler Industr Amec Foster wheeler Industr Amec Foster wheeler Martine Amec Foster wheeler North A Amec Foster wheeler North A Amec Foster wheeler USA Cor Amec Foster wheeler USA Cor Amec Foster wheeler USA Cor Amec Foster wheeler Intercontine Ingenious, Inc. C E C Controls Company, Inc Cape Software, Inc. Foster Wheeler Intercontine Ingenious, Inc. Kelchner, Inc. MACTEC Engineering and Cons MASA Ventures, Inc. Mustang International, Inc. Rider Hunt International US Swaggart Brothers, Inc. Wood Group Alaska, LLC Wood Group PSN, Inc. Wood Group UK, Ltd Wood Massachusetts, Inc. Wood Programs, Inc.	<pre>'ucture Solutions, it, Inc. ting of Michigan, a, S.L.U. 'ial Power Company i, Inc. 2, Inc. wmerica Corp systems, Inc. 'poration 2s, Inc. : ental Corporation sulting, P.C. SA, Inc. SA, Inc. SA, Inc.</pre>	Inc. Inc. , Inc.		

AGENCY CUSTOMER ID: 57000021966



#### I, Mac Warner, Secretary of State of the State of West Virginia, hereby certify that

an Amended Certificate of Authority of

AMEC FOSTER WHEELER ENVIRONMENT & INFRASTRUCTURE, INC.

was filed in my office as required by the provisions of the West Virginia Code and was found to conform to law.

Therefore I issue this

#### CERTIFICATE OF AMENDMENT TO THE CERTIFICATE OF AUTHORITY

changing the name of the corporation to

WOOD ENVIRONMENT & INFRASTRUCTURE SOLUTIONS, INC.



Given under my hand and the Great Seal of the State of West Virginia on this day of April 17, 2018

Mac Warner

Secretary of State

<b>APPLICATION PO</b>	R AMENDED
CERTIFICATE OF	AUTHORITY
Form CF-4	
Rev. 11/2017	

APR 1 7 2018 Website: www.wysos.gov

AMEC FOSTER MREELER ENVIRONMENT & IMPRASTRUCTURE, INC.

#### IN THE OFFICE OF WV SECRETARY OF STATE

(Two if you want a filed stamped copy returned to yon) FEE: \$25.00

FILE ONE ORIGINAL

\*\*\*\* In accordance with the provisions of the West Virginia Code, the undersigned corporation hereby \*\*\*\* applies for an Amended Certificate of Authority and subults the following statement:

3/14/2001

- 1. Name under which the corporation was authorized to transact business in WV:
- Date Certificate of Authority was issued in West Virginia:

Wood Environment & Infrastructure Solutions, Inc.

- Corporate name has been changed to: (Attach one <u>Certified Copy of Name Change</u> as filed in home State of incorporation.)
- Name the corporation elects to use in WV due to home State name not being available: (If name is not available for use in West Virginia, you must attach to this application a Letter of

Resolution signed by the officers or directors of the corporation approving use of a "forced DBA Name." Download a sample Letter of Resolution.)

- Other amendments: (attach additional pages if necessary)
- 6. Name and phone number of contact person. (This is optional, however, if there is a problem with the filing, listing a contact person and phone number may avoid having to return or reject the document.)

Contact Name

Phone Number

7. Signature information (See below \*Important Legal Notice Regarding Signature):

Print Name of Signer: Robert Gomez Title/Capacity: Special Secretary Date: 4/16/2018 Signature:

\*Important Legal Notice Reparding Signature: Per West Virginia Code §31D-1-129. Penalty for signing false document. Any person who signs a document he or she knows is false in any material respect and knows that the document is to be delivered to the secretary of state for filing is guilty of a misdemeanor and, upon conviction thereof, shall be fined not more than one thousand dollars or confined in the county or regional jail not more than one year, or both.

Important Note: This form is a public document. Please do <u>NOT</u> provide any personal identifiable information on this form such as social security number, bank account numbers, credit card numbers, tax identification or driver's livense numbers.

461111

#### STATE OF NEVADA

BARBARA K. CEGAVSKE Surretury of State

KIMBERLEY PERONDI Deputy Secretary for Commercial Recordings



OFFICE OF THE SECRETARY OF STATE

#### **Certified Copy**

Commercial Recordings Division 202 N. Carson Street Carson City, NV 89701-4201 Telephone (775) 684-5708 Fax (775) 584-7138

April 16, 2018

Job Number: C20180416-0943 Reference Number: 00010951731-17 Expedite: Through Date:

The undersigned filing officer hereby certifies that the attached copies are true and exact copies of all requested statements and related subsequent documentation filed with the Secretary of State's Office, Commercial Recordings Division listed on the attached report.

Document Number(s) 20180135367-66 Description Amendment Number of Pages 1 Pages/1 Copies



Certified By: Christine Rakow Certificate Number: C20180416-0943 Respectfully, Berhara K. Cegerste

Barbara K. Cegavske Secretary of State

Commercial Recording Division 202 N. Carson Street Carson City, Nevade 89701-4201 Telephone (775) 684-5708 Fax (775) 684-7138





RANDARA K. CEGAVINE ty of St 10.8 City, WWW. SHIERS . OF

Certificate of Amendment (PURSUANT TO NRS 78.385 AND 78.390)

Filed in the office of	Document Number 20180135367-66
Barbara K. Cegavsk	Filing Date and Time 03/26/2018 1:45 PM
State of Nevada	Entity Muncher C8316-1994

UNE BLACK SHE CALT - DO MOT HIGHLIGHT

ABOVE WACE IS FOR OFFICE USE OFFIC

#### Certificate of Amendment to Asticles of Incorporation For Nevada Profit Corporations (Pursuant to NR8 78.385 and 78.390 - After lecuance of Stock)

1. Name of corporation:

Amer Poster Wheeler Environment & Infrastructure, Inc.

2. The articles have been amended as follows: (provide article numbers, if available)

Article 1: The name of the corporation is "Wood Environment & Infrastructure Solutions, Inc."

3. The vote by which the stockholders holding shares in the corporation entiting them to exarcise at least a majority of the voting power, or such greater proportion of the voting power as may be required in the case of a vote by classes or series, or as may be required by the provisions of the articles of incorporation" have voted in favor of the amendment is: 100%

4. Effective date and time of filing: (optional) Date: April 16, 2018 Time: 12:01:00 AM PST) (must not be later than 90 days after the certificate is filed)

5. Signature: (required)

pendiment would jater or change any preference or any relative or other right given is any class or They the energisterit must be approved by the vole, in addition to the attractive vole otherwise are a replacement of the voling power of each class or surface attacked by the amendment registers on the voling power thereof. 4**1 an**u 6 OF (11)

HIPORTANT: Failure to include any of the above information and submit with the proper fees may cause this filing to be rejected. Billing Second of Bints Annual Parts Annual State This form must be accompanied by appropriate free.

## SECRETARY OF STATE



#### **CERTIFICATE OF NAME CHANGE**

I, Barbara K. Cegavske, the duly qualified and elected Nevada Secretary of State, do hereby certify that on March 26, 2018, a Certificate of Amendment to its Articles of Incorporation changing the name to WOOD ENVIRONMENT & INFRASTRUCTURE SOLUTIONS, INC., was filed in this office by AMEC FOSTER WHEELER ENVIRONMENT & INFRASTRUCTURE, INC.. Said change of name has been made in accordance with the laws of the State of Nevada and that said Certificate of Amendment is now on file and of record in this office.



Certified By: Christine Rakow Certificate Number: C20180416-0943 IN WITNESS WHEREOF, I have hereunto set my hand and affixed the Great Seal of State, at my office on April 16, 2018.

ahora K. Cegesste

Barbara K. Cegavske Secretary of State

### SECRETARY OF STATE



#### CERTIFICATE OF EXISTENCE WITH STATUS IN GOOD STANDING

I, Barbara K. Cegavske, the duly elected and qualified Nevada Secretary of State, do hereby certify that I am, by the laws of said State, the custodian of the records relating to filings by corporations, non-profit corporations, corporation soles, limited-liability companies, limited partnerships, limited-liability partnerships and business trusts pursuant to Title 7 of the Nevada Revised Statutes which are either presently in a status of good standing or were in good standing for a time period subsequent of 1976 and am the proper officer to execute this certificate.

I further certify that the records of the Nevada Secretary of State, at the date of this certificate, evidence, WOOD ENVIRONMENT & INFRASTRUCTURE SOLUTIONS, INC., as a corporation duly organized under the laws of Nevada and existing under and by virtue of the laws of the State of Nevada since June 1, 1994, and is in good standing in this state.



IN WITNESS WHEREOF, I have hereunto set my hand and affixed the Great Seal of State, at my office on April 16, 2018.

hora K. Cegeiste

Barbara K. Cegavske Secretary of State

Electronic Certificate Certificate Number: C20180416-0414

within them initial

## SECRETARY OF STATE



#### CERTIFICATE OF EXISTENCE WITH STATUS IN GOOD STANDING

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hora K. Cegerste

Barbara K. Cegavake Secretary of State

Electronic Certificate Certificate Number: C20180418-0414

#### Limited Power of Attorney

The undersigned Officer of Amec Foster Wheeler Environment & Infrastructure, Inc., a Nevada entity ("the Company"), appoints Robert Gomez as attorneyinfact(s) for the Company and its subsidiaries for the limited purposes authorized in this Limited Power of Attorney. Taylor Page, Special Secretary grants to the attorneyinfact the power to execute the documents necessary to change the registered agent, change of address, amendments, fictitious name registrations, fictitious name renewals, qualifications, annual reports, amended annual reports, initial reports, obtain tax clearance/compliance certificate(s), withdraw, dissolve, reinstate, convert or form the Company and its subsidiaries. The named individuals shall act in such office and with such authority as is required to effect the changes contemplated in this Limited Power of Attorney.

This Limited Power of Attorney expires on the earlier of (a) the filing of change of registered agents and/or change of address and/or amendments and/or fictitious name registrations and/or fictitious name renewals and/or qualifications and/or annual reports and/or amended annual reports and/or initial reports and/or withdraw and/or dissolve and/or formations and/or reinstate for the Company and its subsidiaries or (b) six months after the Effective Date set forth below. The Company may revoke this Power of Attorney at any time by written notice to United Agent Group Inc., 11380 Prosperity Farms Road #221E, Palm Beach Gardens, FL 33410.

The undersigned has executed this Limited Power of Attorney effective as of this 16th day of April, 2018.

Amec Foster Wheeler Environment & Infrastructure, Inc.

By:

Name: Taylor Page Title: Special Secretary

STATE OF FLORIDA COUNTY OF PALM BEACH

Subscribed and sworn to before me this 16th day of April, 2018.

otary



## **Appendix II: Certifications**



23 05 39987 TUCKER W. CLEVENGER 6146 11-23-2020 MESSAGE(S): JUST A REMINDER. EFFECTIVE 1/15/2018 THE NUMBER OF REQUIRED PDH'S HAS BEEN REDUCED FROM 24 TO 16. ALSO THERE IS NO CATEGORY A OR B. TECHNICAL, RESEARCH, ANALYTICAL, OR DESIGN ASPECTS OF ENGINEERING; LAWS AND REGULATIONS APPLICABLE TO THE PRACTICE OF ENGINEERING IN MARYLAND; ENGINEERING-RELATED COMPUTER HARDWARE AND SOFTWARE TOPICS; STANDARDS OF PRACTICE OR CARE; PROFESSIONAL ENGINEERING ETHICS; PROJECT MANAGEMENT, RISK ASSESSMENT AND MANAGEMENT, OR EMERGENCY AND DISASTER MANAGEMENT; OR SIMILAR TOPICS AIMED TO MAINTAIN, IMPROVE, OR EXPAND THE SKILLS AND KNOWLEDGE RELEVANT TO THE LICENSEES FIELD. A MINIMUM OF 1 PDH IN EACH BIENNIAL LICENSING TERM SHALL BE EARNED FROM THE PARTICIPATION IN THE COMPLETION OF QUALIFYING PROGRAMS WITH CONTENT RELATED TO THE FOLLOWING: ETHICAL CONCERNS AND CONFLICTS RELATED TO ENGINEERING FAMILIARITY WITH CODE OF CONDUCT, STANDARDS OF PRACTICE OR MARYLAND LAW LICENSE \* REGISTRATION \* CERTIFICATION \* PERMIT Lawrence J. Hogan, Jr. Maryland Covernor STATE OF MARYLAND Boyd K. Rutherford DEPARTMENT OF LABOR Lt. Governor MARYLAND DEPARTMENT OF LABOR Tillany P. Robinson Secretary STATE BOARD FOR PROFESSIONAL ENGINEERS CERTIFIES THAT: TUCKER W. CLEVENGER 05-PROFESSIONAL ENGINEER IS AN AUTHORIZED: LIC/REG/CERT EFFECTIVE EXPIRATION CONTROL NO 163201-09-2023 N/A Signature of Bearer Secretary WHERE REQUIRED BY LAW THIS MUST BE CONSPICUOUSLY DISPLAYED IN OFFICE TO WHICH IT APPLIES 23 05 39987 5,604,736 LICENSE \* REGISTRATION \* CERTIFICATION Lawrence J. Hogan, Jr. Maryland STATE OF MARYLAND Boyd K. Rutherford MARYLAND DEPARTMENT OF LABOR Tiffany P. Robinson 23 05 39987 STATE BOARD FOR PROFESSIONAL ENGINEERS STATE BOARD FOR PROFESSIONAL ENGINEERS 500 N. CALVERT STREET **CERTIFIES THAT:** TUCKER W. CLEVENGER BALTIMORE, MD 21202-3651 TUCKER W. CLEVENGER IS AN AUTHORIZED: 05 - PROFESSIONAL ENGINEER LIC/REG/CERT EXPIRATION EFFECTIVE CONTROL NO 01 - 09 - 2023N/A

5,604,736

Kom

Secretary

Signature of Bearer

## ASSOCIATION OF STATE FLOODPLAIN MANAGERS, INC. CERTIFICATION BOARD OF REGENTS

HEREBY CERTIFIES THAT PURSUANT TO THE PROVISIONS OF THE CHARTER FOR THE CERTIFIED FLOODPLAIN MANAGER PROGRAM

## Tucker W. Clevenger, CFM

IS DULY REGISTERED AS AN

### **ASFPM CERTIFIED FLOODPLAIN MANAGER**

IN TESTIMONY WHEREOF THIS CERTIFICATE HAS BEEN ISSUED BY THE AUTHORITY OF THE CERTIFICATION BOARD OF REGENTS, CERTIFICATE NO. ISSUED 11/3/2001. THIS CERTIFICATE SHALL EXPIRE 1/31/2022, UNLESS RENEWED ACCORDING TO THE RULES OF THIS BOARD.

CERTIFICATION BOARD OF REGENTS PRESIDENT, LOUIS T. GREENWELL, CFM

ASSOCIATION OF STATE FLOODPLAIN MANAGERS EXECUTIVE DIRECTOR CHAD M. BERGINNIS, CFM



## Be it known that Matthew Breen

Having qualified as required by law is duly licensed and hereby authorized to practice in the State of Delaware as a

## Professional Angineer

License No.

In testimony whereof We have affixed our hand and seal

President Carmune C. Balasci P. F.

of Professional Engineers this <u>eleventh</u> day of <u>March, 2020</u>

Issued by the Delaware Association

Secretary Charles L Mc allister P.E.

## ASSOCIATION OF STATE FLOODPLAIN MANAGERS, INC. CERTIFICATION BOARD OF REGENTS

HEREBY CERTIFIES THAT PURSUANT TO THE PROVISIONS OF THE CHARTER FOR THE CERTIFIED FLOODPLAIN MANAGER PROGRAM

# Matthew T. Breen, CFM

IS DULY REGISTERED AS AN

### **ASFPM CERTIFIED FLOODPLAIN MANAGER**

IN TESTIMONY WHEREOF THIS CERTIFICATE HAS BEEN ISSUED BY THE AUTHORITY OF THE CERTIFICATION BOARD OF REGENTS, CERTIFICATE NO. ISSUED 2/22/2003. THIS CERTIFICATE SHALL EXPIRE 7/31/2021, UNLESS RENEWED ACCORDING TO THE RULES OF THIS BOARD.

CERTIFICATION BOARD OF REGENTS PRESIDENT, LOUIS T. GREENWELL, GISP, CFM

ASSOCIATION OF STATE FLOODPLAIN MANAGERS EXECUTIVE DIRECTOR, CHAD M. BERGINNIS, CFM

# Your **ACTIVE PE** renewal fee has been received...

Your ACTIVE PE renewal fee has been received. Your pocket card indicating you are entitled to practice engineering in West Virginia until the noted expiration date may be detached and used unless invalidated as a result of Board audit of your renewal form or formal disciplinary action.

#### **IMPORTANT REMINDERS:**

- 1. Please include your WV ACTIVE PE license number on any correspondence to this office.
- 2. To use this license as a pocket card, please cut along the dotted line and laminate if desired.
- **3.** You are required to immediately notify the Board, in writing, of the following: loss or theft of license or seal, any name change, any address change, or any employment change.

#### West Virginia State Board of Registration for Professional Engineers

300 Capitol Street, Suite 910 Charleston, West Virginia 25301 304-558-3554 Phone 800-324-6170 Toll Free www.wvpebd.org

#### THIS IS ONE FORM OF YOUR RENEWAL RECEIPT

#### PLEASE SAVE THIS FOR YOUR RECORDS

Date of Renewal: December 31, 2020 Amount Paid: \$70.00



#### **EXPIRES December 31, 2022**

#### **MATTHEW T. BIGGS**



Issued: April 29, 2014

# American Institute of Hydrology

Board of Registration certifies that M. Troy Biggs

has given satisfactory evidence of their professional qualifications as required by the Board of Registration of the American Institute of Hydrology and has complied by the rules and regulations of the Institute and is hereby authorized to use the title:

## Professional Hydrologist

Certificate No.

This certificate is subject to periodic review and annual renewal

Pal T. Willin-

Chair, Board of Registration

G. Michalas Textos

President, AIH

Secretary, Board of Registration



The Trustees of the American Academy of Water Resources Engineers under the authority vested in them by the Civil Engineering Certification, Inc. confirm that

## Matthew Troy Biggs

having given satisfactory evidence of professional qualifications in accordance with the American Academy of Water Resources Engineers Bylaws is awarded this Certificate of Special Knowledge and is authorized to use the title of

## Diplomate, Water Resources Engineer

with all rights, privileges and responsibilities appertaining thereto. In witness thereof, this Certificate of Special Knowledge signed by the designated officers of the Academy and sealed with the official seal of the Academy is granted. Given this day, the 1st day of April in the year 2012.

Presiden

Secretary

An ASCE Certification Program

Certificate Number:



## **Jason Durant**

has met the standards for ethical conduct and professional practice as established by the GIS Certification Institute for recognition as a

### Certified Geographic Information Systems (GIS) Professional (GISP)

and is therefore entitled to all the rights and privileges thereunder.

This grant of certification shall expire or be deemed inactive on 7/25/2022 unless, by that date, the individual shall have successfully completed recertification.

Certification Number

Date of Initial Certification 7/25/2016

Martin Roche

Martin Roche, GISP GISCI President

Dir 42

Bill Hodge, GISP GISCI Executive Director

### **ASSOCIATION OF STATE**

## FLOODPLAIN MANAGERS, INC.

### **CERTIFICATION BOARD OF REGENTS**

HEREBY CERTIFIES THAT PURSUANT TO THE PROVISIONS OF THE CHARTER FOR THE CERTIFIED FLOODPLAIN MANAGER PROGRAM

## Jason Sevanick Durant, CFM

IS DULY REGISTERED AS AN

### **ASFPM CERTIFIED FLOODPLAIN MANAGER**

IN TESTIMONY WHEREOF THIS CERTIFICATE HAS BEEN ISSUED BY THE AUTHORITY OF THE CERTIFICATION BOARD OF REGENTS, CERTIFICATE NO. ISSUED 5/6/2008. THIS CERTIFICATE SHALL EXPIRE 7/31/2022, UNLESS RENEWED ACCORDING TO THE RULES OF THIS BOARD.

CERTIFICATION BOARD OF REGENTS PRESIDENT, LOUIS T. GREENWELL, GISP, CFM

ASSOCIATION OF STATE FLOODPLAIN MANAGERS EXECUTIVE DIRECTOR, CHAD M. BERGINNIS, CFM

## ASSOCIATION OF STATE FLOODPLAIN MANAGERS, INC. CERTIFICATION BOARD OF REGENTS

The we also we also we also we also we also

HEREBY CERTIFIES THAT PURSUANT TO THE PROVISIONS OF THE CHARTER FOR THE CERTIFIED FLOODPLAIN MANAGER PROGRAM

# Yukun Xing, CFM

IS DULY REGISTERED AS AN

### ASFPM CERTIFIED FLOODPLAIN MANAGER

IN TESTIMONY WHEREOF THIS CERTIFICATE HAS BEEN ISSUED BY THE AUTHORITY OF THE CERTIFICATION BOARD OF REGENTS, CERTIFICATE NO. ISSUED 5/6/2008. THIS CERTIFICATE SHALL EXPIRE 1/31/2022, UNLESS RENEWED ACCORDING TO THE RULES OF THIS BOARD.

CERTIFICATION BOARD OF REGENTS PRESIDENT, LOUIS T. GREENWELL, CFM

ASSOCIATION OF ST EXECUTIVE DIRECTOR/CHAD M. BERGINNIS, CEM


#### State of Tennessee

STATE BOARD OF ARCHITECTURAL AND ENGINEERING EXAMINERS PROFESSIONAL ENGINEER MS JENNIFER RENEE MCGEE

This is to certify that all requirements of the State of Tennessee have been met.





12262542

IN-1313 DEPARTMENT OF COMMERCE AND INSURANCE



This certifies that

#### Jennifer R. McGee

has met the standards for ethical conduct and professional practice as established by the GIS Certification Institute for recognition as a

#### **Certified Geographic Information Systems (GIS) Professional (GISP)**

and is therefore entitled to all the rights and privileges thereunder.

This grant of certification shall expire or be deemed inactive on 9/25/2022 unless, by that date, the individual shall have successfully completed recertification.

Certification Number Date of Initial Certification 9/25/2014

Martin Roche

Martin Roche, GISP GISCI President

Rith

Bill Hodge, GISP GISCI Executive Director

### ASSOCIATION OF STATE FLOODPLAIN MANAGERS, INC. CERTIFICATION BOARD OF REGENTS

HEREBY CERTIFIES THAT PURSUANT TO THE PROVISIONS OF THE CHARTER FOR THE CERTIFIED FLOODPLAIN MANAGER PROGRAM

## Jennifer R. McGee, CFM

IS DULY REGISTERED AS AN

#### ASFPM CERTIFIED FLOODPLAIN MANAGER

IN TESTIMONY WHEREOF THIS CERTIFICATE HAS BEEN ISSUED BY THE AUTHORITY OF THE CERTIFICATION BOARD OF REGENTS, CERTIFICATE NO. ISSUED 5/14/2008. THIS CERTIFICATE SHALL EXPIRE 7/31/2022, UNLESS RENEWED ACCORDING TO THE RULES OF THIS BOARD.

CERTIFICATION BOARD OF REGENTS PRESIDENT, LOUIS T. GREENWELL, GISP, CFM

ASSOCIATION OF STATE FLOODPLAIN MANAGERS EXECUTIVE DIRECTOR, CHAD M. BERGINNIS, CFM

all to whom these presents shall come. Greeting Anow Ver That Che Shik Roard of Registration for Professional Engineers. of the State of West Virginia, reposing special confidence in the Intelligence, Integrity and Discretion of James A. Harned DOES, IN PURSUANCE OF AVAILORIARY VESTED IN 17 by law, hereby certify that he, having submitted satisfactory evidence of his ability and experience, is a REGISTERED PROFESSIONAL ENGINEER Registration Anmber To Hold ) and use such title in the practice of his profession, subject to the conditions prescribed by law. Given under the hand and the Seal of the Board at the Capitol in the City of Charleston,

this 7th day of Sept. in the



year of our Lord 2000 and of the State the One Hundred Thirty - Seventh

STATE BOARD OF REGISTRATION FOR PROFESSIONAL ENGINEERS

And Deckley

Herde & Alman.

Frankt Middy

2FSm Jan Duar .

# James Alan Harned

COMMONWEALTH OF KENTUCK

Be it known that

having qualified, as required by act of the General Assembly, is duly Licensed and is hereby authorized to practice in the Commonwealth of Rentucky as a  $I \land A \land ID$ 

SURVEYOR

In Testimony Whereof we have affixed our hand License No. and seal this 19th day of December 2001 Issued by the Kentucky State Board of Licensure for William F. M. crea

Professional Engineers and Land Surveyors

Secretary