



Wright Water Engineers, Inc.

CHRISTOPHER OLSON, Ph.D., P.E. SENIOR WATER RESOURCES ENGINEER

CURRENT

Dr. Olson has about two decades of experience working in program/project management, client service management, project engineering, and training/teaching. He is skilled in hydrologic, hydraulic, and water quality modeling; life cycle cost analysis; stormwater design; and water resource planning. Dr. Olson is the former Program Director of the Colorado Stormwater Center at Colorado State University.

EDUCATION

Ph.D., Civil Engineering, 2017
Colorado State University
Dissertation focus: Stormwater Best Management Practice Performance Modeling and Uncertainty Analysis for TMDL Compliance

M.S., Civil Engineering, 2010
Colorado State University
Thesis focus: A Model for Evaluating the Effectiveness and Life Cycle Costs of Stormwater Best Management Practices

B.S., Environmental Engineering, 2004
University of Wisconsin–Platteville

REGISTRATIONS

Registered Professional Engineer
Colorado #44543
Nebraska #19755
Tennessee #129416
Texas #150021

AREAS OF EXPERTISE

Hydrologic/Hydraulic/Water Quality Modeling	Low Impact Development (LID) & Green Infrastructure (GI)
Program/Project Management	Stormwater Best Management Practice (BMP)/LID/GI Design
Client Service Management	Data/Statistical Analysis
Stormwater Management	Programming (Fortran, Matlab, MS VBA)
Cost Estimating (incl. Life Cycle Cost Analysis)	
Water Resource Planning	

REPRESENTATIVE PROJECTS

Hydrologic/Hydraulic Modeling and Analysis

Confidential Riverine Flooding Investigation. Served as a lead technical engineer on a large, multi-state and multi-plaintiff litigation case involving riverine flooding. Evaluated and analyzed hydraulic models (HEC-RAS), performed hydrologic stream analysis, and other engineering analysis. Case is ongoing as of January 2023.

First Creek Conditional Letter of Map Development (CLOMR). To support a large development project in Aurora, Colorado, performed hydrologic modeling of runoff to First Creek to determine potential flood flows from the new development. In addition, provided a conceptual design for an off-channel detention basin to reduce peak flood flows at a proposed bridge location downstream of the proposed development.

Mile High Flood District (MHFD) Todd Creek Stream Restoration. This project involves the restoration design of Todd Creek as part of a new development that is occurring adjacent to Todd Creek in Thornton, Colorado. Dr. Olson led the hydrologic and hydraulic modeling to support the restoration design.

River Mile Low Impact Development (LID) Conceptual Design and Modeling. Project team member for conceptual design and modeling analysis of innovative stormwater LID practices to be used on the River Mile development corridor in Denver.

Sand Creek Tributary Geomorphic Impacts. Performed hydrologic modeling to inform the potential geomorphic impacts and channel design for a tributary segment of Sand Creek due to a proposed development.

Floodplain Permitting for Xcel Energy. Providing ongoing floodplain permitting support for Xcel's utility projects. Typical tasks include performing scour analysis, hydraulic modeling, and reviewing as-builts to evaluate potential project impacts. Most projects result in certification of "no-rise" conditions.

Keystone Homeowner Letter of Map Amendment (LOMA). Completed a LOMA for a homeowner in Keystone, Colorado. Tasks included coordinating survey of the property and adjacent stream, developing a localized HEC-RAS model to determine flood elevations adjacent to the property, and submitting required materials to the Federal Emergency Management Agency (FEMA). The LOMA was accepted without comments.

Big Thompson River Stream Management Plan. Provided hydrologic analysis of "naturalized" and existing stream flows to support development of the stream management plan. Analysis included evaluating flow gage data along with water diversion data to characterize the hydrologic flow regime of 15 different stream reaches.

Stafford Site Geomorphic Stream Study. Performed hydrologic modeling using Colorado Urban Hydrograph (CUHP) and Environmental Protection Agency (EPA) Stormwater Management Model (SWMM) to determine stream flows for multiple return period storm events (1-year up to 100-year). Also provided a conceptual detention basin design based on two different design criteria.

Salt Creek Flood Resiliency Study. Provided quality assurance/quality control for a comprehensive flood mitigation study for the Salt Creek watershed in Lincoln, Nebraska, as a sub to Olsson, Inc. Study addressed how flood resiliency can be enhanced through structural and non-structural measures and included quality assurance/quality control (QA/QC) of the project teams' approach to analyzing future extreme weather events, review of national and local best practices, and public education plan.

Urban Drainage/Stormwater Management

City of Castle Pines Stormwater Infrastructure Asset Management. Provided project management and engineering to inspect and perform condition assessments of stormwater infrastructure. Also provided recommendations and cost estimates for maintenance and repair of infrastructure deficiencies.

City of Rogers (Arkansas) Stormwater Project. Provided technical advisory and peer review support for the development of a comprehensive (city-wide) stormwater model using PCSWMM. The model covers nearly 40 square miles of tributary area and includes major pipes, crossings, and all minor and major drainageways.

City of Aurora Development Reviews and Consulting. Review preliminary and final drainage reports and drainage master plans for the City of Aurora. Learned City's system for reviews and assisted with multiple reviews for subdivisions and road projects. WWE also is in the process of updating the City's storm drainage criteria manual and conducting these reviews has provided excellent insight into criteria that have been developed since the manual was last updated approximately 20 years ago.

City of Detroit Flood Investigation. Member of an Expert Panel to review causes and extents of flooding experienced during two unusually large rainfall events in 2021. Primary role was to advise a team of modelers on developing and interpreting a 1D/2D PCSWMM model of the City of Detroit and surrounding areas. The Expert Panel report was released in May 2022.

Confidential Flooding Investigation. Served as lead modeling engineer to evaluate and analyze the causes of flooding of two large rainfall events that occurred in 2019. Developed and linked highly-detailed HEC-HMS, SWMM, and HEC-RAS models that clearly demonstrated cause and effects of multiple contributing factors that ultimately led to a settlement among parties.

Stormwater Criteria Manual Development. Assisted with development of stormwater criteria manuals for several Front Range communities and organizations such as MHFD, Southeast Metro Stormwater Authority, City/County of Denver, and Larimer County.

City of Westminster Detention Basin Retrofit. Lead engineer on a detention basin retrofit project to incorporate water quality control and provide additional flood control storage. Tasks include reviewing previous designs, updating hydrologic calculations, developing grading, and evaluating outlet structure scenarios.

Peer Review of Stormwater Detention Criteria. Served as project manager and lead engineer on a confidential peer review project of a large flood control district's existing stormwater detention criteria and assessment of the criteria's performance to reduce flooding over the past 30 years.

Town of Durango Stormwater Management Plan. Developed a SWMM model for the Town's urban stormwater infrastructure and identified appropriate hydrologic modeling schemes for both urban and non-urban watersheds. Also assisted with development of cost estimates for stormwater infrastructure improvements and evaluated funding mechanisms for a stormwater utility fee.

Town of East Vail Stormwater Management Plan. Assisted with the development of a SWMM model for the town's stormwater infrastructure and hydrology development for urban and non-urban watersheds.

Aspen Garmisch Street Master Planning. Evaluating hydrology, hydraulics, and potential improvements to surface and subsurface conveyance along the Garmisch Street corridor in the City of Aspen. WWE is using existing hydrologic and hydraulic models that we developed for the city as a part of WWE's 2014 Detention Analysis and our recently completed mud and debris flow analysis, which included modeling of surface routing through the city using FLO-2D. WWE will jointly apply the CUHP, SWMM, and FLO-2D models to perform the analysis needed for this project.

Oak Gulch Watershed Master Planning. Project team member for MHFD conceptual master planning of Oak Gulch watershed near Parker, Colorado. WWE has worked on evaluating hydrology and hydraulics of traditional and green infrastructure (GI) approaches to development in the watershed. This project has provided significant insights into how master planning can better integrate GI concepts for watersheds and streams.

EPA CLASIC Project. Participating on a national team involved in cutting-edge research and tool development related to whole life-cycle cost analysis of green and grey infrastructure (“CLASIC” project). The project is part of a \$2.5 million effort led by the Water Environment Research Foundation (WRF), largely funded by the EPA.

Stormwater Inspection/Maintenance Training (Non-WWE Project). Developed and taught a training course for stormwater personnel to properly inspect and maintain stormwater infrastructure. This project was completed by Dr. Olson while he was Program Director of the Colorado Stormwater Center at Colorado State University.

BMP-REALCOST Project (Non-WWE Project). Developed the BMP-REALCOST tool for the MHFD to estimate the life-cycle costs (capital plus maintenance) of stormwater infrastructure, with the intent of providing utilities with the necessary cost information to determine appropriate fee structures to cover the costs of stormwater infrastructure. This project was completed by Dr. Olson while he worked at Colorado State University.

City of Fort Collins Stormwater Control Measure Design, Research, and Monitoring (Non-WWE Project). Served as project manager and Co-Principal Investigator on various projects with the City of Fort Collins Stormwater Utility to design and monitor (via water quality sampling) multiple stormwater control measures for water quality effectiveness.

Dam Failures

Confidential Dam Failure. Provided engineering analysis on the potential causes, impacts and remedial efforts regarding a dam failure. The dam was constructed on private property, without relevant permits, and allegedly without professional engineering design. Litigation is ongoing as of 2023.

Water Quality Studies and Data Analysis

Castle Pines Stormwater Inspections and Asset Management. Providing assistance with Municipal Separate Storm Sewer System (MS4) programs including development of several standard operating procedures (SOPs) associated with the MS4 program. WWE also performs required oversight inspections for construction and post-construction and is developing a city grading, erosion, and sediment control (GESC) manual. Assist with review of drainage reports and plans in Castle Pines related to features including water quality and detention ponds, channels, outfalls, etc. Provide support for developing guidance and criteria and peer review related to MS4 inspections/reporting.

University of Colorado–Boulder MS4 Permit and *E. coli* TMDL Compliance. Developing an implementation plan pertaining to the total maximum daily load (TMDL) for Boulder Creek. Creating storm sewer cleaning program plan and dry weather outfall inspection and monitoring plan, including worksheets.

Renew Jordan Creek Water Quality. Provided technical and conceptual design support for incorporating stormwater control measures into the Jordan Creek daylighting project in Springfield, Missouri. Stormwater control measures included bioswales, rain gardens (bioretention) and permeable pavement incorporated within future pedestrian areas.

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Town of Vail Stormwater Quality Assistance. Served as project manager and lead engineer on several stormwater quality projects including conceptual analysis and design of stormwater control measures in highly urbanized settings and development and implementation of a stormwater monitoring program to characterize urban stormwater quality and the performance of stormwater control measures.

City of Fort Collins *E. coli* Investigation. As lead technical engineer, investigating potential sources of *E. coli* in urbanized streams by conducting water quality monitoring as well as analysis of stream flows, land use characteristics, and other factors that may correlate with *E. coli* concentrations in those streams.

401 Certification Modeling Review. Assisted the Colorado Department of Public Health and Environment (CDPHE) Water Quality Control Division with technical review of analysis and modeling in support of 401 Water Quality Certification for major water development projects in Colorado.

Denver Department of Public Health and Environment Stormwater Monitoring. Project manager and engineer for studies to evaluate the effectiveness of various GI stormwater control measures, including water quality sampling. Work performed included installing sampling equipment, identifying and performing monitoring protocols, and data analysis.

City of Fort Collins Spring Creek Winter Runoff Monitoring (Non-WWE Project). Served as project manager and Co-Principal Investigator to assist the City of Fort Collins with evaluating the effects of deicing activities on Spring Creek water quality.

OTHER EXPERIENCE

Innovyze, Client Service Manager, Broomfield, Colorado, 2017–2018. Managed utility and consultant clients' needs related to hydrologic/hydraulic modeling and asset management software sales and training.

Dept. of Civil/Environmental Engineering, Colorado State University, Research Associate III, Fort Collins, Colorado, 2015–2017. Managed the start-up and implementation of the Colorado Stormwater Center to provide education and training opportunities for various audiences on proper stormwater management. Performed self-funded research to develop new algorithms for estimating water quality performance of stormwater facilities and the uncertainty of that performance, resulting in Doctor of Philosophy Dissertation and Degree.

Dept. of Civil/Environmental Engineering, Colorado State University, Adjunct Instructor, Fort Collins, Colorado, 2014–2017. Developed curriculum and taught undergraduate and graduate level courses in non-point source pollution and urban stormwater management.

Dept. of Civil/Environmental Engineering, Colorado State University, Graduate Researcher, Fort Collins, Colorado, 2007–2015. Developed software to estimate life cycle costs of stormwater BMPs, resulting in master's thesis and degree. Obtained funding for and managed multiple research projects associated with the design, implementation, evaluation, and modeling of stormwater BMPs. Mentored undergraduate and graduate students, resulting in four master's theses and multiple technical reports.

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MWH Americas, Associate Engineer, Sacramento, California, 2005–2007. Served as project engineer on multiple federal/state/local water supply feasibility study studies and assisted with the development of the CALSIM-III water resource management model.

HydroGeoLogic, Inc., Assistant Engineer, Sacramento, California, 2004–2005. Performed groundwater sampling, data analysis, reporting, and feasibility studies for contaminated sites at Department of Defense facilities.

PROFESSIONAL & HONORARY SOCIETIES

Member of the American Society of Civil Engineers (ASCE)

Member of Environmental and Water Resources Institute (EWRI) of ASCE

PUBLICATIONS

Olson, C., M. Ghanbari, M. Arabi, and L. Roesner. 2022. Appraisal of Steady-State Stormwater Control Measure Pollutant Removal Models within a Dynamic Stormwater Routing Framework. *ASCE Journal of Water Resources Planning and Management*. Volume 148, Issue 4. April 2022.

Clary, J., J. Ervin, B. Steets, and C. Olson. 2022. Pathogens in Urban Stormwater Systems: Where Are We Now? *ASCE Journal of Sustainable Water in the Built Environment*. Volume 8, Issue 1. February 2022.

Olson, C., M. Arabi, T. Dell, and L. Roesner. 2020. Probabilistic Assessment of Extended Detention Basins: Role of Model Parameter Uncertainty. *ASCE Journal of Water Resources Planning and Management*. Volume 146, Issue 8. August 2020.

Pathak, C., R. Teegavarapu, C. Olson, A. Singh, C. Polatel, V. Zahraeifard, and S. Senarath. 2015. Uncertainty Analysis in Hydrology/Hydraulic Modeling: Challenges and Proposed Resolutions. *ASCE Journal of Hydrologic Engineering*. Volume 20, Issue 10.

Urbonas, B.R., C.C. Olson, K. MacKenzie, and J.C.Y. Guo. 2013. BMP Economics and Sizing. *Pragmatic Modeling of Urban Water Systems, Monograph 21*. CHI Press.

Negahban-Azar, M., S.E. Sharvelle, M.E. Stromberger, C.C. Olson, and L.A. Roesner. 2012. Fate of Graywater Constituents After Long-Term Application for Landscape Irrigation. *Water, Air and Soil Pollution*.

Urbonas, B.R., and C.C. Olson. 2011. Assessment of Stormwater BMP Cost Effectiveness – A New Model for Decision Makers. *Stormwater*. March–April.

Olson, C.C., L.A. Roesner, and B.R. Urbonas. 2009. A Tool for Determining Effectiveness and Whole Life Costs of BMPs. *World Environmental and Water Resources Congress*. ASCE.