

CHARLES M. SCHLINGER, Ph.D., P.E., R.G., P.Gp., LSIT
Principal, EN3 Professionals, LLC

EDUCATION

Ph.D., M.A., The Johns Hopkins University, 1983. *Geophysics and geology.*

M.S., Civil and Environmental Engineering, Utah State University, 1991. *Geotechnical engineering and ground water hydrology.*

B.S., Physical Geography, University of Michigan at Flint, 1977. *Land-use and environmental planning.*

PRESENT AND PAST EMPLOYMENT

- 7/16- EN3 Professionals, LLC, Flagstaff, Arizona. *Principal Engineer.* Energy, environmental and water resources engineering consulting services for corporate, governmental, legal & tribal clients – local, regional & national.
- 12/14-6/16 CD&E, Flagstaff, Arizona. *Senior Civil Engineer.* Civil & environmental engineering for energy-sector, DoT, municipal, tribal and federal clients, inclusive of business development.
- 8/99-5/15 Department of Civil & Environmental Engineering, Northern Arizona University, Flagstaff, Arizona. *Associate Professor.* Water systems/resources & geotechnical engineering & surveying applied research and teaching; project and program development; university and public service.
- 10/13-2/15 Independent civil & environmental engineering consultant working on energy-sector and municipal projects.
- 4/09-9/13 EN3 Professionals, LLC, Flagstaff, Arizona. *Principal Engineer.* Energy, environmental and water resources engineering consulting services for corporate, governmental, legal & tribal clients – local, regional & national.
- 3/96-4/09 Plateau Engineering, Flagstaff, Arizona. *Project Manager.* Civil engineering and geoscience services for municipal, county, school district, mining industry and private sector clients; business development, field construction observation, and occasional surveying. (*Served in a part-time consulting engineering capacity from 8/99 through 4/09.*)
- 6/94-1/96 STS Consultants, Ltd., Minneapolis, Minnesota. *Geotechnical Engineer.* Tailings basin and dam engineering, subsurface exploration, geotechnical engineering, testing and monitoring, geophysical investigations, construction testing and business development.
- 12/91-2/94 Science Applications International Corporation, Las Vegas, Nevada. *Senior Scientist and Geotechnical Engineer.* Hydrogeological and engineering site characterization, GIS operation and analyses.

- 7/90-12/91 Department of Civil & Environmental Engineering, Utah State University. *Graduate Student in Geotechnical Engineering.*
- 7/83-6/90 Department of Geology and Geophysics, University of Utah. *Assistant Professor.* Geophysical, geological & materials science research and teaching.
- 9/77-6/83 The Johns Hopkins University, Baltimore, Maryland. *Teaching and Research Assistant – Graduate Student.* NASA-sponsored geophysical & geological research.
- 6/78-9/78 Amoco Production Company, Tulsa, Oklahoma. *Seismologist - Summer Intern.* 3D seismic data acquisition modeling and processing.
- 9/75-9/77 The University of Michigan at Flint. *Teaching, Laboratory and Field Assistant.*

PROFESSIONAL EXPERIENCE

From 12/2014 to 6/2016, I was a Senior Civil Engineer with CD&E. Assignments include:

- Project Manager for development of an integrated hydrologic & hydraulic Model and Flood Study for the Rio de Flag for the City of Flagstaff. Project team of CD&E (prime consultant), Integrated Hydro Systems, and DHI. FEMA and City funded. MIKE SHE / MIKE 11 numerical model developed from City and other GIS data. This is a GIS-intensive model development with applications to watersheds potentially impacted by fire.
- Support to HDR, the General Engineering Consultant (GEC) on the ADOT State Route 202 South Mountain Freeway project for utilities relocation / accommodation and other engineering needs. This \$1.7B 3P project commenced in early 2016.
- Continued service on the Technical Review Committee (TRC), in support of Colorado River area Tribes (Fort Mojave Indian Tribe, the Colorado River Indian Tribes, Cocopah Tribe, Chemehuevi Tribe, and the Hualapai Tribe), for hexavalent-chromium contamination remediation at the Pacific Gas & Electric (PG&E) Topock Gas Compressor Station, south of Needles, California..
- Completion of Water & Sewer Impact Analyses for the City of Flagstaff using Bentley Watergems (ArcGIS/Civil 3D) and SewerCad software – assessment of system impacts and infrastructure upgrade needs associated with proposed developments.

From October, 2013, to March of 2015, I worked as an independent consultant. Projects included:

- Continued service on the Technical Review Committee (TRC) – see above.
- Preparing a Preliminary Engineering Report (PER) for the Sipaulovi Water Association. Sub-consultant to Plateau Engineering. (Project start of 6/1/2014).

From April 2009 through September 2013, I was with *EN3 Professionals, LLC*. Projects included:

- Civil engineering design for Sipaulovi Development Corporation's Marketplace at Second Mesa, Arizona. Full surveying and civil engineering services for a 4-acre development on the Hopi Reservation. Sub-consultant to Springer Group (Architect). With Plateau Engineering.
- Environmental Impact Statement (EIS) hydrology and hydraulic evaluations for a planned Verde River diversion in Middle Verde, AZ, and other services (Clean Water Act Section 404 permitting support; diversion ditch flow quantification) for the Yavapai Apache Nation (funded by Bureau of Reclamation – U.S. Department of Interior).
- Service on the Technical Review Committee (TRC) – see above.

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- Civil engineering design and construction-period services for an APS 300kW photovoltaic generating facility at Cromer School in Doney Park, AZ. Commissioned May, 2012.
- Civil engineering design and construction-period services in support of an APS 500kW photovoltaic generating facility and future substation in Doney Park, AZ. Commissioned April, 2012.
- An effort to develop a widely-accepted agreement among the many parties having an interest in the reduction of emissions from the Navajo Generating Station in Page, AZ. Nitrogen oxides, particulate matter, and hazardous air pollutant emissions from NGS Units 1, 2, & 3 will be addressed. Client: Salt River Project (SRP).
- Research in support of a utility-scale wind energy development ordinance; Permit review for Iberdrola Dry Lake Phase II Wind Energy development (for Navajo County, AZ).
- Water supply and infrastructure evaluation for the Village of Upper Moenkopi, Hopi Reservation, AZ. Included scoping and costing for a new well field and 18-mile transmission line.
- Production well equipping design support, including sub-consultant coordination, for the Ak-Chin Indian Community (for Plateau Engineering).
- Childs-Irving hydroelectric facility project dam removal and decommissioning close-out; evaluation of dust palliatives; and, assessment of Federal, State and Tribal records criteria for APS dams at Cholla and Four Corners power plants.
- Review of air quality permit application for a proposed coal-to-gasoline facility in Mingo County, West Virginia.

While with *Plateau Engineering*, I served as a *Project Manager*, *Project Engineer* or *Surveyor* (infrequently) on the following assignments:

- Water Infrastructure Master Plan for Sipaulovi Village, Hopi Reservation.
- Flood studies for Schoolhouse Draw (Flagstaff) and Honey Draw (Page); review of drainage and flood studies for Coconino County.
- Water and Wastewater Infrastructure Design (WWTP; production wells, storage facilities, booster pumping facilities, water transmission, wastewater collection, etc.) for the Ak-Chin Indian Community. \$4.2M design fee.
- Design and construction period-services for a 1,500 gpm production well and related infrastructure for the Ak-Chin Indian Community's Industrial Park.
- Groundwater Assessment and Evaluation for the Yavapai Apache Nation.
- Water supply and water systems evaluations and full design of new water systems (Navajo-aquifer well, 200,000-gallon storage, disinfection, pH control & arsenic treatment, service and fire-flow pumping, transmission); 500-yr flood studies and SWPPP for the new Second Mesa Day School (commissioned 4/2007).
- Drainage Report, drainage design & SWPPP for US 89 multi-use pathway for City of Flagstaff.
- Value Engineering for \$40M+ Cotton Lane Bridge over the Gila River for the Maricopa County Department of Transportation.
- Water supply and water systems evaluation and recommendations, water quality testing, and well/aquifer evaluation for Kayenta Community School.
- Water system master planning (pumping, storage, treatment and distribution) for Page, AZ - project team of Plateau Engineering and CDM.
- Dredging evaluation and design for Hopi Reservation reservoirs in Keams Canyon.

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- Operations and Reclamation Plan for White Vulcan Pumice Mine, Flagstaff, AZ.
- Lake Mary Road Pavement Improvements for Coconino County (construction documents utilizing ADOT Standard Plans and Specifications).
- Value Engineering training and analysis of Arizona Department of Transportation realignment/reconstruction projects for State Route 260 (Payson to Heber) – Kohl’s Ranch and Christopher Creek segments - \$55M construction cost.
- Drainage evaluation and design, surveying, retaining wall design, traffic control plans, traffic signal relocation, and remediation-phase construction layout surveying for City of Flagstaff’s Route 66 Streetscape Improvements.
- Drainage evaluation, design and plans, surveying, and final plat for a 260-acre development with an anticipated build-out value of \$12-\$15M. Offsite drainage from nearly 15 square miles of prairie and mountain land.
- Comprehensive pavement evaluation for 22 Flagstaff Unified School District sites. Provided recommendations for \$2.5M repair and replacement, maintenance recommendations, and financial planning and prioritization.
- Water well test pumping, water quality testing, hydrogeological evaluation, and drainage study for a Young Life camp in Williams, Arizona.
- Water distribution system model, model calibration and related work for Page, AZ.
- Surveying, design, hydrologic analysis, preparation of plans and specifications, and cost estimating for reconstruction of Espee Road, Coconino County.
- Astronomical determination, using star shots on Polaris and Sirius, of true north, for construction layout of a new observatory facility for the U.S. Naval Observatory.
- Land survey, design, and preparation of plans and specifications for a solid waste transfer station in Tuba City, for Coconino County and the Navajo Nation.
- Design, plan preparation, contract administration and construction observation for major paving rehabilitation and new paving projects completed for University and School District facilities.

My responsibilities as a *Staff Engineer* with *STS Consultants*, a regional geotechnical firm, included project engineering and project management for federal, county and municipal government, and commercial and industrial clients. Highlights follow.

- Preparation of plans and specifications for a solid waste landfill closure.
- Geophysical investigation and discovery using magnetic, radar and electromagnetic methods, subsurface exploration, and environmental characterization of a DDT burial site for the U.S. Forest Service – Ottawa National Forest.
- Geotechnical engineering, settlement monitoring, field construction observation of fill placement and construction testing for a 3-million-ton 170-ft-thick rock fill and the associated ore-loading pocket (consisting of a railroad tunnel, sheet-pile walls and a 60-ft high concrete headwall) on the Mesabi Iron Range.
- Woven/nonwoven geotextile and geomembrane recommendations & testing.
- Routine construction testing for commercial and public buildings.
- Engineering, geotechnical (pore pressure cells, piezometers & inclinometers) monitoring, field testing (vane shear) and short- and long-term construction planning and observation in support of operation,

closure and reclamation of 160-ft-high, 600-acre tailings basins with a total of 8 miles of perimeter dikes founded on organic soils.

- Mapping of lake bottom using a GPS-supported hydrographic survey.
- Construction observation, followed by pore pressure and settlement monitoring of a geotextile-reinforced embankment and surcharge over weak foundation soils.
- Subsurface exploration and geotechnical engineering evaluations for roads and utilities.
- Geotechnical engineering and development of recommendations for both deep (pile) and shallow foundation systems, including mat foundations.

While employed as a *Geotechnical Engineer/Senior Scientist* by SAIC, I worked on geotechnical, hydrogeological, and geophysical characterization activities conducted by the Department of Energy at and adjacent to the Nevada Test Site (Yucca Mountain Project). Highlights:

- serving as a Project Engineer on pump and geochemical testing of deep aquifers.
- integration, oversight and planning of geophysical investigations; use of the workstation-based ARC/INFO GIS for planning and management of site investigation activities.
- evaluation and use of global positioning system (GPS) equipment and related software, including datum shifting and coordinate projection packages.
- review and evaluation of hydrogeologic and engineering studies.

Prior to 1991, while an *Assistant Professor* at the *University of Utah*, I managed geology, geophysics and materials science projects. Typically, these efforts were multi-disciplinary, funded by federal & state agencies – primarily the National Science Foundation and Smithsonian Institution, and involved colleagues from across the nation and from overseas. I taught courses in Applied Potential Field Theory, and, Gravity and Magnetic Methods in Geophysical Exploration. In addition, I supervised the work of research and teaching assistants, presented research and study findings at national and international meetings and in peer-reviewed journals, and managed laboratory and computer facilities. Representative applied research projects completed during this time included:

- Location of underground storage tanks, using magnetic methods, for the United States Air Force at Hill Field in Utah.
- Fault plane mapping in the Newcastle geothermal area, southern Utah, using gravity and magnetic methods, for the Utah Geological and Mineralogical Survey.
- Field and laboratory study of formations at Yucca Mountain, Nevada, for the State of Nevada. Documented the applicability of magnetic susceptibility for stratigraphic correlation between site characterization boreholes.

SELECTED NORTHERN ARIZONA UNIVERSITY PROJECTS & ACTIVITIES

- *Capstone Dam Evaluation Projects – Technical Advisor.* Supervised two student teams that completed dam safety evaluations of the Odell and West Cataract Creek dams in northern Arizona. Fall 2014.
- *Environmental Noise.* Implemented environmental noise measurement and monitoring fundamentals and applications in the NAU CENE 330 Air Quality Engineering course using Bruel & Kjaer Model 2250 Class 1 sound level meter and software. 2014-2015.
- *Pipe Springs National Monument Pond Evaluation.* Evaluation of pond rehabilitation options; quantification of water budget elements; structural testing / research and design of masonry retaining walls. 3/12-3/13; \$25k budget.
- *Wupatki National Monument Drainage Research Study.* Research on application of low-impact storm water management practices in National Park settings, acquisition of aerial and ground topographic data for the Wupatki Visitor Center area, and development of storm water management alternatives. (PI). 9/09-12/11; \$30k budget.
- *Global Navigation Satellite System (GNSS) Implementation.* Implemented GNSS technology (TOPCON GR3 receivers) for educational and project use. This included working with the Arizona Height Modernization Program to establish a GNSS base station at NAU that is part of the AZ CORS network. Static, RTK, network RTK, localization and other GNSS surveys. 2008-2014.
- *Verde River Low-Flow Study.* This GIS-based hydraulic study examined impacts of irrigation diversions between Cottonwood and Camp Verde. (co-PI). 7/08-12/10; approximately \$35k/yr.
- *Best Practices Guide for Water & Energy Conservation and Management in Rural Arizona.* \$56.5k grant from Arizona Water Institute (co-PI). Supported development of a best practices guide for water and wastewater systems. 3/08 thru 6/09. Supported by \$7.5k and \$10k matches from the National Park Service and AZ State Parks.
- From 2000-2008, co-directed or directed the *Watershed Research and Education Program (WREP)* – a continuation of the Verde Watershed Research and Education Program; \$150,000 gift and \$100,000 grant from the Salt River Project (SRP) to continue and support the program for five years (2004-2009).
- *Evaluation of Locations and Technology for Stream-flow Gages on Fossil Creek*, \$20,000, 5/2005-6/2006 (PI), Salt River Project, completed 6/2006. *Based on recommendations presented in this evaluation, the USGS installed a permanent gage on Fossil Creek in 2010.*
- *A Comprehensive Monitoring Plan for Fossil Creek Restoration: A Model for Decommissioning Hydropower Facilities in the 21st Century*, \$145,000 for 2003-2005 (PI) and \$140,000 for 2005-2006 (co-PI). The Childs/Irving hydroelectric facilities were shut down in June, 2005 and decommissioning was completed in June of 2010. This Nina Mason Pulliam Trust grant supported ecological, hydrological, sediment and recreation impacts research and monitoring to assess the success and impacts of planned riparian corridor and watershed restoration actions (completed 8/2006).
- *Black Canyon Lake Hydrology & Hydraulics*, Arizona Game and Fish Department, \$68,000 (PI). The Black Canyon Lake watershed was extensively burned during the June-July 2002 400,000+ acre Rodeo-Chedeski fire in NE Arizona. We evaluated post-burn watershed hydrology, estimated the Probable Maximum Precipitation and Flood (PMP/PMF), routed this flood through the existing spillway (found to be inadequate), and evaluated spillway improvement feasibility and alternatives.
- *Raymond Park and Harrenburg Wash Dam Evaluation*, Coconino County Parks & Recreation Department, \$9,500 (PI). This project supported NAU undergraduate students and involved: an evaluation of water rights history and hydrology, completion of topographic surveys and soil testing, and, preparation of a plan for County in-house repair of two small dams on a tributary of Pumphouse Wash.

- *Master Agreement between NAU and APS (PI)*. Three phases of work (\$130,000), addressing Engineering and Ecological Evaluations in Support of Decommissioning APS Childs-Irving Hydroelectric Facilities, Watershed Restoration and Return of Perennial Flow to Fossil Creek were completed. (FERC Docket #P-2069-007).
- *Show Low Creek Reservoir System Evaluation and Recommendations*; project with Navajo County/Arizona Department of Water Resources; 7/2001 –2/2003; \$91,370; PI. Lone Pine dam (100-ft high) on Show Low Creek is an unsafe significant-hazard dam, due to a pervious foundation and abutments. The reservoir floor (10,000 ac-ft) is pervious. We evaluated alternatives to reduce severity of classification and identify improvements that meet County needs, and researched the ground water recharge benefit provided by Lone Pine. A larger pool was considered for Schoens dam and reservoir – constructed primarily for flood control.
- *Silver Creek Stream Channel Rehabilitation and Riparian Corridor Enhancement*; funded by Navajo County/Arizona Department of Water Resources; 7/2001 – 11/2002; \$70,396; Co-PI. In the Taylor and Snowflake areas, the Silver Creek stream channel changed markedly in response to development over the past 150 years. Hydraulic and geomorphic characteristics of two reaches were evaluated. A preliminary stable channel design was developed.
- *Fate of Big Park Wastewater District Effluent Discharges into Jacks Canyon, Village of Oak Creek*. Funded by the Big Park Wastewater District; 2/2001–12/2001; \$20,947; Co-PI. This effort assessed the fate of wastewater treatment plant discharges into Jacks Canyon. Water budget estimates indicate that nearly all effluent goes toward groundwater recharge. Faults and fractures appear responsible for flow losses, with evaporative and transpirative losses much less significant. Biological processes appear to actively utilize Nitrate-Nitrogen along the flowing reach.
- Co-Director for the *Verde Watershed Research and Education Program (VWREP)*. VWREP was focused on water issues in the 5,500 sq.-mi. Verde watershed and assisted stakeholders and local communities, and fostered an interdisciplinary 'science and policy approach to Verde watershed issues. The VWREP was established in summer 2000, when the Salt River Project (SRP) gave \$250,000 to NAU to establish and support the program for 5 years.
- *Geotechnical Evaluation and Engineering for Hopi Tribe Reservoirs at Keams Canyon, Arizona*. Project funded by Plateau Engineering; 9/1999 – 9/2000; \$9,272 (PI). Project team of NAU, Plateau Engineering and Copper State Engineering. We conducted an assessment of dredging and sediment disposal alternatives for sediment removal from Beaver Dam and Twin Dams reservoirs. This included a geotechnical investigation to determine stability of the earthen embankment structures in response to sediment removal. Plans and specifications were prepared for the Hopi Tribe.
- Founding Co-Director and Past Director of the *Watershed Research & Education Program* at Northern Arizona University (2000-2008).
- Founding member and past Director of the *Sustainable Water Resources Alliance (SWRA)* at Northern Arizona University (2002-2005).

NORTHERN ARIZONA UNIVERSITY COURSES TAUGHT

- CENE 270 – Surveying (2006-2014)
- CENE 383 – Geotechnical Engineering I (1996 – 2005, 2010-2013)
- CENE 333 – Water Resources I (1997, 2000, 2002, 2007-2009)
- CENE 333L – Applied Hydraulics Lab (2000, 2007-2015)
- CENE 336 – Water Resources II – (2012-2013, 2015)
- CENE 476 – Capstone Design I (2003, 2004, 2014-2015)
- CENE 486 – Capstone Design II (2004, 2014-2015)
- CENE 450/550 – Geotechnical Engineering II (2000-2012, 2014)
- CENE 551 – Geotechnical Earthquake Engineering (2001)

OTHER UNIVERSITY COURSES TAUGHT

- Geotechnical Elements of Offshore and Coastal Engineering (2012-2013) – English-language Master’s program at Far Eastern Federal University, Vladivostok (Russian Far East)

RECENT PROFESSIONAL TRAINING

- Driven Pile Institute (given by the Pile Driving Contractors Association), week-long course with pile driving and testing, Utah State University, June of 2013.

PROFESSIONAL REGISTRATION AND SOCIETY MEMBERSHIPS

- *Registered Professional Engineer* (MN License No. 24459; AZ License No. 30615; CA license No. 60331; MI License No. 6201052934; CO License No. PE-43991)
- *Registered Professional Geophysicist* (CA License GP 994)
- *Registered Professional Geologist* (AZ License No. 33755)
- *Certified Professional Geologist* (#9554)
- *Land Surveyor In Training* (LSIT)
- National Council of Examiners for Engineering and Surveying (NCEES) – Council Record
- Arizona Hydrological Society (AHS)

VOLUNTEER & PUBLIC SERVICE WORK

- Advised City of Flagstaff Storm Water Program regarding approaches for a FEMA-funded flood study of the Rio de Flag watershed and watercourse (2014)
- Water distribution system computer models (standalone version, Civil 3D, ArcMap), using Bentley Watergems software, for Sipaulovi Water Association (2014)
- Ridgeline to Rio Summit – Development of Actions to Mitigate Post-Forest-Fire Flooding and Debris Flows – Coconino County (2010)
- NAU Watershed Research & Education Program Advisory Council (2008-2011)
- City of Flagstaff Water Commission (2008-2009)
- Action Team, Northern Arizona Council of Governments (NACOG) Focused Future II – Strategic Planning (2003)
- Yavapai County Water Advisory Committee – Technical Coordinating Subcommittee (2001-2002)
- Coconino Plateau Water Advisory Council (Fall 2000 to summer 2002; 2007).

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- Coconino County Planning and Zoning Commission (Summer – Winter, 1999).

RELEVANT CONFERENCE PROCEEDINGS & PRESENTATIONS

Wadsack, K., Auberle, W. & Schlinger, C., 2011, Ground Zero for Wind Energy Development Policy – The Navajo County, Arizona, Experience, AWEA Windpower 2011 Conference, Anaheim, CA.

Mead, S.P., Schlinger, C.M., and Auberle, W.M., 2009, A Best Practices Guide to Water and Energy Usage in Rural Arizona, Proceedings of the WaterEC 2009, International Water Efficiency Conference, Forester Press.

Schlinger, C.M., Helton, C., and Janecek, J., 2004, PMF Hydrology, with Rodeo-Chediski Fire Impacts, and Spillway Hydraulics for Black Canyon Lake and Dam, Proceedings of Dam Safety 2004 Conference, Association of State Safety Officials, Lexington, KY (peer-reviewed paper, and poster).

Schlinger, C.M., Welch, S., Ramsey J., Trotta, P., Janecek, J., Auberle, W., 2003, Sediment Transport Evaluation for Dam Removal Scenarios, Fossil Springs Diversion Dam, Arizona, Proceedings of Dam Safety 2003 Conference, Association of State Safety Officials, Lexington, KY (peer-reviewed paper, and poster).

Schlinger, C.M., and Springer, A., 2002, Navajo Aquifer Water Supply for the Kayenta Community School, Proceedings of Fractured Rock Aquifers 2002, National Ground Water Association, Denver, CO (peer-reviewed paper).

BOOK SECTIONS

Schlinger, C.M, and Yazzie, L., 2010, Dams, Continuity of Flow, and Landscape Equilibria: Fossil Creek, Arizona, in: Marsh, W., Landscape Planning, 5th Ed., Wiley.

Schlinger, C.M., Helton, C., and Janecek, J., 2010, Flood Risk and the Impacts of Fire in a Small Forested Watershed, in: Marsh, W., Landscape Planning, 5th Ed., Wiley.