# SEDHYD 2023 Short Course Descriptions

**Monday May 8: 8:00am – 5:00pm**



**Monday May 8: 8:00am - 12:00pm**



**Monday May 8: 1:00pm - 5:00pm**



**Friday May 12: 8:00am - 12:00pm**



*All short courses and field trips will be held on either Monday, May 8 or Friday, May 12, 2023. There are no courses on Friday afternoon. The full conference registration includes either 1 full-day short course, 2 half-day short courses, or 1 field trip. Conference attendees may register for additional short courses or field trips for an additional fee.*

**SHORT COURSE:**
1. Reservoir Sedimentation: Measuring and Managing into the Future

**DATE & TIME:**
Monday, May 8, 2023 from 8:00 am to 5:00 pm

**DESCRIPTION:**
Sedimentation and loss of storage is a chronic problem in reservoirs big and small. Reservoir managers are looking to maintain current benefits and reduce the loss of benefits in the future. To preserve these benefits, a plan for reservoir sustainability must be developed through studies and analysis. Reservoir sedimentation analysis is becoming a key component in many O&M, environmental, hydropower, and flood risk reduction studies. USACE engineers will demonstrate how to analyze reservoir sedimentation problems and explain how to select and assess solutions using tools and technologies that represent current best practices, including empirical equations and numerical models. This workshop will include numerous case studies, tabletop demonstrations, and a demonstration of the application of numerical models.

The workshop topics include a brief overview of sedimentation mechanics and computing current and future reservoir volume change based on available data. The afternoon session will cover available management methods, selecting a reservoir management method, empirical analysis for reservoir future without project conditions, and demonstration of using numerical modeling to evaluate sediment management scenarios.

***Morning Session 8:00am-12:00pm***
*Why does it matter?*
- Predicting Future Reservoir Sedimentation and Impacts without Management
    - Calculating deposition from rangelines or bathymetric surfaces
    - Calculating deposition with limited or no data
- Application of sediment rating curves
- Workshop: Developing a sediment rating curve
- Estimating trapping efficiency with the Brune Curve method
- Estimating future storage volumes using a sediment budget approach
- Workshop: Using a rating curve and Brune Curve to estimate future storage volumes

***Afternoon Session 1:00pm-4:00pm***
*What methods are available?*
- Overview of Reservoir Sediment Management Methods
    - Applications
    - Case Studies
    - Tabletop demos
- Workshop: Estimating drawdown flushes with the Atkinson method
- Numerical Modeling Workshop: What do models tell us that the above analyses cannot? (HEC-RAS 1D and 2D examples). Bring a laptop with HEC-RAS v6.3+ and work along!

**INSTRUCTORS:**

**John Shelley, Ph.D., P.E., US Army Corps of Engineers, Kansas City District**

Dr. John Shelley is a hydraulic engineer and sedimentation specialist at the US Army Corps of Engineers, Kansas City District, where he focuses on river and reservoir sediment management, bank stabilization, and quantitative geomorphology. John has analyzed sedimentation at 21 large and medium-sized reservoirs across multiple states and countries. He has organized numerous workshops and taught short courses on reservoir sedimentation and sediment modeling across the United States and in the countries of Brazil and Laos. John is also an adjunct professor at William Jewell College, where he teaches river engineering, and a registered professional engineer in the State of Kansas. John received his BS in Civil Engineering from Brigham Young University and his Ph.D. in Civil Engineering from the University of Kansas.

**Travis Dahl, Ph.D., P.E., US Army Corps of Engineers, ERDC Coastal and Hydraulics Lab**

Dr. Travis Dahl is a Research Hydraulic Engineer at the U.S. Army Engineer Research and Development Center's Coastal & Hydraulics Laboratory, where he has spent the last 8 years working on a range of sediment issues, including reservoir sedimentation. He has worked on sediment and reservoir issues across the U.S. and around the world. Most recently, he led a research work unit focused on improving reservoir sediment management. He started his USACE career with the Detroit District, spending a decade working on sediment and water management projects in the Great Lakes region.

**Stanford Gibson, Ph.D., US Army Corps of Engineers, Hydrologic Engineering Center**

Dr. Stanford Gibson is the sediment specialist at the Hydrologic Engineering Center (HEC) where he has worked for 20 years. He is responsible for the sediment transport capabilities in HEC-RAS. His areas of expertise include sediment modeling, debris flow, sustainable reservoir sediment-management analysis, and dam removal simulations. Stanford also regularly applies sediment models to support ecosystem restoration, flood damage reduction, and navigation projects and has taught hydraulics and sediment transport in more than ten countries. Stanford has a PhD in Civil and Environmental Engineering from UC Davis, and Masters' degrees in Geotechnical Engineering, Restoration Ecology, and Theology. Dr. Gibson has published more than fifteen papers in peer reviewed journals and more than 50 other publications. He posts regular YouTube Videos on sediment and modeling topics:
https://www.youtube.com/user/stanfordgibson

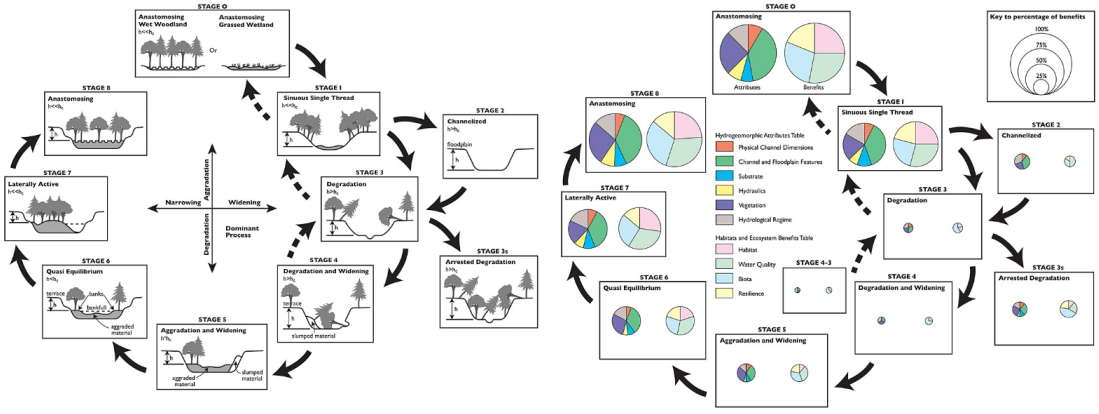
**Paul Boyd, Ph.D., P.E., US Army Corps of Engineers, Omaha District**

Dr. Paul Boyd is the Regional Technical Specialist for Sedimentation at the Omaha District, US Army Corps of Engineers. In his 20-year career he has worked on numerous assessments of reservoir sedimentation around the world and is involved in developing Reservoir Sediment Management Plans for select USACE reservoirs. He also serves as a USACE representative on the SEDHYD Sedimentation Committee and the National Reservoir Sedimentation and Sustainability Team (NRSST).

**SHORT COURSE:**
2. Stage 0/8 River Restoration Workshop

**DATE & TIME:**
Monday, May 8, 2023 from 8:00 am to 5:00 pm

**DESCRIPTION:**
*What are Stages 0 and 8?*
Stage Zero is the initial, pre-disturbance condition in the 'Stream Evolution Model' (SEM) proposed by Cluer and Thorne (2013).




Stream Evolution Model proposed by Cluer and Thorne (2014)

In the SEM, Stage Zero is characterised by an abundance of wide range of hydromorphic attributes and ecosystem benefits, high fluvial complexity, and full connectivity to the floodplain and the hyporheic aquifer. Stage Zero is a condition in which an alluvial (self-formed) river and its floodplain have been undisturbed for a period of time sufficient to allow the cross-sectional geometry, planform pattern and long-stream profile to adjust to the catchment (watershed in US parlance) context, and prevailing flow, sediment, and biological processes. When in a Stage Zero condition, the river characteristically comprises of a river-wetland corridor that may feature a patchy-wetland without a distinct channel, a multi-threaded planform (which may be braided, wandering, or anastomosed) or a single-threaded, meandering planform with side-channels.

The surface water component constitutes the stream and floodplain flows, which may be perennial, intermittent or ephemeral. The sub-surface component of the river (the 'hyporheos' – literally 'the river below') is fully-connected to the surface flows but may, or may not, be connected to the regional, groundwater aquifer. When studying, describing and evaluating any alluvial river (but especially one that is in its Stage Zero condition), it is important to do so in three dimensions (long-stream, lateral (i.e. cross valley), and vertical), because a river is, by definition, "a system of inter-connected, surface and sub-surface flows that form a unitary whole".

Anthropogenic disturbance often causes a stream that is fully connected to its floodplain to incise and widen (Stages 1-4) but experience shows that, eventually, the channel aggrades and narrows, recovering to something close to its pre-disturbance condition (Stage 8).

*What is 'Stage 0/8' Restoration?*
During the early-2000s, US Forest Service river restoration practitioners moved from channel-centered restoration to valley-wide treatments that focused more on valley and floodplain processes. This shift involved filling incised channels in unconfined alluvial valleys to recreate valley-wide connectivity. These reconnected floodplains in the Pacific Northwest, USA have increased habitat for threatened and endangered species of fish and wildlife, serve as foundational areas for food web and water table recovery and act as refugia during floods and fires. In response to Cluer and Thorne's 2014 paper, Forest Service practitioners began referring to their projects as "Stage Zero Restoration", and use of this 'shorthand' term for river-floodplain reconnection has now spread across North America and the UK. Restoration to a Stage Zero condition can be achieved by filling-in a degraded channel mechanically – which is sometimes termed a 'valley floor reset' and has been equated to pressing 'Ctrl-Alt-Delete' to clear an intractable computer problem. This approach is particularly apt if removal of redundant, artificial features such as levees and embankments can supply the sediment needed to fill the incised channel. However, Stage Zero is a river restoration outcome, rather than a specific river restoration approach, and in less severely degraded streams, restoration to Stage Zero can also be achieved using a raft of Light Touch, Process-Based Restoration (LTPBR) approaches, especially when beaver can be reintroduced or allowed to re-colonize a river reach from which they were previously extirpated. Stage Zero can therefore be thought of as a destination rather than a journey. The path taken to restore a river to Stage Zero should be bespoke to the catchment context and anthropogenic setting of the river.

In many locations, restoration of a river to its pre-disturbance condition may currently be impractical due to the severity of the degradation and presence of anthropogenic constraints. In these situations, restoration to 'Stage 8' by reconnecting it to a lower, inset floodplain is still preferrable to attempting to restore channel functions without fully reconnecting an incised stream to even part floodplain.

*Why is this short course being offered at SEDHYD in 2023, and who should take it?*
In 2019, a 'Stage 0' short course attracted a lot of attention and a large group of participants. At that time, the small number and narrow geographical spread of implemented projects limited the range experience and volume of post-project monitoring data available. Since 2019, dozens of 'Stage 0' and 'Stage 8' restorations have been implemented coast to coast, as well as in the UK. Consequently, in the 2023 workshop, the presenters will cover not only the theory and practice of restoration to 'Stages 0 & 8'; they will also report on experience gained and lessons learned from projects performed on headwater, middle and lowland streams located not only in the Pacific Northwest, but also California, Colorado, Kentucky, Maryland & Pennsylvania, as well as in the United Kingdom.

The short course is recommended for river engineers, scientists, and managers with an interest in restoring lost river functions and habitats while simultaneously building resilience to climate change and wildfires, and managing down future river and flood-related risks to people, property, infrastructure and ecosystems.

| Schedule - Morning | | | |
|---|---|---|---|
| 8:00 – 8:30 | 30 | **Welcome, Introductions and Aim of Workshop** | Brian Cluer |
| 8:30 – 9:00 | 30 | **Background and theory**<br>How rivers and floodplains work and work better together, anabranching channels in history, anthropogenic impacts, bankfull discharge in depositional vs transport reaches, constrained vs unconstrained reaches, stable channel design vs stable channel evolution & adaptation | Colin Thorne |
| 9:00 – 9:30 | 30 | **The Long Road to Stage Zero**<br>Review of disturbance history, early attempts at restoring incised channels, and transition to 'thinking outside the channel', stressing lessons learned & learning by doing | Janine Castro |
| 9:30 – 10:00 | 30 | **Practical 1 - Identifying candidate sites**<br>Identifying potential sites for reconnecting anthropogenically-incised streams to some (Stage 8) or all (Stage 0) of their pre-disturbance floodplains | Brian Cluer |
| 10:00-10:15 | 15 | **Morning Break** | |
| 10:15 – 10:45 | 30 | **Geomorphic analysis and design**<br>Channel-floodplain reconnection based on Geomorphic Grade Line (GGL), Relative Elevation Models (REM), cut/fill balance, d/s grade control, & preserving relict features in headwater, upland and lowland contexts | Brice Crayne |
| 10:45 – 11:15 | 30 | **Practical 2 – Creating a GGL and REM in practice**<br>Geomorphic analysis for a floodplain reconnection project using the GGL and REM approach. Applying the GGL-REM Toolbox in practice to a site selected by the participants. | Amanda Jones PE |
| 11:15 – 12:00 | 45 | **Engineering analysis and design**<br>H & H analysis & modeling, stream & site surveys, permitting (ESA, FEMA, etc.), engineering design, contracting, and construction (water management planning, sediment control, supervising & working with contractors) | Amanda Jones PE |
| 12:00 – 13:00 | 60 | **LUNCH BREAK** | |

| Schedule - Afternoon | | | |
|---|---|---|---|
| 13:00 – 13:30 | 30 | **Overview of completed projects** Starting with small projects in meadows and creeks and scaling up to rivers. Drawing on examples from the USA and UK. | Colin Thorne |
| 13:30 – 14:15 | 45 | **Case Study 1: Whychus Creek** A multi-phase floodplain reconnection project on a gravel-bed, headwater tributary to the Deschutes River, Oregon. | Mathias Perle, Lauren Mork & Brian Cluer |
| 14:15 – 15:00 | 45 | **Case Study 2: Low-Tech Process Based Restoration** Putting the LTPBR approach into practice when restoring streams to Stages 8 or 0 in a variety of stream types and watershed contexts. | Jared McKee |
| 15:00 – 15:15 | 15 | **Afternoon Break** | |
| 15:15 – 16:00 | 45 | **Case Study 3: Deer Creek, South Fork & Mainstem McKenzie Rivers** Two multi-phase floodplain reconnection projects in a large, high-energy river basin in the Western Cascades of Oregon | Colin Thorne |
| 16:00 – 16:30 | 30 | **Knowledge Exchange Forum: Lessons Learned + Future Potential** Overview of issues with full floodplain reconnection. Experience, opportunities, outcomes, benefits, risks and challenges: physical, biological, social, and regulatory. | All |
| 16:30 – 17:00 | 30 | **Closure** Each participant gives their brief comments, feedback and overall reaction, plus closing remarks from speakers and suggestions for follow-up actions/next steps | All |

**INSTRUCTORS:**

**Janine Castro**

Janine is the Project Leader for the US Fish and Wildlife Service Fisheries Office in Vancouver, Washington. She has worked as a Geomorphologist for the Fish and Wildlife Service for 20+ years and spent the preceding 10 years working for the Natural Resources Conservation Service. Janine is one of the five founding members of River Restoration Northwest and the Technical Director for the Portland State University, River Restoration Professional Certificate Program.

**Brian Cluer**

Brian is a senior scientist in river resource management for NOAA's National Marine Fisheries Service - West Coast Region, with 32 years of federal service. He holds a BS in Geology (Idaho State University) an MS in Geophysics and Groundwater (Northern Arizona University), and a PhD in Earth Resources (Colorado State University). Since joining the NMFS in 2000 he has focused on planning and implementing several dam removal projects, and improving restoration science & practice to support the recovery of ESA-listed salmonids, notably by advancing the scientific support for floodplain restoration.

**Brice Crayne**
Brice is a Project Manager who has been with the Lower Columbia Fish Enhancement Group since 2015. He has a B.A. in Chemistry and Environmental Studies (Whitman College) and a Masters in Fisheries Management (Oregon State University). Brice started his career as an AmeriCorps habitat restoration coordinator and has worked for state agencies in Idaho, watershed councils in Oregon, and public utilities in Washington. He currently leads projects to support recovery of ESA-listed fish species in the upper Coweeman watershed and the upper South Fork Toutle River valley at Mount St Helens.

**Amanda Jones**
AJ is a water resources engineer with 11 years of experience in river and wetland restoration analysis and design. She has been the design lead on multiple process-based restoration projects featuring Stage 0 techniques, side channel and floodplain connections, and large log jam implementation in various fluvial and estuarine environments. With a career primarily centered in restoration, AJ brings a well-honed and integrated knowledge of stream and floodplain processes, fish passage design, and construction methods.

**Lauren Mork**
Lauren Mork, Monitoring Program Manager with Upper Deschutes Watershed Council, has led UDWC's restoration effectiveness monitoring program for the last 12 years. Since 2016 she has collaborated with restoration practitioners and researchers across Oregon to develop and advance methods for monitoring the complex ecological and geomorphic outcomes of valley-bottom reset floodplain reconnection restoration approaches. Lauren holds a Master's in Environmental Sciences and Policy from Northern Arizona University and a Bachelor of Arts from Earlham College.

**Jared McKee**
Jared holds a B.S. and M.S. in Civil and Environmental Engineering from Mississippi State University. In 2011, he began work for the USFWS in the Klamath Falls Ecological Services Office. Between 2016 and 2019, he worked at the Stone Lakes and Upper Klamath Basin National Wildlife Refuges. In 2020, Jared was appointed as a Fish Passage Engineer at the Columbia River Fish and Wildlife Office, WA. He provides technical support on fluvial restoration and fish passage to field offices and refuges throughout the PNW, as well as to the Service and Service partners nationally. Jared also works on large projects in the Pacific Southwest Region, particularly in the Upper Klamath Basin.

**Colin Thorne**
Colin is Emeritus Professor Physical Geography at Nottingham University, UK and works part-time as a River Scientist with Wolf Water Resources Inc., based in Portland OR. He has ~50 years experience having worked for the USDA, USACE and NOAA-NMFS as well as holding faculty posts at Mississippi State University, Colorado State University, and London University. In 2013 he published (with Brian Cluer) the Stream Evolution Model, which is the source of the term 'Stage Zero'.

**SHORT COURSE:**
3. OpenFOAM CFD Workshop

**DATE & TIME:**
Monday, May 8, 2023 from 8:00 am to 5:00 pm

**DESCRIPTION:**
The objective of the course is to enable participants to perform computational fluid dynamics (CFD) numerical analysis utilizing the software OpenFOAM. OpenFOAM is a free, open source CFD software that has a large user base across academia and industry. The workshop will cover flow volume development, mesh case development, simulation case development, simulation case execution, and post-processing.

**INSTRUCTORS:**
**Brian Hall** is a Registered Professional Engineer currently working in the U.S. Army Corps of Engineers Dam Safety Modification Mandatory Center of Expertise (DSMMCX). He has over 11 years of hydraulic and hydrologic engineering experience with the U.S. Army Corps of Engineers. Brian has a Bachelor's and Master's degree in Environmental Engineering for Rensselaer Polytechnic Institute (Troy, NY). Brian worked for the Risk Management Center (RMC) and the Memphis District prior to his current position in the DSMMCX. He has been involved in a multitude of dam and levee safety, flood damage reduction, and navigation projects.

**Nick Koutsunis** is a registered professional engineer with 12 years of experience currently working at the U.S. Army Corps of Engineers Dam Safety Modification Center. Nick has performed a range of hydraulic engineering analyses and designs for dams across the country, including watershed-scale hydrologic assessments and hydraulic modeling. Nick is currently focused on the development and implementation of a computational fluid dynamics modeling workflow using open-source software for use across the USACE dam portfolio.

**Dana Moses** is a registered professional engineer, professional hydrologist, and Diplomate of Water resource Engineering with close to 20 years of experience in design, construction, and rehabilitation of hydraulic structures. Dana is involved with multiple aspects of research and policy development for the US Army Corps related to extreme flow hydrology, hydraulic structures analysis and design, and risk informed design procedures. In addition to these activities, Dana is also the lead technical advisor on several large spillway modifications currently in design and construction.

**SHORT COURSE:**
4. Sediment Fingerprinting

**DATE & TIME:**
Monday, May 8, 2023 from 8:00 am to 12:00 pm

**DESCRIPTION:**
Sediment is a major pollutant in U.S. waterways degrading both ecologic health and infrastructure. In order to reduce sediment to these waterways it is critical to determine the sources of sediment. This short course will highlight the "sediment-fingerprinting approach" for determining sediment sources. The sediment-fingerprinting approach uses the properties of sediment to differentiate between multiple sediment sources by establishing a set of chemical properties (tracers) that uniquely characterize each source in the watershed. Using samples of fluvial sediment (target samples) and comparing them with the source tracers, the major sources of sediment can be identified.
We will discuss all the necessary steps needed to conduct a sediment fingerprinting study, including:

- Identifying sources
- field collection of sources and target sediment
- equipment needed
- lab preparation and analysis
- statistical operations
- influence of grain size and organic content
- uncertainty analysis
- final model answers

The workshop will instruct the use of the downloadable USGS-CAU Sediment Source Assessment Tool (Sed_SAT3). Sed_SAT3 is a program written in $C^{++}$ that allows the user to step through all the necessary steps to apportion sediment. Sed_SAT3 uses both Bayesian and multivariate statistical approaches. Participants are encouraged to bring laptops (MAC or PC).

**INSTRUCTORS:**
**Dr. Allen Gellis** is a Research Geomorphologist with the U.S Geological Survey. He received his Ph.D. from Colorado State University in geology. He has spent his career studying sediment as it relates to land use and climate, and has worked in a variety of geomorphic settings including Puerto Rico, the Southwest, the Midwest, and the Mid-Atlantic. His current research examines sediment budgets with a focus on sediment fingerprinting to determine the sources and ages of fluvial sediment.

**Dr. Arash Massoudieh** is a Civil and Environmental Engineering professor at the Catholic University of America. He received his Ph.D. from the University of California, Davis. His research is mainly on developing modeling tools for hydrologic and water quality processes in surface waters, soil, and groundwater, focusing on auto-calibration and probabilistic parameter estimation.

**SHORT COURSE:**
5. HEC-RTS

**DATE & TIME:**
Monday, May 8, 2023 from 8:00 am to 12:00 pm

**DESCRIPTION:**
The Hydrologic Engineering Center's Real-Time Simulation (HEC-RTS) program package is a comprehensive data management as well as hydrologic and hydraulic modeling system for short-term to seasonal water management decisions support. Through HEC-DSS (Data Storage System), HEC-RTS facilitates the real-time use of observed and forecasted precipitation, observed flows and stages, and other meteorological and hydrologic data. HEC-RTS also facilitates the integration of HEC-MetVue (Meteorological Visualization Utility Engine), HEC-HMS (Hydrologic Modeling System) for forecasting flows throughout a watershed, HEC-ResSim (Reservoir System Simulation) for simulating reservoir operations and release decisions, HEC-RAS (River Analysis System) for forecasting river stages and producing flood inundation maps, and HEC-FIA (Flood Impact Analysis) for estimating potential flood impacts on life safety and agricultural and urban infrastructure.

This short course will provide overview presentations on HEC-RTS and its data and modeling components, including updates on latest versions of the modeling components. The course will also include HEC-RTS live demonstrations of real-time data acquisition, the use of gridded precipitation preprocessor, flow forecasting, reservoir releases determination, and flood inundation map generation for decision support. The demonstration HEC-RTS models and datasets along with walkthrough exercise notes will also be available online for download.

**INSTRUCTORS:**
**Fauwaz Hanbali** is a Senior Hydraulic Engineer at the US Army Corps of Engineers Hydrologic Engineering Center (HEC). He has been a member of Water Management Systems Division at HEC for twenty years. Fauwaz is a member of the software development teams for the Corps Water Management System (CWMS) suite of software for real-time decision support and HEC-ResSim software for reservoir system simulation. Fauwaz is also the program manager for the HEC-MetVue software for meteorological data visualization and analysis. Fauwaz specializes in hydrology, river hydraulics, and reservoir system management and has been involved a number of domestic and international water resources management studies. Fauwaz has a Bachelor's degree in Civil Engineering from the University of Maryland and a Master's degree in Hydraulic Engineering from IHE Delft, The Netherlands.

**Alex Davis** is a Hydraulic Engineer at the US Army Corps of Engineers Hydrologic Engineering Center (HEC). He has been a member of Water Management Systems Division at HEC for three years. Alex is a member of the software development team for the Corps Water Management System (CWMS) suite of software for real-time decision support and HEC-HMS software for hydrologic modeling. Alex has a Bachelor's and Master's degree in Civil and Environmental Engineering from Tennessee Tech University.

**Simon Evans** is a Senior Hydraulic Engineer at the US Army Corps of Engineers, Hydrologic Engineering Center (HEC). He has been a member of Water Management Systems Division at HEC for one year. Previously he has worked for the US Army Corps of Engineers, Baltimore District in the Water Management Section for five years, and the US Army Corps of Engineers, Los Angeles District Hydrology and Hydraulics Branch for five years. Simon is a member of the software development team for the Corps Water Management System (CWMS) suite of software for real-time decision support, and the technical lead for HEC-FIA. Simon specializes in river hydraulics, hydrology, and reservoir system management. Simon has Bachelor's and Master's degrees in Civil Engineering from the University of California, Los Angeles. He is a registered Civil Engineer in California, and a Certified Floodplain Manager.

**SHORT COURSE:**
6. Sediment Data Collection Techniques

**DATE & TIME:**
Monday, May 8, 2023 from 8:00 am to 12:00 pm

**DESCRIPTION:**
This short course would cover highlights of basic fluvial-sediment concepts, sediment sampler characteristics, and field techniques (including Safety concepts) for sampling with suspended-sediment, bed material, and bedload samplers. The course is designed for those actively engaged in/or supervising individuals engaged in sediment or water-quality data-collection activities, or who plan to become involved in these activities.

*AGENDA:*
8:00am Introduction
8:15am Sediment Fundamentals
8:45am Types of Samplers
9:00am Collecting suspended-sediment samples
10:00am Break
10:15am Collecting bed material samples
11:00am Collecting bedload samples
Adjourn by Noon

**INSTRUCTORS:**
**Gary Johnson** is currently the Operations Coordinator for the USGS Central Midwest Water Science Center. Gary has a BS in General Engineering and a Masters in Public Administration, both from the University of Illinois. Gary has completed a variety of Surface Water quantity, bathymetric, sediment and water quality projects and has a passion for collection and dissemination of high-quality water-resources data. Gary serves as the Course Coordinator of the USGS "Sediment Data Collection Techniques" course, held annually in the Pacific Northwest. Kurt Spicer is a Supervisory Hydrologic Technician from the Cascades Volcano Observatory in Vancouver, WA. Kurt is well known for his diligent long term monitoring of water and sediment discharge at Mount St. Helens. Kurt serves as the Field Coordinator of the USGS "Sediment Data Collection Techniques" course, held annually in the Pacific Northwest.

**Molly Wood** is currently the USGS National Sediment Specialist and acting Hydrologic Networks Branch Chief for USGS Headquarters. She provides technical guidance for and leads initiatives to support national sediment and streamflow monitoring programs and related research. Her scientific work includes the estimation of fluvial sediment transport using surrogate technologies, estimation of reservoir capacity and sustainability, and applications of statistical hydrology. She has provided technical assistance in hydrologic data collection and research to government agencies across the world, including in Iraq, Laos, Chile, and Brazil. She has a B.S. and M.S. in Civil and Environmental Engineering from the University of Tennessee and is a registered Professional Engineer.

**Tim Straub** is currently the Chief of the Federal Interagency Sedimentation Project (FISP) and Program Manager for the USGS Illinois River Basin Next Generation Water Observing System. In his FISP role, he works to help standardize fluvial sediment science methods and instruments. His previous scientific work includes studies concerning stream-restoration evaluations, dam-removal effects, sediment and geomorphic investigations, hydrologic and hydraulic modeling, and statistical analysis of hydrologic data. He has earned Civil and Environmental Engineering degrees from the University of Illinois and Colorado State University and is a registered Professional Engineer.

**SHORT COURSE:**
7. Flow Frequency Analysis using Bulletin 17C

**DATE & TIME:**
Monday, May 8, 2023 from 8:00 am to 12:00 pm

**DESCRIPTION:**
Flood-frequency analysis of peak streamflow records provides the essential statistical interpretation of hydrologic data for estimating flood risk and for floodplain mapping. This workshop will provide an overview and refresher on flood-frequency analysis of peak streamflow data, as well as introducing methods adopted in the Federal guidelines, Bulletin 17C at https://doi.org/10.3133/tm4B5. These methods include a generalized method-of-moments estimator, the Expected Moments Algorithm (EMA), for dealing with zeroes, low outliers and historical data. Bulletin 17C methods also employ a generalized version of the Grubbs-Beck test (MGB) for the identification of potentially influential low floods (PILFs). Participants will learn about the various methods implemented within Bulletin 17C, how to properly characterize data for inclusion in a Bulletin 17C analysis, and how to interpret Bulletin 17C flood frequency analyses. Recent updates and enhancements to Bulletin 17C will be discussed as well. Software with actual examples from Bulletin 17C will be used. The course will run for a half day.

Software with actual examples from Bulletin 17C will be used. The latest version of HEC-SSP (version 2.3-beta, as of 11 July 2022) can be downloaded here: https://www.hec.usace.army.mil/software/hec-ssp/download.aspx. Bulletin 17C Examples can be found here: https://www.hec.usace.army.mil/confluence/display/SSPExamples/Bulletin+17C+Examples. USGS PeakFQ software: PeakFQ - Flood-Frequency Analysis (usgs.gov)

**INSTRUCTORS:**
***Mike Bartles, P.E.***
Mike is a Senior Hydraulic Engineer at the U.S. Army Corps of Engineers Hydrologic Engineering Center in Davis, CA. He is the team lead for the Hydrologic Engineering Center's Statistical Software Package (HEC-SSP). Mike has been with USACE for 13 years, starting with the Philadelphia District in 2009 and joining HEC in 2015. His specialties are statistical hydrology, hydrologic and hydraulic modeling, snowmelt/accumulation, and real-time flood forecasting. michael.d.bartles@usace.army.mil

***Greg Karlovits, P.E., P.H., CFM***
Greg is the Senior Technical Specialist for Statistical and Hydrologic Analysis at the US Army Corps of Engineers Hydrologic Engineering Center in Davis, CA. He is the current team lead for the Hydrologic Engineering Center's Hydrologic Modeling System (HMS) software. Greg has been with USACE for 11.5 years, starting with the Rock Island District in 2011, RMC from 2014-2017, and HEC since 2017. His specialties are in statistical analysis, hydrometeorology, hydroclimatology, and hydrologic modeling. gregory.s.karlovits@usace.army.mil

***Dan Wagner***
Dan Wagner is a hydrologist in the Fayetteville, AR office of the USGS Lower Mississippi-Gulf Water Science Center. Dan started with the USGS in 2006 as a student hydrologic technician and became a hydrologist in 2008. Dan has done a variety of things in his career, including streamgaging, water-quality sampling, hydrographic surveying with sonar and LiDAR, streamflow statistics and trend analysis, and regional flood frequency projects. Currently, Dan works with the USGS Water Mission Area on regional flood skew projects and several USGS water science centers on regional flood frequency projects. dwagner@usgs.gov

***Nancy Barth, Ph.D.***
Nancy Barth is a Hydrologist with the U.S. Geological Survey (USGS) Dakota Water Science Center in Bismarck, North Dakota. She is currently a co-investigator on a multi-year, multi-phase regional study evaluating potential nonstationarity in annual peak flows and changes in seasonality related to hydroclimatic variability in the Midwest. And she is currently updating at-site flood frequency analysis (FFA) in South Dakota. Previously she worked on studies to update FFA estimates at both gaged and ungaged sites in California and Alaska. She also worked with the USGS Office of Surface Water as a corresponding member of the Hydrologic Frequency Analysis Workgroup (HFAWG) under ACWI's Subcommittee on Hydrology to update the federal guidelines for determining flood frequency estimates for Bulletin 17C. In 2018, she completed her doctoral research at the University of Iowa in Civil and Environmental Engineering focused on improving flood frequency estimates based on the hydrometeorologic processes that drive much of the mixed population of flood flow throughout the western United States. Her doctoral research built upon her work as a hydrologist with the USGS to better understand the complex process-driven flood hydrology found in the WUS. nabarth@usgs.gov

**SHORT COURSE:**
8. Introduction to Successful Sediment Transport Modeling

**DATE & TIME:**
Monday, May 8, 2023 from 8:00 am to 12:00 pm

**DESCRIPTION:**
This Workshop will introduce the basic principles of designing a successful sediment transport modeling analysis. It is intended to be a supplement to the panel discussion "**Morphological Modeling**" panel discussion and a complement to the "**SRH-2D sediment modeling**" short course. Participants will be exposed to a wide range of sediment transport modeling applications. The course will discuss the steps necessary in the design of a modeling project: question identification, choice of processes to simulate, limitations of various model types, the role of model zeroing, treatment of depositional features, and review of available models. The importance of understanding model limitations will be emphasized as that is a key to properly designing and interpreting the analysis. Once the model questions are developed and the model selection is complete, we will step participants through the process of completing the study beginning with data collection, proceeding to model setup, model calibration, model simulations, and then uncertainty analysis. The process will be demonstrated using several case studies including degradation downstream of a dam and dam removal.

**INSTRUCTORS:**
**Blair Greimann** has 24 years of experience scoping, performing, and reviewing hydraulic and sediment transport analyses in rivers and reservoirs. His primary focus is the analysis of sediment transport resulting from dam removal, river restoration, water diversion, changing dam operations, and management of reservoir sediment. Some of the projects where he has performed a critical role include the San Joaquin River Restoration Program, the Klamath Dam Removal Studies, Matilija Dam Removal, Glen Canyon Long-Term Experimental and Management Plan, Stanislaus Gravel Augmentation, Red Bluff Pumping Plant on the Sacramento River, and Paonia Reservoir Sedimentation Management. In these projects, he assessed the benefits and risks associated with sediment transport in natural systems analyzing such issues as changes to flood inundation, bed and bank erosion, river-bed material, water quality, and riparian vegetation communities. He was the lead developer of the hydraulic and sediment transport model called SRH-1D (Sedimentation and River Hydraulics – One Dimension) and has applied this model to several of the projects listed above. He has been recognized for his outstanding work by being named Reclamation Engineer of the Year in 2007 and receiving the best paper award in the Journal of Hydraulic Research for work related to his Ph.D. research. He enjoys teaching and mentoring and has taught as an adjunct professor for University of Colorado. He has also organized and given short courses related to sediment transport modeling and reservoir sedimentation training for domestic and international engineers.

**Peter Wilcock** specializes in erosion and sedimentation processes and their application to stream and watershed restoration and management. His research spans grain-scale mechanics, sediment-channel interactions at the reach scale, and the control and management of sedimentation at the watershed scale. Applications include channel restoration, reservoir and channel response to dam removal, and reservoir operations for downstream channel maintenance. He has worked

extensively in experimentation, field observation, and computer simulation of sediment systems and has published more than 100 peer-reviewed articles. Dr. Wilcock has provided expert and litigation consultation to industry and government agencies and has served on many academic and government panels, including three National Research Council committees, one of which he chaired. After receiving his PhD in Earth Science from MIT in 1987, he served on the faculty of the Whiting School of Engineering at the Johns Hopkins University for 27 years and then joined Utah State University to serve as Head of the Watershed Sciences Department in the Quinney College of Natural Resources from 2014 to 2020. Prof. Wilcock is a Fellow of the American Geophysical Union and received the Hans Albert Einstein Award from the American Society of Civil Engineers for outstanding contributions to the understanding of sediment transport in gravel-bed rivers.

**SHORT COURSE:**
9. Sediment Transport Modeling with SRH-2D: Riverine and Watershed Scale

**DATE & TIME:**
Monday, May 8, 2023 from 1:00 pm to 5:00 pm

**DESCRIPTION:**
SRH-2D is a two-dimensional (2D) depth-integrated flow and sediment transport model developed by the Bureau of Reclamation and distributed for general use since 2006. SRH-2D has been applied successfully to an extensive number of engineering projects. Since 2013, FHWA has partnered with Reclamation to further develop and apply SRH-2D for detailed transportation hydraulic analysis and design, including bridge scour evaluation and sediment transport analysis. Recently, SRH-2D has also been extended to erosion and sediment delivery modeling on watersheds.

In this course, key features of SRH-2D will be highlighted, with an emphasis on new applications in riverine and watershed-scale sediment transport simulation, and a training on SRH-2D practical use. Relevant manuals/publications and the latest version will be distributed at the class. A free community version of the SMS interface will also be introduced. An outline of the topics is as follows:

- Introduction
    - General introduction of SRH-2D
    - New features
- Model setup and data requirements
    - Use of SMS Community Version
    - Input data needs
    - Modeling steps
- Sediment transport modeling case studies in rivers
    - Bridge scour analysis
    - Interesting case studies (instream structure, bend scour, contract scour, etc.)
- Watershed erosion and sediment delivery modeling
    - A field case is used to illustrate the use of the model
    -

The learning outcome: Attendees will learn the following: (1) How to use community SMS to generate a 2D mesh and run SRH-2D; (2) Sediment modeling input data needs and modeling steps; (3) Relative importance of model input data; (4) Complex sediment cases that may or may not be simulated with a 2D model, and (5) Erosion and sediment delivery modeling on a watershed.

**INSTRUCTORS:**

**Yong Lai** is a specialist hydraulic engineer at the Technical Service Center, U.S. Bureau of Reclamation, Denver, Colorado. Dr. Lai obtained his Ph.D. in 1990 from Arizona State University and has since been involved in a wide range of research, development and engineering projects. His professional career includes working for a consulting company, a research institute, the University of Iowa, and the federal government. Dr. Lai has published more than 60 scientific journal papers and numerous conference papers in diverse engineering areas. He is the lead developer of SRH-2D - a 2D flow and sediment transport model, and $U^2$RANS - a 3D CFD model. Dr. Lai currently serves as an associate editor of the ASCE Journal of Hydraulic Engineering and a member of the Scientific Advisory Board for several conferences and open journals. He regularly provides short courses on hydraulic and sediment modeling.

**Scott Hogan** has spent more than 30-years working in the field of river engineering hydraulics. For the past 16 years, he has worked with the US Federal Highway Administration (FHWA) and was a consulting engineer prior to that. He graduated from Colorado State University with a B.S. and M.S. in Civil Engineering. Mr. Hogan specializes in bridge hydraulic modeling and design, scour analyses, sediment transport, counter measure design, and floodplain analysis. For more than 25 years he has been an instructor for several hydraulics training courses through FHWA National Highway Institute (NHI). He has a sincere passion for hydraulic engineering and advancing the state of our practice.

**SHORT COURSE:**
10. New Feature and Capabilities in HEC-RAS 6

**DATE & TIME:**
Monday, May 8, 2023 from 1:00 pm to 5:00 pm

**DESCRIPTION:**
This half-day short course will cover many of the new feature that have been added to HEC-RAS. These new capabilities will be introduced, explained, and an example application will walk participants through the use of the features. Instruction on modeling bridges in a 2D flow area and using spatially varied precipitation modeling with a 2D mesh will be provided. Further discussion will cover the acquisition and use of elevation data in RAS Mapper, using initial conditions for 2D simulations, referencing observed data, and inundation mapping options. Participants will be encouraged to interact with the instructors through questions and answers. As time allows, addition capabilities and future development activities will be discussed.

**INSTRUCTORS:**
**Cameron Ackerman** has been working at HEC for more than 25 years. He started his career by bringing GIS capabilities to surface water modeling and has been working towards HEC-RAS' success ever since as the development lead for RAS Mapper. His expertise is in dam breach modeling and river analysis studies and developing GIS-based flood warning systems. Cameron enjoys providing guidance, technical support, and instruction throughout the world with training in more than a dozen countries. Cameron received his BS and MS from the University of California, Davis in Civil and Environmental Engineering. He is a registered Professional Engineer in the state of California.

**Mark Jensen** is the lead programmer for HEC-RAS. Having worked on HEC-RAS for more than 30 years, Mark's technical expertise in river hydraulics and numerical methods have shaped what HEC-RAS is today. While Mark is the HEC-RAS software Technical Lead, he is also the lead for the HEC-RAS water quality and temperature modeling. Mark received his BS and MS from the University of California, Davis in Civil and Environmental Engineering.

**Eric Tichansky** has worked at HEC for 6 years after having worked for the Tulsa District for 6 years. While at HEC, specializes in hydrologic and hydraulic modeling, real-time flood forecasting with CWMS, and consequences estimation (as the previous HEC-FIA application lead). As the newest member to the HEC-RAS team, Eric is focus on rain-on-mesh analysis and providing technical support, education, and guidance to the field. Eric has a BS from the University of Oklahoma in Environmental Engineering. He is a registered Professional Engineer in Oklahoma and a Certified Floodplain Manager.

**SHORT COURSE:**
11. An Overview of Selected Sediment Surrogate Techniques

**DATE & TIME:**
Monday, May 8, 2023 from 1:00 pm to 5:00 pm

**DESCRIPTION:**
This short course would cover highlights of selected sediment surrogate techniques being used or funded for evaluation by the Federal Interagency Sedimentation Project and others. Instructors will present the operational status, use cases, procedural highlights, and limitations of each technique. The short course agenda may change but is expected to include:

*AGENDA:*
1:00 pm Introduction
1:15 pm Surrogates for suspended sediment
2:45 pm Break
3:00 pm Surrogates for bedload sediment
4:30 pm Open Q&A discussion with participants on future research needs in sediment surrogates
5:00 pm Adjourn

**INSTRUCTORS:**
**Molly Wood** is currently the USGS National Sediment Specialist and acting Hydrologic Networks Branch Chief for USGS Headquarters. She provides technical guidance for and leads initiatives to support national sediment and streamflow monitoring programs and related research. Her scientific work includes the estimation of fluvial sediment transport using surrogate technologies, estimation of reservoir capacity and sustainability, and applications of statistical hydrology. She has provided technical assistance in hydrologic data collection and research to government agencies across the world, including in Iraq, Laos, Chile, and Brazil. She has a B.S. and M.S. in Civil and Environmental Engineering from the University of Tennessee and is a registered Professional Engineer.

**Tim Straub** is currently the Chief of the Federal Interagency Sedimentation Project (FISP) and Program Manager for the USGS Illinois River Basin Next Generation Water Observing System. In his FISP role, he works to help standardize fluvial sediment science methods and instruments. His previous scientific work includes studies concerning stream-restoration evaluations, dam-removal effects, sediment and geomorphic investigations, hydrologic and hydraulic modeling, and statistical analysis of hydrologic data. He has earned Civil and Environmental Engineering degrees from the University of Illinois and Colorado State University and is a registered Professional Engineer.

**SHORT COURSE:**
12. Sediment Transport in Stream Channel Design

**DATE & TIME:**
Monday, May 8, 2023 from 1:00 pm to 5:00 pm

**DESCRIPTION:**
It is time for stream channel design to move beyond a template approach to a method that explicitly uses water and sediment supply in a forward design process that incorporates uncertainty, supports alternatives analysis, and accommodates traditional empirical relations in an appropriate supporting role. This short course presents a design approach that begins with specification of desired channel dynamics and then uses estimates of water and sediment supply to explore design alternatives. The method builds on the classic definitions of threshold and alluvial channels. A threshold channel is one for which the bed material is immobile at a design discharge. An alluvial channel is one for which transport capacity is balanced against the rate and grain size of sediment supply. A third type of channel is defined and combines the first two – over-capacity threshold – in which transport capacity exceeds supply but design flows do not exceed threshold limits for channel erosion. This type of channel is more common than often realized, is unintentionally designed in many cases, and offers both advantages and disadvantages that can only be weighed if the design objectives are specifically defined. Uncertainty in water and sediment supply is explicitly included in assessing channel performance. A risk framework is developed for threshold channels and alluvial channels are evaluated in terms of the probability of undesirable aggradation or degradation. At small sediment supply rates, channel performance is relatively insensitive to uncertainty in sediment supply and principles of flow competence may be used to design a threshold-like channel. At large sediment supply rates, the potential for storing or evacuating channel-changing quantities of sediment is much larger. A computational tool will be presented that assists in estimating the sensitivity of channel performance to uncertainty in sediment supply. The tool includes river state diagrams useful for reconnaissance evaluation and channel stability diagrams useful at the planning stage.

The method presented includes a number of important components: (i) it is based on specified channel behavior, such that rates of water and sediment supply and their uncertainty can be directly incorporated in the design process, (ii) it accommodates traditional empirical observations of channel geometry in an appropriate supporting role, (iii) it uses a surface-based mixed-size sediment transport relation that accommodates transient conditions, and (iv) it identifies design channel geometry using the full range of water and sediment supply, rather than a single design discharge. At last, we can move beyond bankfull in designing channels!

Reading materials will be distributed in advance of the course. Spreadsheet models will be made available and used in the short course. Students should bring their own laptops for use during the workshop.

**INSTRUCTOR:**
**Prof. Peter Wilcock** specializes in erosion and sedimentation processes and their application to stream and watershed restoration and management. His research spans grain-scale mechanics,

sediment-channel interactions at the reach scale, and the control and management of sedimentation at the watershed scale. Applications include channel restoration, reservoir and channel response to dam removal, and reservoir operations for downstream channel maintenance. He has worked extensively in experimentation, field observation, and computer simulation of sediment systems and has published more than 100 peer-reviewed articles. Dr. Wilcock has provided expert and litigation consultation to industry and government agencies and has served on many academic and government panels, including three National Research Council committees, one of which he chaired. After receiving his PhD in Earth Science from MIT in 1987, he served on the faculty of the Whiting School of Engineering at the Johns Hopkins University for 27 years and then joined Utah State University to serve as Head of the Watershed Sciences Department in the Quinney College of Natural Resources from 2014 to 2020. Prof. Wilcock is a Fellow of the American Geophysical Union and received the Hans Albert Einstein Award from the American Society of Civil Engineers for outstanding contributions to the understanding of sediment transport in gravel-bed rivers.

**SHORT COURSE:**
13. Debris Flow Analysis with HEC-HMS and HEC-RAS

**DATE & TIME:**
Monday, May 8, 2023 from 1:00 pm to 5:00 pm

**DESCRIPTION:**
The U.S. Army Corps of Engineers (USACE) Hydrologic Engineering Center (HEC) has added debris yield and flow capabilities to its popular hydrologic and hydraulic software. HEC's Hydrologic Modeling System (HEC-HMS) can now compute debris yield and the River Analysis System (HEC-RAS) can simulate the non-Newtonian fluid physics of mud and debris flows associated with post-wildfire events and mine-tailing dam breaches. A four-hour training is being offered that covers hands on application of debris simulation capabilities in both HEC-HMS and HEC-RAS. The course will be delivered in two parts, each two-hours in length with breaks integrated as appropriate.

*Part One: Debris Yield Analysis Using HEC-HMS*
HEC-HMS includes five debris yield methods - LA Debris Method EQ.1, LA Debris Method EQ 2-5, Multi-Sequence Debris Prediction Method (MSDPM), U.S. Geological Survey (USGS) Long-Term Debris Model, and USGS Emergency Assessment Debris Model - that simulate the post-wildfire debris yield processes from burned watershed areas. The overall goal of Part 1 of the short course is to use the debris yield methods in HEC-HMS for debris yield calculation from burned watershed areas. The first objective is to understand sediment and debris yield process and the empirical debris yield equations implemented in HEC-HMS (Lecture). The second objective is to develop debris yield model including parameter estimation and calibration using HEC-HMS (Hand-on workshop).

*Part Two: Non-Newtonian Mud and Debris Transport Using HEC-RAS*
Part Two will use debris yield results from HEC-HMS as boundary conditions for the mud- and debris-flow simulations in HEC-RAS. This session will introduce the non-Newtonian physics that HEC-RAS uses to simulate these high-concentration events and go through the interface and input parameters required to model these flows in HEC-RAS. Participants will learn how to parameterize an HEC-RAS model to compute the effects of post-wildfire or mine-tailing debris on flood depth, flood warning time, and mapping the debris inundation floodplain.

Training participants will need to download the latest versions of HEC-RAS and HEC-HMS at https://www.hec.usace.army.mil/software/. Other training materials will be available about one week before the scheduled training. Please contact Jay Pak at jay.h.pak@usace.army.mil with HEC-HMS, debris yield, and post-fire hydrology questions and Stan Gibson at stanford.gibson@usace.army.mil with HEC-RAS and Non-Newtonian mud and debris transport questions.

**INSTRUCTORS:**
***Jang (Jay) Pak, Ph.D***. has worked at USACE for more than 20 years, and is currently a senior research hydraulic engineer in the Hydrology & Statistics Division at the HEC. Previously he has worked at the Far East and Los Angeles USACE Districts as a hydraulic engineer and

supervisory civil engineer. His areas of expertise include surface water hydrology, post-fire hydrology, river hydraulics, debris flow analysis, land surface erosion and debris yield, and damage reduction and impact analysis. He also has expertise in geology, geotechnical engineering, coastal engineering, and project/program management. Dr. Pak received his Ph.D. and Master's degrees in Civil and Environmental Engineering from the University of Southern California. His Ph.D. research focus involved real-time debris prediction models incorporating wildfire and subsequent storm events. He is a registered civil engineer in the state of California.

***Stanford Gibson, Ph.D***. is the sediment specialist at the Hydrologic Engineering Center (HEC) where he has worked for 20 years. He is responsible for the sediment transport capabilities in HEC-RAS. His areas of expertise include sediment modeling, debris flow, sustainable reservoir sediment-management analysis, and dam removal simulations. Dr. Gibson also regularly applies sediment models to support ecosystem restoration, flood damage reduction, and navigation projects, and has taught hydraulics and sediment transport in more than 10 countries. He earned a Ph.D. in Civil and Environmental Engineering from UC Davis, and a Master's degree in Geotechnical Engineering, Restoration Ecology, and Theology. Within the last five years, Dr, Gibson received the USACE Engineers Hydrology, Hydraulics, and Coastal Practitioner of the Year award, and was recognized as the Hydrologic Engineering Center and Institute for Water Resources Employee of the Year and for research of the year for the Flood and Coastal and Regional Sediment Management programs in USACE. Dr. Gibson has published more than 15 papers in peer reviewed journals and more than 50 other publications. He sometimes posts YouTube videos on sediment modeling topics: https://www.youtube.com/user/stanfordgibson

**SHORT COURSE:**

14. Predicting fish response to infrastructure and management in different environments: the Eulerian-Lagrangian-agent Method (ELAM)

**DATE & TIME:**

Friday, May 12, 2023 from 8:00 am to 12:00 pm

**DESCRIPTION:**

This half-day short course will introduce participants to the basic capabilities and use of the USACE ERDC-EL Eulerian-Lagrangian-agent Method (ELAM) model for describing past (hindcasting) and predicting future fish response to infrastructure and management design alternatives. ELAM model development dates back nearly 25 years (August 1998) and has leveraged over $65 million dollars worth of river and fish movement/passage data near infrastructure. The model is not perfect, and limitations will be discussed. However, the ELAM model has achieved unique success in predicting future 3-D/2-D fish movement, passage, and entrainment patterns. Specifically, the ELAM model has accurately predicted fish patterns prior to the availability of field data for specific river and infrastructure operating conditions. Further, the ELAM has performed well on out-of-sample data where the future condition was different from the calibration conditions. ELAM applications to date include predicting fish passage at Columbia and Snake River Dams, where model output was part of the engineering design process for both Federal and Public Utility District hydropower facilities. The ELAM is also part of the California Department of Water Resources design process for fish guidance and entrainment at tidal river junctions within the Bay-Delta. Emerging applications include upstream-migrating fishes in the Laurentian Great Lakes.

Participants will gain a sense of the growing ELAM application portfolio and what is involved in applying the model to different river contexts. For the workshop, participants do not need to be able to run the ELAM model to gain useful information about applying the tool to their own projects. The ELAM model is not a GUI-based support tool, the ability to write computer source code in C++ and Fortran90 is (as of the current version) a prerequisite. However, participants will gain a sense of the type of applications easily done in-house, as part of the growing user community, or by a growing list of experienced ELAM users.

An executable form of the ELAM model will be made available to participants before the workshop. To run the ELAM model at the workshop, one will need a laptop with a specific version of the latest macOS or Windows operating system, which will be determined weeks before the workshop. It is anticipated that the prerequisite of a certain operating system will hinder many participants from being able to run simulations on the day of the workshop; for this reason, the workshop will mostly focus on describing applications and how to make best use of the self-guided user manual. Participants interested after the workshop can contact Dr. R. Andrew Goodwin (Andy.Goodwin@usace.army.mil) for the underlying source code in concert with existing ERDC-EL distribution policies. To run the ELAM model at the workshop, participants will need the following software installed: www.tecplot.com/products/tecplot-360/. A 3-day free trial (full version) is available via the Tecplot website, and a 30-day free trial is available by contacting San Lian (email: s.lian@tecplot.com).

Participants will leave the course with enough understanding of the technology to begin the process of applying the ELAM model to their own work.

**INSTRUCTOR:**

**Dr. R. Andrew Goodwin** has worked at USACE for more than 20 years stationed in Portland, Oregon, and is currently a senior research environmental engineer in the Environmental Processes & Engineering Division, Environmental Laboratory of the U.S. Army Engineer Research & Development Center. His areas of expertise include modeling (hindcasting, predicting) animal movement behavior near infrastructure, particularly fish in rivers, reservoirs, and estuaries. Dr. Goodwin received his Ph.D. and M.S. degrees in Civil and Environmental Engineering (Environmental Systems Engineering) from Cornell University and a B.S. in Civil Engineering from Virginia Tech. His Ph.D. research focus involved modeling fish cognition and sensory ecology in relation to 3-D river hydrodynamic models. Dr. Goodwin's work with USACE has been published in peer-review scientific journals such as *Ecological Modelling*, *Journal of Theoretical Biology*, *BioScience*, and the highly prestigious *Proceedings of the National Academy of Sciences of the United States of America*. He is a registered civil engineer in the State of Oregon.

**SHORT COURSE:**
15. CE-QUAL-W2 Hydrodynamic and Water Quality Modeling in Support of Reservoir Operations

**DATE & TIME:**
Friday, May 12, 2023 from 8:00 am to 12:00 pm

**DESCRIPTION:**
CE-QUAL-W2 is a water quality and hydrodynamic model in 2D (longitudinal-vertical) for rivers, estuaries, lakes, reservoirs and river basin systems. W2 models basic eutrophication processes such as temperature-nutrient-algae-dissolved oxygen-organic matter and sediment relationships. The current model release is Version 4.5. CE-QUAL-W2 can be freely accessed and downloaded from the Portland State University website: http://www.ce.pdx.edu/w2/.

Topics to be covered include an overview of CE-QUAL-W2 model; hydrodynamics and transport modeling; water quality capabilities in CE-QUAL-W2; water quality model data requirements and inputs; setting up a water quality model for simulating water temperature, general constituents, and nutrients; water quality model calibration and sensitivity analysis.

To provide attendees with the knowledge to effectively utilize the latest CE-QUAL-W2 model to perform two-dimensional water quality modeling and analysis in support of reservoir and riverine water quality, environmental impact assessment, and ecosystem restoration projects. The workshop is designed for practicing engineers and scientists in consulting engineering, local, state, and federal agencies, research organizations, and academic institutions. Having completed this course, attendees will gain a working knowledge of the CE-QUAL-W2 water quality model. Through a combination of lectures and hands-on exercises, attendees will learn to use CE-QUAL-W2 to set up, calibrate, and validate a river water quality model and perform an analysis of water temperature, general constituents, and eutrophication.

Attendees are encouraged to bring their own notebook computer. In addition participants should have administrator privileges on their computer in order to install the software. HOWEVER, participants are welcome to attend the workshop without a computer with the understanding that one will not be provided.

Schedule**:** (Subject to modification)
- Welcome and introductions (15 minutes)
- Overview of latest CE-QUAL-W2 (45 minutes)
- Break (10 minutes)
- CE-QUAL-W2 data requirements, model development, demonstration (60 minutes)
- Break (10 minutes)
- CE-QUAL-W2 case studies – modeling water quality management and reservoir operations (70 minutes)

**INSTRUCTORS:**
**Dr. Zhonglong Zhang** has a PhD in Biosystems Engineering from Clemson University. He is a Research Professor and Principal Investigator of Civil and Environmental Engineering at

Portland State University. He has been working side-by-side with the U.S. Army Corps of Engineers ERDC and HEC team for the development of watershed, riparian vegetation, water quality, and multimedia environmental modeling capabilities and software. He is the primary author of water quality modules that are currently coupled with HEC-RAS, HEC-ResSim as a companion water quality model. He is a major contributor of the latest version of CE-QUAL-W2 model. He has conducted a wide range of hydraulic and water quality modeling applications for many of the major US river systems. Additionally, he has provided modeling review and technical support for several districts of the U.S. Army Corps of Engineers. Currently he serves as the Vice President for Academic Affairs of the American Institute of Hydrology (AIH).

**Dr. Todd E. Steissberg** is a Research Environmental Engineer at the Environmental Laboratory, U.S. Army Engineer Research and Development Center (ERDC). He and his team develop and apply water quality and environmental systems models for rivers, reservoirs, and watersheds. The objective of his research is to provide interdisciplinary teams with the tools and methods needed to perform integrated watershed-scale environmental impact assessments, improve real-time water quality management, and design and implement ecosystem restoration projects that incorporate natural and nature-based features to enhance the health and resiliency of ecosystems and communities. Dr. Steissberg obtained his B.S. in Civil Engineering from Washington State University, where he researched air pollution chemistry and transport processes and aquatic ecosystem restoration. He obtained his M.S. and Ph.D. in Civil and Environmental Engineering from University of California, Davis, while serving as a NASA Earth System Science fellow at NASA/JPL, researching satellite remote sensing, physical limnology, and water quality. As a Postdoctoral Researcher at the Tahoe Environmental Research Center, John Muir Institute of the Environment, University of California, Davis between 2008 and 2010, he developed methods to characterize nearshore and offshore water quality and its spatial-temporal variability using satellite and field measurements. Dr. Steissberg lead development and application of water quality models and geospatial tools as a Senior Research Hydraulic Engineer at the U.S. Army Corps of Engineers Hydrologic Engineering Center (USACE-HEC) between 2008 and 2019. In 2019, he transitioned to ERDC to continue his research, serve as a water quality expert for USACE, and build a team of researchers to address complex issues in water quality and water resource modeling, ecosystem restoration, and environmental resiliency and adaptation of freshwater and coastal ecosystems, civil works infrastructure, and military installations under the threat of climate change. Dr. Steissberg is the lead developer of ERDC's CE-QUAL-W2 model and the Corps Library for the Environmental Analysis and Restoration of Watersheds (ClearWater) and continues to lead water quality capability development for the HEC models (HEC-RAS, HEC-ResSim, and HEC-HMS) and the Gridded Surface Subsurface Hydrologic Analysis (GSSSHA) program.

**SHORT COURSE:**
16. Natural Infrastructure Design for Riverine Environments

**DATE & TIME:**
Friday, May 12, 2023 from 8:00 am to 12:00 pm

**DESCRIPTION:**
Natural infrastructure generally involves a family of infrastructure planning and design approaches that emphasize the need to expand the scope of benefits and reduce unintentional costs with a particular focus on social and environmental outcomes. These holistic management actions go by many names, including nature-based solutions, natural and nature-based features, and Engineering With Nature. The river engineering community has long embraced many of these practices, although the science and practice of natural infrastructure design has grown dramatically in recent years. This short course seeks to generally advance attendees' knowledge of Engineering With Nature® practice in rivers with the following specific objectives:

- Improve understanding of how conventional infrastructure and natural infrastructure can be integrated to do the right project, and do the project right;
- Familiarize participants with recent guidelines on natural infrastructure including the USACE International Guidelines on Natural and Nature-based Features;
- Expose participants to riverine case studies to improve technical understanding of natural infrastructure projects, processes, and benefits; and
- Build awareness of opportunities for expanding acceptance and deployment of natural infrastructure.

**INSTRUCTORS:**
**Kyle McKay** is a research civil engineer with the U.S. Army Engineer Research and Development Center (ERDC) Environmental Laboratory (EL). He received a B.S. in Environmental Engineering from Colorado State University, an M.S. in Civil Engineering from University of Illinois Urbana-Champaign, and a Ph.D. at the University of Georgia's Odum School of Ecology. His research focuses broadly on examining ecological effects of water resources infrastructure with applications related to urban ecosystem restoration, ecological models, dam operations and decommissioning, and flood risk management. He is stationed in New York City to facilitate cooperative research between the ERDC, local U.S. Army Corps of Engineers offices, the City University of New York, and other local partners. He is adjunct faculty at the University of Georgia and Brooklyn College and is registered as a Professional Engineer in the State of Georgia.

**Edward Brauer** is a senior hydraulic engineer in the USACE St. Louis District (MVS) and regional technical specialist in river engineering for the Mississippi Valley Division. He has 19 years of project experience, which includes navigation; environmental restoration; research on river-training structures, including physical effects and environmental impacts; sediment transport; geomorphology; field methods; and lock design on rivers within the U.S., South America, and Europe. He has developed and led classes on shallow draft navigation and river-training-structure design and construction (including EWN topics) for engineers in the U.S. and Brazil. He is a member of the USACE River Engineering Committee, the chair of the River Engineering Working Group, the secretary of the World Association for Waterborne Transport

Infrastructure (PIANC) Environmental Commission, and an adjunct professor at St. Louis University.

**Dr. Brian Bledsoe** is a Georgia Athletic Association Distinguished Professor in the College of Engineering at the University of Georgia. Brian has over 25 years of experience as a civil and environmental engineer, hydrologist, and environmental scientist in the private and public sectors. Before entering the professorate, he worked as a consulting engineer and surveyor, and for the State of North Carolina as a watershed restoration specialist and nonpoint source program coordinator. Brian's research is focused on the interface of engineering, hydrology, and ecology with an emphasis on water quality, stormwater, flood hazards, infrastructure, and restoration of river and wetland ecosystems. He received a National Science Foundation CAREER Award in 2006, served as a Fulbright Scholar in Chile in 2008, and is currently president of the American Ecological Engineering Society. Brian's advisory activities include the Everglades and Louisiana Coastal Area restoration efforts, the Platte River and San Juan River Recovery Implementation Programs, the Environmental Protection Agency Environmental Monitoring and Assessment Program, Engineers Without Borders, and collaborative water planning and management with numerous municipal, industrial, and agricultural partners.

**Aubrey Harris** is an engineer in the US Army Corps of Engineers, Albuquerque District, Hydraulics and Hydrology Division. Her projects pertain to habitat restoration and infrastructure issues in the Middle Rio Grande, with expanding interest to watersheds in the Southwestern United States. She uses spatial analysis and hydraulic engineering to research and fulfill various and competing water systems concerns. She received a B.S. in Biological and Agricultural Engineering from Texas A&M University, an M.S. in Civil Engineering from West Virginia University, and a Ph.D. at the University of New Mexico. She is registered as a Professional Engineer in the State of New Mexico.

**SHORT COURSE:**

17. Data driven support of resilience decision making: US Army Corps of Engineers climate preparedness tools, data, and approaches

**DATE & TIME:**

Friday, May 12, 2023 from 8:00 am to 12:00 pm

**DESCRIPTION:**

An overarching objective of the U.S. Army Corps of Engineers (USACE) is to continuously evaluate and anticipate vulnerabilities, risks, and resilience of the nation's water resource infrastructure for the many purposes it serves. Evidence of non-stationarities in the observed records that are the basis for design and water management decisions is increasing, heightening the necessity for incorporating projections of future hydroclimatic conditions into decision making.

Over the past-decade the U.S. Army Corps of Engineers has invested in the development of datasets, analytical tools, and technical guidance for incorporating the effects of climate change into decision making. The datasets include ensembles of climate and hydrological projections available for CONUS, Alaska, and Hawaii. A suite of publicly available web applications facilitate analysis of historical observationally derived and projected hydroclimatic variables. These web applications include a toolbox of statistical capabilities to support timeseries and non-stationarity analyses, a web platform for evaluating observed and projected sea level rise, and a web platform for analyzing projections of precipitation, temperature, and streamflow.

This proposed short course will include:

1) An overview of USACE climate policy and technical guidance
2) A theoretical background of the datasets and tools maintained by USACE supporting climate resilience decision making
3) Hands on applications of publicly available resources, including example interpretations

**INSTRUCTORS:**

**Will Veatch, PhD PH** Acting lead of USACE Climate Preparedness and Resilience Community of Practice USACE Headquarters

Will Veatch is a Hydrologist with twelve years' experience, with the New Orleans District and more recently USACE Headquarters. He served in the Water Management Section of the Hydrology and Hydraulics Branch of the New Orleans District, and was also a Regional Technical Specialist for Climate Change Adaptation for the Mississippi Valley Division. Since February 2021, he has been the acting lead for the USACE Climate Preparedness and Resilience Community of Practice. Mr. Veatch holds a BA degree in Environmental Studies (Hydrology focus) from the University of Colorado and an MS degree in Hydrology from the University of Arizona. He completed a PhD at the University of Iowa in fall of 2022. He is a registered Professional Hydrologist with the American Institute of Hydrology.

**Chris Frans, PhD PE** USACE Climate Preparedness and Resilience Community of Practice Subject Matter Expert, USACE Seattle District

Chris has been a civil engineer with USACE Seattle District since 2015. Chris is a regional technical specialist for hydrology and climate change for the Northwest and leads multiple

climate change efforts for the Columbia River Reservoir system. Chris also serves as a national subject matter expert assisting with the conception and review of climate change applications, oversight of research and development conducted by external contractors, and developing technical guidance. He is currently serving a detail for USACE HQ as a Senior Policy Advisor. Prior to joining USACE Chris completed a PhD in Civil Engineering at the University of Washington with a dissertation focused on modeling the effects of climate change on water resources in mountainous regions. He is a registered Professional Engineer in the State of Delaware.

Potential Instructors:
**Brantley Thames, PE** USACE Climate Preparedness and Resilience Community of Practice National Policy Advisor: Climate and Military Programs, USACE Louisville District

**Chanel Mueller, PE** USACE Climate Preparedness and Resilience Community of Practice Subject Matter Expert, USACE Saint Paul District

**Arianne Pinson, PhD** USACE Climate Preparedness and Resilience Community of Practice Subject Matter Expert, USACE Albuquerque District

**SHORT COURSE:**
18. Risk and Uncertainty Principles for Flood Control Projects

**DATE & TIME:**
Friday, May 12, 2023 from 8:00 am to 12:00 pm

**DESCRIPTION:**
In the 1990's, the U.S. Army Corps of Engineers, the primary custodians of the U.S. river systems, decided that future flood control projects would be designed based upon Risk and Uncertainty principles (R&U). Although R&U had been utilized in other industries, this was the first time it was to be applied to water resources projects on such a grand scale. This workshop will present the concept of uncertainty (both in nature and in the tools that are used by water resources engineers), principles of R&U in an easily understandable manner and how they are applied to flood control design. It will also explore risk, uncertainty, and probabilistic approaches for hydrologic sciences and engineering.

Upon completion of this workshop, you will be able to:
- Determine the differences between the types of uncertainties
- Identify how R&U is used in water resources projects and specifically levee design
- Understand how PDFs are transformed to CDFs and how they are used in R&U analysis
- Comprehend how uncertainties in hydrology and hydraulics are interrelated

Benefits:
- Distinguish between natural and human induced uncertainty
- Find out how FEMA and the U.S. Army Corps of Engineers view R&U analysis
- Discover the sources of uncertainty and how they affect risk
- Ascertain the benefits of R&U analysis versus the traditional deterministic methods
- See how to define uncertainty in hydrology and hydraulics

Outline:
- Definitions of risk and uncertainty
- Relationship between risk and uncertainty
- Types of uncertainty
- Definitions used in uncertainty analysis
- The Monte Carlo method
- What are PDFs and CDFs
- How is R&U used in water resources
- Uncertainty in hydrology
- Uncertainty in hydraulics
- Applications of R&U to levee design and the reason

**INSTRUCTOR:**
**David T. Williams**, Ph.D., P.E., P.H., CPESC, D.WRE, F.ASCE, CFM is President of David T. Williams and Associates. A registered professional engineer in 11 states, Dr. David T. Williams has a variety of work experience which includes National Technical Director for Water Resources for PBS&J (now Atkins) and HDR, co-founder and President of WEST Consultants (a

nationally recognized water resources engineering firm), the U.S. Army Corps of Engineers (USACE), and adjunct professor at San Diego State University. His professional experience includes being an Airborne Combat Engineer with the 7th Special Forces Group (Green Berets), over 18 years as a hydraulic engineer with the USACE at the Waterways Experiment Station (WES, now ERDC) in Vicksburg, MS, both the Nashville and Baltimore Districts, and the Hydrologic Engineering Center (HEC) in Davis, CA. While at WES, Dr. Williams worked on national research applications of sediment transport in rivers and reservoirs and the solution of unusual hydraulic and sediment related problems using computer models and state-of-the-art techniques. During the 1970's, Dr. Williams helped in the development of spatial data management techniques and evaluation of the economic benefits of flood control projects while at HEC which were subsequently used on a national basis. He has presented short courses throughout the U.S. and overseas for the American Society of Civil Engineers (ASCE) and other professional and public organizations such as ASFPM and FMA on computer training using HEC-2, HEC-RAS, HEC-HMS, Bridge Scour and HEC-6 in addition to courses on channel toe protection design, sediment transport, stream restoration, fluvial geomorphology and streambank protection. His national society activities have included past chairs of the ASCE/EWRI Committees on Sedimentation, Computational Hydraulics, Probabilistic Approaches and Stream Restoration as well as past President of the International Erosion Control Association (IECA). He is a registered Professional Hydrologist (PH), a Certified Floodplain Manager (CFM), a Diplomate of the American Academy of Water Resources Engineers (D.WRE) and a Fellow and Life Member of ASCE.

David T. Williams and Associates
13611 E. 104th Ave., Suite 800, PM 100
Commerce City, CO 80022
Ph: (619) 823–4778. Email: David@dtwassoc.com

**SHORT COURSE:**
19. Reservoir Sedimentation Monitoring and Prediction

**DATE & TIME:**
Friday, May 12, 2023 from 8:00 am to 12:00 pm

**DESCRIPTION:**
All reservoirs face the threat of sedimentation. To transition from the traditional "life of reservoir" to a "sustainable management" paradigm requires information on the rate of capacity loss, the consequences of that loss, and the ability to predict how rapidly those consequences will play out under No Action vs. Management Scenarios. Long-term prediction requires key types of monitoring data to develop a reliable calibrated sediment transport model. This short course outlines cost-effective methods to collect needed field data, formats for data display to help identify and understand key sedimentation processes, and demonstrates how these data are then used in the calibration of transport models that may be used to simulate 100+ years of sediment loading on a reservoir. Examples are also given showing how these data can help identify appropriate management alternatives for model testing. An example is presented using the SRH-1D model and physical modeling, but the data collection and calibration approaches apply equally to all types of modeling software. The presenters have decades of experience with reservoir monitoring and predictive modeling at multiple existing and proposed reservoirs in a wide range of environments, including Himalayan and Andean reservoirs with extreme sediment loads.

**INSTRUCTORS:**
**Dr. Gregory Morris** is a world-class professional engineer with over 40 years of experience, working on design problems and lecturing in over 30 countries. Dr. Morris is co-author of the Reservoir Sedimentation Handbook and numerous peer-reviewed publications. He seeks to make the water resources community more aware of cost-effective design and operational practices that can sustain operation of critical reservoir infrastructure.

**Juan Portalatín**

**SHORT COURSE:**
20. Fluvial Geomorphic Processes, Hazards, and Opportunities in Stream Corridors

**DATE & TIME:**
Friday, May 12, 2023 from 8:00 am to 12:00 pm

**DESCRIPTION:**
Streams are not lines, they are corridors! Stream corridors are naturally dynamic environments that bring together physical, biological, and chemical processes all while supporting a host of societal and ecological benefits. When streams and floodplains are treated as static lines on the landscape, stream health declines and risk to human-made infrastructure increases. Providing streams the space they need to accommodate and facilitate natural processes and functions is becoming a central tenet in land, water, and floodplain management practices. But how do we define the stream corridor and effectively communicate the importance of protecting and re-storing the processes that define them? What tools are commonly used to protect and restore stream corridors and how well do they really accomplish this? How do we strategically focus watershed and community-level planning to protect stream corridor functions given limited funding and time?

Participants will be introduced to stream corridor processes (physical and biological) and the various ways of defining them. You will explore more and less compatible management practices and opportunities within stream corridors. Participants will identify and understand the fundamental processes and components of Fluvial Hazard Zone maps and how the FHZ Mapping Program can be ap-plied to manage the stream corridors under their purview.

Anyone interested in stream corridors and functional floodplains—ecological, regulatory, and geomorphic. No prerequisites necessary! This includes (but is not limited to) municipal planners and staff or managers in public works, floodplains and stormwater departments; consultants; and state or federal agency staff with purview over stream corridor regulation, projects, permitting, or other forms of stream management.

**INSTRUCTOR:**
**Joel Sholtes, PhD, PE**, teaches civil engineering specializing in water resources: hydraulics, hydrology and water resource management. His professional and academic experiences focus on physical river processes (river hydraulics, hydrology, and fluvial geomorphology) with applications to stream rehabilitation, riverine infrastructure management, and flood hazards. Dr. Sholtes co-developed the Colorado Fluvial Hazard Zone Program and actively works on river corridor management studies and planning. Prior to teaching at CMU, Dr. Sholtes worked in the Bureau of Reclamation, Sedimentation River Hydraulics Group.