

FRED ERNST, P.E.

Senior Hydraulics & Hydrology Engineer

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EXPERIENCE

30 years in civil / water resources
Principal, Ernst Engineering, LLC
Senior H&H Engineer, ABES Engineering

PROFESSIONAL ENGINEER

AR · AZ · CA · CO · MT · TN · WY
All seven licenses active
NCEES Record holder (comity-ready)

EDUCATION

B.S. Civil Engineering, Cum Laude
Colorado State University
B.A. Geology, Idaho State University

PROFESSIONAL SUMMARY

Licensed civil engineer (PE in seven states) with 30 years of hydrologic and hydraulic practice spanning **watershed- and program-scale H&H modeling, hydraulic structures, scour and sediment transport, slope and erosion protection, and FEMA floodplain certification**. Expert-level HEC-RAS 1D/2D modeler (unsteady flow, rain-on-grid, 2D pipe networks, sediment transport), SRH-2D modeler with 3D bridge structures, and PCSWMM / EPA SWMM 5 modeler, who also produces the **Autodesk Civil 3D design** — channels, embankments, ponds, grading, and earthwork — that turns model results into constructible drawings. Senior H&H technical lead on the City of Memphis MSQ2 stormwater program, managing and reviewing modeling across more than 20 urban drainage basins, and Phase 1 H&H lead on an NRCS PL 83-566 watershed plan in Arkansas. A Beaver Lake stormwater model he developed is the basis of one of the two official HEC-RAS Pipe Networks tutorials published by the USACE Hydrologic Engineering Center. Carries analyses from data collection through agency approval, writes the technical reports, reviews other consultants' models for defensibility, and supports construction through RFIs, submittals, and record drawings.

CORE EXPERTISE

- **Watershed & Program Management:** Multi-basin modeling programs, QC review of other consultants' studies, data and model document control, capital project prioritization, level-of-service alternatives, and cost estimating for municipal decision-makers
- **Hydraulic Modeling:** HEC-RAS 1D/2D unsteady flow, rain-on-grid, 2D pipe networks, 1D/2D coupling, sediment transport and bed change; SRH-2D (SMS) with 3D bridge and pressure-flow structures; HEC-HMS; PCSWMM / EPA SWMM 5 dynamic-wave routing
- **Hydraulic Structures:** Bridges and culverts (including 3D pressure flow), weirs and outlet structures, reservoir spillway rating, stage-storage-discharge development, regional detention, channel modifications, and storm sewer trunk lines
- **Scour, Erosion & Slope Protection:** FHWA bridge scour, 2D bed-change analysis for buried crossings, riprap sizing, articulated concrete block and turf-reinforcement mat alternatives, HEC-15 channel lining, shear-stress and velocity analysis
- **Permitting & Regulatory:** FEMA CLOMR / LOMR / no-rise (MT-1, MT-2), corrected-effective models, HEC-RAS 2D floodway encroachment analysis, floodplain development permits, NRCS PL 83-566 watershed planning
- **Civil 3D Design:** Channel and conveyance design with corridors and custom subassemblies (Subassembly Composer), detention and pond grading, embankments, earthwork and mass haul, LiDAR / bathymetric surfaces, pipe networks with HGL/EGL
- **GIS & Automation:** ArcGIS Pro, LiDAR terrain processing and breakline enforcement, watershed discretization, Python / ArcPy toolboxes (Green-Ampt parameterization, flood-depth comparison rasters), PCSWMM automation, QGIS
- **Project Delivery:** Technical reports, drawings and specifications, opinions of probable cost, alternatives analysis, peer and QC review of others' models, stakeholder presentations, construction-phase services

Software: HEC-RAS 6.x / 7.0 · SMS / SRH-2D · HEC-HMS · PCSWMM · EPA SWMM 5 · Autodesk Civil 3D · ArcGIS Pro · QGIS · HY-8 · Python · Excel / VBA

SELECTED PROJECT EXPERIENCE

WATERSHED PROGRAM MANAGEMENT – CITY OF MEMPHIS MSQ2

Senior H&H technical lead for ABES Engineering on the Memphis Stormwater Quality & Quantity (MSQ2) program, a City-wide effort to reduce chronic urban flooding through data-driven capital planning. Reviewed H&H studies by other consultants across more than 20 urban drainage basins (Wolf River, Nonconnah Creek, Loosahatchie, and Horn Lake Creek); organized models, studies, and GIS into a program document control system; coordinated model reviews with the Surface Water Institute; prioritized City-wide “QuickStart” projects; and developed level-of-service alternatives, regional detention designs, and cost estimates presented to City directors.

- **Mountain Terrace (\$31.4M opinion of probable cost; 1,450-ac model domain):** First MSQ2 study in HEC-RAS 2D with a coupled pipe network. Concept of 5,610 LF of new and upsized conduits with an 8 ft x 4 ft to 16 ft x 8 ft box trunk, 24 inlets, and three regional detention ponds (42.9 ac-ft, ~85,900 CY) graded in Civil 3D; reduces 10-yr building inundation by 68%. Prepared the full infrastructure inventory and a bid tabulation with quantities derived from the model geometry.
- **Wilson Road / The Links (1,132 ac):** Four linked detention ponds with backwater and flow-reversal analysis in SWMM, a 72-inch diversion, HEC-RAS 2D lateral conveyance, outlet structures, and Civil 3D pond grading.
- **Belvedere Blvd, LCK_12 (211 ac):** PCSWMM with 42 subcatchments and Modified Green-Ampt; a new 5 ft x 12 ft RCBC trunk line cut 10-yr / 100-yr inundation by 57% / 34%; \$9.5M opinion of probable cost.
- **Otter Lake East Tributary, FOR_02 (112 ac):** 10-yr and 25-yr LOS alternatives that eliminated inlet flooding and reduced structure inundation; \$1.44M / \$1.60M estimates.
- **Also:** Ridgemont / Trudy channel modification (SWMM + HEC-RAS 2D), Evergreen century-old box sewer rehabilitation, Falcon Park and Canary Lane regional detention, and City drainage manual revision.

WATERSHED, RESERVOIR & RIVER MODELING

Long Lake Bayou Watershed Plan – NRCS PL 83-566

Helena-West Helena & Elaine, AR | 2025–Present
 Arkansas Black Mayors Association (Long Lake & Little Bee Bayou) • Role: Phase 1 H&H Lead

- Leading HEC-RAS 2D rain-on-grid modeling of flat, storage-dominated Delta watersheds; built an ArcPy toolbox for Green-Ampt parameters from gSSURGO limiting-layer Ksat; performed QC review of 30% drainage plans and other consultants' models.

Cub Creek Lake No. 2a Reservoir & Causeway Model

Hardeman County, TN | 2023
 West Tennessee River Basin Authority • Role: Lead H&H Modeler

- Built the HEC-RAS 2D rain-on-grid model of the 2,966-acre watershed (NOAA Atlas 14, 10-yr 24-hr SCS Type II, 5.54 in.) with LiDAR terrain, breakline enforcement, NLCD land cover, and gSSURGO soils; the model became the basis of design for a causeway partitioning the lake into wet and dry basins with two-way flow transfer.
- Developed the principal spillway rating for the 1963 multi-stage outlet in EPA SWMM 5 (full dynamic-wave equations) and coupled it into HEC-RAS 2D for dynamic routing; peak inflow of about 1,536 cfs attenuated to about 37 cfs, below emergency spillway activation. Delivered on schedule and within budget.

Sunset Lake / Wolf River Harbor Feasibility Study

Memphis, TN
 Wolf River watershed • Role: H&H Lead

- Led H&H analysis of the hydraulic interaction between the harbor, proposed lake conditions, and Mississippi River stages; evaluated weir structure concepts for water-level control on the deauthorized waterway section north of the Gayoso Pump Station.

Farnsworth-Scharding Lake Feasibility Study

Shelby County, TN | 2020
 Shelby County • Role: Senior Engineer / Project Manager

- Evaluated options for a small County-owned lake under TDEC criteria, using HEC-HMS hydrology, EPA SWMM 5 spillway hydraulics, and Civil 3D bathymetric volume and spillway grading; prepared cost estimates and the report to the County.

SCOUR, SEDIMENT TRANSPORT & EROSION PROTECTION

Little Thompson River Water Main Crossing – 2D Sediment Transport

Berthoud, CO | 2025
 For Tait Engineering • Role: Lead HEC-RAS 2D Sediment Transport Modeler

- Modeled bed change, sediment load capacity, and bed elevation over a six-hour 1% AEP hydrograph for a 16-inch HDPE main beneath the river, using survey bathymetry and gSSURGO gradations, with hydraulics aligned to the FEMA-approved LOMR. Predicted peak scour of about 8 ft at the alignment with partial bed recovery, and set burial depth and armoring recommendations.

Galloway Levee Road Bridges – SRH-2D with 3D Bridge Structures

Shelby County, TN
 Role: Lead Hydraulic Modeler

- Modeled three bridge crossings and a 48-inch culvert in SMS / SRH-2D with 3D bridge geometry and pressure flow to support a LOMR; performed bridge scour depth predictions. The new LiDAR-based model computed water-surface elevations 0.44 ft below the FEMA regulatory elevation.

Fletcher Creek No-Rise Study – 42-inch Sanitary Sewer Crossing

Memphis, TN
 Zone AE regulatory floodway, Q100 = 6,138 cfs • Role: H&H Engineer

- Developed HEC-RAS 2D no-rise analysis for bank stabilization at the crossing, testing six slope-protection alternatives with HEC-15 (Blodgett) roughness; showed Class C riprap would cause a +0.88 ft rise, and certified the selected Flexamat alternative as no-rise.

Fossil Creek Pedestrian Bridge

Fort Collins, CO

Role: Hydraulic Engineer

- Corrected the FEMA effective HEC-RAS model, evaluated bridge impacts at the 100-year flow (3,616 cfs), computed bridge scour, and designed riprap erosion protection for the floodplain special review.

FEMA FLOODPLAIN CERTIFICATION

Parmalee Gulch CLOMR – FEMA Case No. 23-08-0632R (Approved)

Jefferson County, CO | 2024

Role: Principal H&H Engineer

- Replaced a 1981 HEC-2 effective model with a HEC-RAS 2D model built from 2019 LiDAR and survey for a twin 10 ft x 5 ft RCBC crossing (10% / 1% AEP = 875 / 2,675 cfs). Reduced 1% AEP overtopping by more than 1 ft; managed the MT-2 package and agency coordination through FEMA approval on December 2, 2024.

Whiteman's Creek Floodway Modification – Nettleton High School

Jonesboro, AR | 2025–2026

For Fisher Arnold • Role: H&H Lead

- Built a corrected-effective HEC-RAS 2D model (Q100 = 4,865 cfs) showing that the legacy HEC-2 floodway was overstated. Now defining a revised regulatory floodway with HEC-RAS 2D encroachment tools for the FEMA LOMR, within a 1.0 ft surcharge and accommodating about 27,000 CY of fill, to reclaim developable campus land.

South Cypress Creek Post-Construction LOMR

Memphis, TN | 2026

Shelby County • Role: H&H Lead

- Developed the HEC-RAS 2D LOMR approach and scope, and the technical justification to the County floodplain administrator, for 4,757 LF of multi-phase stream restoration with creek realignment, beaver dam analogs, riffles, wetland channels, and riprap energy dissipators.

PROFESSIONAL EXPERIENCE

Principal | Ernst Engineering, LLC — Fort Collins, CO

2002 – Present

- Senior H&H Engineer (subconsultant) to ABES Engineering, Memphis, TN:** Leads modeling, design, and reporting for municipal, county, river basin authority, and NRCS-funded work in Tennessee and Arkansas.
- FEMA CLOMR/LOMR, no-rise, bridge hydraulics, and scour studies in Colorado, Texas, Tennessee, and Arkansas; obtains floodplain development permits for work in Special Flood Hazard Areas.
- Heavy-civil site design for oil and gas facilities on federal and private lands: a 30-acre crude-oil terminal (mass grading, detention, and secondary containment), plus access roads, well pads, and pipeline corridors to BLM standards.
- Construction-phase services and forensic engineering: remedial grading and drainage designs, agency submittals, RFI responses, construction redlines, and expert testimony in six construction-defect matters.

Senior Engineer | The Sear-Brown Group — Fort Collins, CO

1996 – 2002

- Bridge and culvert capacity, bridge scour, and channel analysis (HEC-RAS, HY-8, HEC-15, HEC-22); drainage routing studies in EPA SWMM, EXTRAN, and XPSWMM; site grading, road, and utility design.

Earlier Experience | Engineering Inspector, Larimer County Engineering Department (1995–1996); Staff Professional, Hydrogeology, Delta Environmental Consultants (1989–1992)

PROFESSIONAL RECOGNITION

- USACE Hydrologic Engineering Center (HEC) – Official HEC-RAS Tutorial:** A Beaver Lake stormwater model developed by Fred Ernst is the basis of “Pipe Networks – SWMM Import Beaver Lake,” one of the two official HEC-RAS Pipe Networks tutorials, which teaches engineers to convert EPA SWMM models into HEC-RAS pipe networks.

PROFESSIONAL REGISTRATIONS

Professional Engineer (Civil), all active: Arkansas No. 25068 · Arizona No. 64891 · California No. 95418 · Colorado No. 35830 · Montana No. PEL-PE-LIC-60310 · Tennessee No. 134744 · Wyoming No. 9916

NCEES Record holder, which supports expedited comity registration in additional states.

EDUCATION, TRAINING & AFFILIATIONS

- B.S., Civil Engineering**, Colorado State University, 1996 — Cum Laude (3.78 GPA)
- B.A., Geology**, Idaho State University, 1987
- UNESCO certificate, Hydraulic Modeling with HEC-RAS; UWRI Urban Channel Design and Flow Analysis
- American Society of Civil Engineers (ASCE) · Colorado Association of Stormwater & Floodplain Managers (CASFM)