Sanaz Borhani, PhD, PE

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Summary

- Licensed **Water Resources Engineer** experienced in **Hydrologic** and **Hydraulic** modeling
- Experienced in **H&H** modeling using **HEC-RAS, SRH-2D, HEC-HMS, HEC-GeoHMS** and **EPA-SWMM** family combined with **GIS** work
- Experienced in code development, documenting model methodologies, technical report writing, data analysis and visualization with **FORTRAN** and **Python**
- Comfortable in multi-dimensional team projects

Education

PhD, **Civil and Environmental Engineering (Water Resources Engineering)**
University of South Carolina (Columbia, SC)
Dissertation: "Modeling Particle Dispersal in Bedload Dominated Settings"

MSc, **Civil and Environmental Engineering (Water Resources Engineering)**
Sharif University of Technology (Iran)
Thesis: "Controlling Local Scour Due to Hydraulic Jump Using Inclined Buried Plates"

BSc, **Civil Engineering**
Shahid Madani University of Azarbaijan (Iran)

Professional Experience

Water Resources Engineer III   **January 2025-Present**

AECOM, Boston, MA

Performed as a hydraulic and hydrologic engineer for numerous projects for the New York Department of Transportation, Connecticut Department of Transportation, Massachusetts Department of Transportation:

- H&H Reports for Multiple AMTRAK Culverts, CT
  - ✓ Conducted thorough reviews of H&H reports for multiple AMTRAK culverts prepared by other firms, at locations including Enfield, Hartford, and WindsorLocks.
- Onondaga Creek, Evans Street, Syracuse, NY
  - ✓ Performed a preliminary hydraulic and scour analysis to support the design build proposal for the replacement of five structures over Onondaga Creek.
- Mystic River Pedestrian Bridge, Everett, MA
  - ✓ Conducted hydrologic analysis to determine peak flow rates using the Massachusetts streamflow regression equations (USGS, 2016).
  - ✓ Performed climate change analysis to account for future sea level rise, using the Massachusetts Climate Change projections.
- Route 20 Over Connecticut River, Springfield, MA
  - ✓ Performed 2-D steady-state hydrodynamic analysis in SRH-2D to produce detailed hydrodynamic current velocities and water levels for the scour calculations.
- Cranes Hollow Road Bridge Replacement over the Evans Kill, Town of Amsterdam, NY
  - ✓ Conducted hydrologic analysis using the USGS web utility tool, StreamStats to determine peak flow rates and performed Hydraulic analysis using 1-D HEC-RAS model.
- Wagners Hollow Road Bridge Replacement over The Caroga Creek, Town of Palatine, NY
  - ✓ Conducted hydrologic analysis using the USGS web utility tool, StreamStats to determine peak flow rates and performed Hydraulic analysis using 1-D HEC-RAS model.
- Kensico Reservoir Drainage Basin, Westchester, NY
  - ✓ Performed environmental observed concentration data analysis and provided a methodology for PFAS loading.

Water Resources Engineer   **2022-2025**

Jacobs Engineering Group, Morristown, NJ

Performed as a hydraulic and hydrologic engineer for numerous projects for the New Jersey Department of Transportation, New Jersey Department of Environmental Protection, Massachusetts Department of Transportation, and Pennsylvania Department of Transportation including:

- Green Brook Flood Risk Management Project Segment B-3 and B-4, Middlesex, Somerset, and Union Counties, NJ
  - ✓ Revised the permitting HEC-RAS model for floodplain analysis to ensure accuracy and compliance, while utilizing ArcGIS to generate comprehensive floodplain maps for effective project assessment.
  - ✓ Performed a scour analysis on the existing Route 28 bridge, assessing the impact of increased flow velocities from the proposed floodwalls and levees, and designed Articulated Concrete Blocks as effective scour countermeasures to enhance structural stability.
- Hamilton Road Bridge over Conrail (CSX) Railroad, Structure No. 1850-166, Hillsborough Township, Somerset County, NJ
  - ✓ Conducted hydrologic analysis to determine peak flow design storm event discharges to the culvert using NRCS TR-55 method.
  - ✓ Developed a steady-state, one-dimensional hydraulic model with HEC-RAS Version 6.3 to analyze hydraulic impacts on flood elevations for existing and proposed conditions.
- 2D Hydraulic Analysis using HEC-RAS 2D Rain-on-Grid for Climate Change Assessment
  - ✓ Utilized HEC-RAS two-dimensional rain-on-grid river modeling to enhance understanding of complex flow conditions affecting the selected site.
  - ✓ Conducted floodplain analysis by evaluating rainfall events from 1999, 2020, and projected 2100, ensuring comprehensive consideration of historical and future conditions.
- Route 23, Bridge over Mill Brook, Concept Development, Montague Township, NJ
  - ✓ Utilized the Natural Resource Conservation Service methodology in PondPack to calculate peak flow rates, considering both current and projected rainfall depths for the year 2100 to estimate future 100-year storm flows and Flood Hazard Area flows.
  - ✓ Modeled the stream using both 1-D steady-state HEC-RAS and SRH-2D modeling techniques to account for complex split flow conditions during high storm events.
- Newton-Weston Bridge Bundle Design Build, Boston, MA
  - ✓ Developed 1-D steady-state HEC-RAS models to assess existing and proposed conditions, followed by unsteady SRH-2D modeling for more accurate velocity and flow calculations.
  - ✓ Conducted scour analysis in accordance with 2024 MassDOT LRFD Bridge Manual evaluating 200-year and 500-year storm events.
  - ✓ Performed a FEMA "No-Rise" analysis to ensure that the proposed replacements meet the no-rise flood elevation change criteria.
- Route 27, Culvert over Northern Tributary to Ten Mile Run, Final Design, Franklin Township, NJ
  - ✓ Modeled the stream flow and its complex split between two bridges using 1-D Steady-state HEC-RAS
  - ✓ Utilized Natural Resource Conservation Service (NRCS) methodology in PondPack to calculate peak flow rates, incorporating current and projected rainfall depths for the year 2100 to assess future 100-year storm flows and Flood Hazard Area flows.
- Route 30, Bridge over Duck Thorofare, Bridge Replacement Project, Structure No. 0103-153, Atlantic City, Atlantic County, NJ
  - ✓ Developed unsteady-state, two-dimensional hydraulic models using the Surface-water Modeling System (SMS) and SRH-2D Program to simulate surface water conditions and assess hydraulic impacts on flood elevations.
  - ✓ Applied methodologies from Federal Highway Administration's HEC-25 to analyze tidal hydrology, hydraulics, and scour related to local tidal cycles and potential hurricane storm surge impacts on Duck Thorofare water surface elevations.
  - ✓ Conducted scour analyses for 0.5% Annual Exceedance Probability (AEP) 200-year and 0.2% AEP 500-year design storm events, in accordance with FHWA HEC-18, 5th Edition.
- Route 88 Bridge Replacement over Beaver Dam Creek, Brick Township and Point Pleasant Borough, Ocean County, NJ

- ✓ Conducted comprehensive hydrology and hydraulics analysis, including hydrologic analysis employing NRCS methodology, ArcGIS, and PondPack modeling software, and hydraulic analysis utilizing HEC-RAS Mapper.
  - ✓ Integrated upstream stage storage and flow routing data into HEC-RAS models to demonstrate no downstream impacts.
  - ✓ Performed detailed scour analysis for the proposed bridge in compliance with HEC-18, HEC-20, HEC-23, and HEC-25 procedures, calculating fluvial and tidal scour depths.
  - ✓ Implemented the Tidal Prism method for the tidal analysis to ensure comprehensive evaluation of potential scour impacts.
- Route 94 Bridge Replacement over Jacksonburg Creek– Preliminary Engineering, Blairstown Township, Warren, NJ
  - ✓ Developed comprehensive HEC-RAS models to evaluate existing, temporary, and proposed conditions, guiding the design of the new replacement bridge.
  - ✓ Conducted bridge scour analysis for the proposed bridge, following HEC-18, HEC-20, and HEC-23 procedures.
  - ✓ Evaluated project impacts in accordance with NJDEP FHACAR and SWM Regulations related to Inland Flood Protection.
  - ✓ Conducted a detailed alternative analysis, exploring options for raising the roadway above projected flood hazard areas, and assessed potential downstream impacts, confirming no adverse effects on neighboring properties.
- SR 0012 Crossing over Bernhart Creek, Alsace Township, Berks County, PA
  - ✓ Revised hydrology calculations and design flow assessments for the creek, evaluating factors such as land usage uniformity, drainage area, and watershed location to identify the most applicable hydrologic method, ultimately using the SCS Technical Release 55 (TR-55 method) for peak flow evaluation.
- Tremley Point Connector Road over the Rahway River – Preliminary Engineering, Carteret and Linden, NJ
  - ✓ Designed SRH-2D model for floodplain analysis of proposed bridge over the Rahway River, utilizing fluvial peak flows from an unsteady-state HEC-RAS model and revising the steady-state, 1-D HEC-RAS model to assess hydraulic impacts.

Postdoctoral Researcher   **2021-2022**

Sustainable Water Resources Engineering Laboratory, Drexel University
- Performed a 2-D flood modeling project using PCSWMM for Camden, NJ to downscale extreme precipitation in ultra-urban H&H models as a part of Cross-RISA partnership with MARISA and Pacific RISA.

Hydrologic and Hydraulic (H&H) Modeler   **2020-2022**

Montalto and Rothstein engineering DPC, eDesign Dynamics, NYC
- Developed a 1D-2D hydraulic and hydrologic model using PCSWMM and ArcGIS software to analyze the impacts of dredging on flood inundation maps for Puerto Rico.
- Developed a hydrologic and hydraulic model using HEC-RAS, HEC-HMS and HEC-GeoHMS in preparation for the development of new building site in the San Juan Estuary System according to guidelines set forth by the Puerto Rico Planning Board.

Postdoctoral Fellow   **2019-2020**

Biological Systems Engineering Department, Virginia Tech
- Collaborated with University of Maryland Baltimore County performing a Chesapeake Bay Trust-funded project of "Effectiveness of stormwater management practices in protecting stream channel stability".
- Performed watershed delineation for Minebank Run in Baltimore County, MD.
- Performed frequency analysis of the river flow discharge data for effective discharge calculation on a reach of Po River in Italy with Python.

Research Assistant   **2013 - 2019**
Civil and Environmental Engineering Department, University of South Carolina
- Collaborated with US Army Corps of Engineers to conduct morphodynamic modeling of bedload dominated river channels.
- Served as part of a group performing NSF-supported projects of "Modeling of Flood Hazards" and "Modeling of Geomorphic Impacts of Levee Breach and Dam Failure".
- Experienced in sediment and scour modeling of coastal channel to capture the characteristics of tide dominated estuaries in collaboration with geologists.
- Performed hydrologic modeling including pond design, channel routing and watershed calculation.
- Collaborated with multi-disciplinary teams of engineers to renew and design hydraulics lab facilities (e.g. a new open channel flume and an electric hydraulic valve) Served voluntarily as a tour leader in hydraulics lab to provide undergraduate and graduate students with an opportunity to explore and understand the fundamental principles of fluid mechanics and open channel hydraulics.

Lecturer and Teaching Assistant   **2016 - 2019**
Dep. of Civil Engineering, University of South Carolina
- Lecturer, Fluid Mechanics, Dynamics, and Computational Methods for Engineering, University of South Carolina

Computer Skills
- Experienced with Programming Languages: Python, FORTRAN and MATLAB
- Proficient in GIS work with ArcGIS Pro, ArcMAP, ArcHydro
- Experienced with Technical engineering software (PCSWMM, HEC-RAS, HEC-HMS, SRH-2D)

Technical Skills
- Hydraulic/Hydrologic Modeling
- Stormwater Modeling
- Scour Countermeasure Design
- Data Analysis and Visualization
- Bridge Scour Analysis
- River Morphology
- Hydraulic Structures Design
- Erosion/Sediment Transport

Distinctions and Academic Awards
- R.L. Sumwalt, Sr. Endowed Fund, University of South Carolina
- Engineering Scholarship, University of South Carolina
- Student Award, to attend CSDMS and AGU, University of South Carolina
- AGU Student Award

Selected Publications and Presentations
- Hensyl, B., Borhani, S., Payab, A., Montalto, F., "Opportunities for Leveraging Existing Hydrologic and Hydraulic Models Developed for Water Quantity Management to Mitigate Flooding Due to Extreme Precipitation", Journal of Water Management Modeling, 2024.
- Hill, K., Ghasemi, A., Borhani, S., Viparelli, E., "Computational Simulations of Bed Surface Variability 1 and Particle Entrainment in a Gravel-bed River", ESS, 2020.
- Borhani, S., Hosseiny, H., Strom, K., "Effective Discharge Calculations: Comparison of Classic Methods with a Morphodynamic Model", River Flow, 2020.
- Viparelli, E., Borhani, S., Torres, R., Kendall, C. G. S. C., "Equilibrium of Tidal Channels Carrying Nonuniform Sand and Interacting with the Ocean", Geomorphology, 329, 1-16. 2019.