

TECHNICAL SPECIALTIES

Providing services for governmental agencies (federal, state, and local), non-profit and for-profit corporations, and private individuals. Providing services ranging from water resource/supply investigations, impact analyses related to NEPA and CEQA analyses, groundwater modeling, water sourcing investigations, water supply management plans, mine hydrology investigations, minerals remoteness assessments, restoration project management, and environmental investigations.

EXPERIENCE SUMMARY

Mr. Zdon has more than 30 years of experience in a variety of geology and hydrogeology-related projects. He is a California Professional Geologist, Certified Hydrogeologist and Certified Engineering Geologist. Mr. Zdon is a recognized subject matter expert in numerical groundwater flow modeling and has been an instructor at California State University, Los Angeles in Groundwater Models and Management (1995).

Mr. Zdon was also appointed in 2013 by the Inyo County Superior Court as Watermaster for a surface water system in the Owens Valley. His specialties include basin analyses and relationships with spring systems, numerical groundwater modeling including, flow, groundwater/surface water interactions including spring flow, contaminant transport and dual-phase flow in both basin fill and fractured rock environments. Investigations in these areas can be in support of CEQA/NEPA analyses, water resource development evaluations, or providing third party review, supervision of UST identification, abandonment and removal.

He has served as an expert witness on many cases and has provided both depositions and court testimony. Mr. Zdon was appointed to serve on the first Technical Advisory Committee for the newly combined California Board for Engineers, Land Surveyors and Geologists. He also received Certificates of Commendation and Appreciation for his volunteer service as a Subject Matter Expert for the former California Board for Geologists and Geophysicists.

CREDENTIALS

- State of California, Professional Geologist (No. 6006)
- State of California, Certified Engineering Geologist (No. 1974)
- State of California, Certified Hydrogeologist (No. 348)
- State of Arizona, Registered Geologist (No. 33686)
- State of Utah, Professional Geologist (No. 11907683-2250)
- B.S., Geology, Northern Arizona University, Flagstaff, Arizona, 1984
- Assessment, Use and Management of Groundwater in Areas of Limited Supply, 2006, Groundwater Resources Association of California
- Introduction to ArcGIS9 and Environmental Applications of GIS, 2005, Northwest Environmental Training

Application of Risk Assessment for Environmental Decision Making at Contaminant Release Sites, 2005, University of California, Riverside – University Extension

Conceptual Site Models and the Data Necessary to Make Technical Decisions Regarding Cleanup and Site Closure, University of California, Riverside – University Extension

Model Calibration and Uncertainty Analysis Using PEST, 2003, Groundwater Resources Association of California

KEY PROJECTS

Environmental Forensics related to Desert Riparian Habitats. Principal investigator on forensic evaluations of spring water sources for multiple locations in Mono, Inyo, San Bernardino and Kern Counties, California. Methodologies used in these analyses have included stable isotope analysis of waters, water age-dating (using tritium and carbon-dating methods), noble gas analysis, general chemistry, and remote sensing techniques inclusive of Landsat imagery time-series analysis associated with Normalized Difference Vegetation Index (NDVI) signals, and changes in NDVI over time. The results of these studies have been published in the peer-reviewed journals Hydrology, Environmental Forensics and the International Journal of Water Resources and Environmental Management.

Spring Survey, Mojave and Sonoran Deserts, San Bernardino, Los Angeles, Kern and Inyo Counties, California. Principal investigator for Mojave Desert-wide spring survey for the Barstow, Needles and Ridgecrest U.S. Bureau of Land Management Districts. Also included lands owned by project partner land trusts. Work consisted of records search (inclusive of technical data, water rights information, BLM records search, and cultural historic information), field inspection of more than 300 springs, and preparation of a comprehensive report and catalog of springs that serves as the most comprehensive and temporally consistent investigation of springs ever to occur in the region. Field data included refining location information, field water quality parameters and flow, collection and analysis of water samples for stable isotope analysis, identification of vegetation present including invasive species, identification of wildlife use including use by non-native animals, types of spring disturbance, and general geological observations. Subsequent work has included extensive isotopic characterizations including stable isotope, tritium and radiocarbon analyses to evaluate regional aquifer connections with springs and working cooperatively with biologists conducting vegetation mapping and environmental DNA analyses on selected springs. This project was reported on in several publications including USA Today.

Technical Expert, Pine Valley and Wab Wab Valley Groundwater Basins, Utah. Serving as technical expert to the Beaver County Board of Commissioners regarding proposed groundwater export project by the Central Iron County Water District. The project proposes to export groundwater from proposed wells on public lands managed by the U.S. Bureau of Land Management to

alleviate overdraft and related subsidence issues in the Cedar City area. Work involves evaluating the effects of proposed groundwater production on springs and other resources in Beaver County, and to prepare comments to upcoming environmental impact statement.

Technical Expert, Orange County Groundwater Basin, California. Served as an expert witness and provided deposition regarding hydrogeologic conditions and numerical groundwater flow and transport modeling associated with the shallow, principal and deep aquifers of the Orange County Groundwater Basin. Focus was on groundwater flow, Irvine Ranch Water District well field-caused hydraulic gradient changes, and the potential for shallow contamination to reach the principal and deep aquifers.

Technical Expert – Hydrogeology of Proposed Yucca Mountain Nuclear Waste Repository, Nevada. Technical expert representing the County of Inyo, California relating to potential impacts to water resources in the County of Inyo including downgradient groundwater/spring water users in the communities of Shoshone and Tecopa and ecological resources associated with springs and the federally designated Amargosa Wild and Scenic River and Death Valley National Park. Work has included reviewing existing numerical groundwater flow and transport modeling for the region, and running the carbonate-aquifer model (which covers portions of California, Nevada and Utah) developed by the U.S. Geological Survey to evaluate the effect of pumping related to Southern Nevada Water Authority water rights and applications on vertical hydraulic gradients beneath Yucca Mountain and preparation of comments to Supplemental Environmental Impact Statement for Groundwater (prepared and submitted during 2015).

Project Management and Water-Supply Well, Feather River Basin, Plumas County, California. Project management and hydrogeological services related to a restoration of the historic Heart K Ranch project along Indian Creek in the Feather River headwaters for the Feather River Land Trust. Work included organizing hydrogeological (including production well drilling) and engineering and irrigation subcontractors to complete infrastructure for the project in a brief timeframe (less than six months). Successful siting of the well resulted in yield more than two times greater than client expectations.

Groundwater Recharge Operations, San Joaquin Valley, California. Technical and operational review of groundwater recharge/replenishment operations throughout the San Joaquin Valley, California. Work included identifying all non-private groundwater replenishment facilities in the San Joaquin Valley, providing technical review of operations including periodicity of use, spreading-basin geometry, and reviewing surrounding environment (including potential liabilities) associated with the potential use of the operations as water-bird habitat.

Hydrogeologic Evaluation, Amargosa River Basin, California and Nevada. Principal in Charge and project manager for ongoing basin-wide investigation of the resources of the

California-portion of the Amargosa River basin. Investigations have ranged from baseline data collection efforts to wide-ranging geochemical investigations (including isotope studies) of groundwater issuing from springs, from the Amargosa River, and from existing wells. Results have been groundbreaking and have resulted in ongoing reevaluation of the conceptual model of this part of the basin (more than 2,000 square miles) that had been held for nearly 50 years. Being a spring-fed river, the investigations along the Amargosa River highlight the evaluation interactions between surface water and groundwater. These data have been incorporated into multiple peer-reviewed journal articles and in U.S. Geological Survey report on the Lower Amargosa River Valley (Scientific Investigations Report 2018-5151).

Hydrogeologic Characterization and Flow Modeling, Big Valley Groundwater Basin, Lake County, California. Conducted numerical modeling analysis of the Big Valley Groundwater Basin (inclusive of Soda Bay) in Lake County, California as part of environmental review/feasibility study related to using the Kelseyville water system as an alternative water supply review for the Soda Bay area. The Soda Bay area is in complex volcanic terrain and has been previously served primarily by surface water from Clear Lake which is seasonally problematic due to water quality issues. Additionally, the numerical modeling provided estimates of streamflow depletion in Kelsey Creek due to groundwater pumping addressing concerns related to the Clear Lake Hitch, a California-state listed threatened species fish (also under federal review).

Hydrogeologic Characterization and Flow and Transport Modeling in Volcanic Terrain, Mono County, California. Served as expert witness and manager of environmental activities at 7,000-gallon gasoline release that occurred in faulted, volcanic terrain upgradient of a town water-supply well field. Work conducted at the site also included characterization of rock units including the use of rotary drilling and oriented-core drilling, surface and down-hole geophysical surveys, and extensive vapor and groundwater sampling. Developed a conceptual model and follow-up numerical groundwater flow and transport model to evaluate potential timing and magnitude of impacts to down-gradient town water-supply wells and associated remediation scenarios both to evaluate on-site remedial effectiveness and risk reduction associated with water supply.

Well Siting along the San Andreas Fault Zone, Lake Elizabeth area, Los Angeles County, California. Provided technical review and recommendations for future well siting in the Lake Elizabeth area. The Lake Elizabeth area is situated along the San Andreas Fault Zone, the lake being a manifestation of the fault zone (sag pond). Groundwater in this complex area is highly compartmentalized, and differences in well yields and groundwater quality can vary substantially in short distances. This work successfully informed the Lake Elizabeth Mutual Water Company in new well siting after previous well construction attempts.

Watershed Assessment, Flow Modeling and Impact Analysis for Potential Well-field, Sierra Nevada, Mono County, California. Consultant to Mammoth Mountain Ski Area in a joint project with the Mammoth Community Water District regarding water resources issues associated with a proposed land transfer with the Inyo National Forest, and the potential development of a water supply in an eastern Sierra watershed. Work involved developing conceptual model and associated preliminary numerical groundwater flow model of an eastern Sierra watershed, conducting field investigations to evaluate hydrogeologic parameters (including aquifer testing of potential water-supply wells) identified to be sensitive in the numerical model, and finalizing the numerical groundwater flow model through updating parameters and boundary conditions based on data obtained from the field investigations and performing a transient calibration. The final numerical model was used to evaluate potential groundwater impacts of the proposed project.

Seepage Modeling, Multiple Projects, New Zealand. Provided technical oversight for finite element groundwater seepage modeling (SEEP/W) and hydrogeologic evaluation of tailings mitigation, Coeur Gold Golden Cross Mine Tailings Impoundment, New Zealand. Modeling was conducted to evaluate practicability of tailings dam dewatering schemes. Additionally, conducted seepage modeling to evaluate effects and feasibility of dewatering for the Mangare Waste Treatment Plant Upgrade. This would ultimately lead to the biggest environmental restoration program to be undertaken in New Zealand including removing 500 hectares of oxidation ponds (the subject of the modeling) and restoring 13 kilometers of coastline.

Numerical Flow Modeling, Owens Valley, Inyo County, California. Hydrogeologic consultant for the Owens Valley Indian Water Commission through the development of hydrogeologic data gathering, development of conceptual models for the Lone Pine Reservation, Big Pine Reservation and Bishop Reservation areas of the Owens Valley, and development of numerical groundwater models for each of these areas. The models developed provide these Paiute/Shoshone tribes with tools to evaluate the impacts on local reservations of water resource activities conducted by outside agencies. This U.S. Geological Survey – peer reviewed modeling effort provided strong water management tools for the tribal community of the Owens Valley.

Water-Supply Feasibility Study, Inyo County, California. Principal in Charge for hydrogeologic services associated with a feasibility study for a potable water supply and fire-flow system for the community of Tecopa in Inyo County, California. Work was conducted under a California Department of Water Resources grant (Integrated Regional Water Management Planning – Proposition 84). Waters in the area typically have elevated dissolved solids and metals such as arsenic and residents routinely obtain water from distant sources. The study was being conducted under a grant from the California Department of Water Resources, and because of this work, a grant to

implement the water system has been received and the facility constructed and operational.

Water Resource Assessments, Mono County, California. Served as consultant to Mono County conducting groundwater availability assessments for several Mono County communities including: Antelope Valley (West Walker River); Mono City and Lee Vining (Mono Basin), Crowley and the Tri-Valley areas (Owens River). Work included conducting field reconnaissance activities, developing groundwater recharge estimates, evaluating local groundwater budgets, identifying potential future impacts due to regional growth, water quality issues, etc. He has also provided hydrogeologic support to the County of Mono with respect to reviewing and evaluating groundwater modeling conducted to evaluate potential impacts caused by expansion of a geothermal plant in Mono County.

Groundwater-Supply Feasibility Study, San Mateo County, California. Currently conducting a feasibility/well siting study related to the development of a groundwater supply for the La Honda area in the northern Santa Cruz Mountains of San Mateo County. The area has relied on surface water for its water supply and groundwater is being considered as a supplemental source of water for the San Mateo County Community Service Area No. 7 water system.

Vineyard Water Resource Assessment, Lake County, California. Served as consultant to Shannon Vineyards to evaluate water supply for existing and future development of vineyards in Lake County, California. Investigation identified a previously unidentified aspect to the hydrologic conceptual model indicating that more groundwater may be available to support future development and potentially alleviate long-term concerns for local impacts to springs. Additional data collection and analysis was recommended to support these new findings.

Well Siting Analysis, Los Angeles County, California. Conducted analyses including fracture trace analysis to identify potential production well sites for the Elizabeth Lake Mutual Water Company. The area of the well will be within the trace of the San Andreas Fault Zone, resulting in a complex fracture analysis and review of existing of wells and springs.

PUBLICATIONS

Zdon, A., Love, A.H. (2020). "Groundwater Forensics Methods for Differentiating Local and Regional Springs in Arid Eastern California, USA." Environmental Forensics.
<https://doi.org/10.1080/15275922.2020.1836075>.

Parker, S.S., Zdon, A., Christian, W.T., Cohen, B.S., Mejia, M.P., Fraga, N.S., Curd, E.E., Edalati, K., and Renshaw, M.A. (2020). "Conservation of Mojave Desert Springs and Associated Biota: Status, Threats and Policy Opportunities." Biodiversity and Conservation.
<https://doi.org/10.1007/s10531-020-02090-7>.

Zdon, A. (2019). "An inventory of operational and planned groundwater recharge basins in the San Joaquin Valley, California." Prepared for Point Blue Conservation Science.

https://data.pointblue.org/apps/data_catalog/dataset/california-ecological-data-layers.

Zdon, A., Rainville, K., Love, A.H., Buckmaster, N., and Parmenter, S. (2019). "Identification of source-water mixing in the Fish Slough spring complex, Mono County, California, USA." *Hydrology* 2019, 6. 26. <https://www.mdpi.com/2306-5338/6/1/26>.

Love, A.H., Zdon, A. (2018). "Use of Radiocarbon Ages to Narrow Groundwater Recharge Estimates in the Southeastern Mojave Desert, USA." *Hydrology* 2018, 5, 51. <https://www.mdpi.com/2306-5338/5/3/51>.

Zdon, A., Davisson, M.L., and Love, A.H. (2018) "Understanding the source of water for selected springs within Mojave Trails National Monument, California." *Environmental Forensics*, Volume 19, No. 2, 99-111. <https://doi.org/10.1080/15275922.2018.1448909>.

Zdon, A. (2017). "Water in the Desert? A Survey of Springs 2015-2016." *Desert Report: News of the Desert from Sierra Club California and Nevada Desert Committee*. June.

Potter, Christopher, Zdon, A., and Weigand, J. (2017) "Monitoring Springs in the Mojave Desert using Landsat Time Series Analysis. *International Journal of Water Resources and Environmental Management*, Volume 8, No. 2. December.

Zdon, A., Davisson, M. L., and Love, A.H. (2015) "Testing the Established Hydrogeologic Model of Source Water to the Amargosa River Basin, Inyo and San Bernardino Counties, California." *Environmental forensics*, v. 16,4 pp. 344-355. <https://doi.org/10.1080/15375922.2015.1091406>.

Zdon, A. (2014) "Wading Deep: The Importance of Hydrological Monitoring." *California Council of Land Trusts, Conservation Frontiers*, Volume 5.3, July. 8 p.

Traylor, R.L., Zdon, A., Zawadki, A. (2001) "Identification of Areas for Potential Recharge Projects, New Well Siting Areas and Basin Source Water Assessment." *Proceedings of the XXXI International Association of Hydrogeologists Congress Munich, Germany, 10-14 September 2001: New Approaches Characterizing Groundwater Flow*. Pages 657-661.

Brothers, K., Tracy, J., Kaufmann, R. F., Stock, M., Bentley, C., Zdon, A., and Kepper, J. (1992) "Hydrology and Interactive Computer Modeling of Ground and Surface Water in the Lower Virgin River Valley, primarily in Clark County, Nevada." *Las Vegas Valley Water District, Cooperative Water Project, Series Report No. 1*, 90 p.

Brothers, K., Buqo, T. S., Tracy, J., Kaufmann, R. F., Stock, M., Bentley, C., Zdon, A., and Kepper, J., 1993, *Hydrology and steady state ground-water model of Cave Valley, Lincoln and White Pine Counties, Nevada: Las Vegas Valley Water District, Cooperative Water Project, Series Report No. 11*, 48.

Zdon, A., ed. (1991) "Geology of the Las Vegas Region." *American Association of Professional Geologists, Nevada Section, 1991 Field Trip Guidebook*. Las Vegas, Nevada.

PROFESSIONAL AFFILIATIONS

National Ground Water Association

Geological Society of America

Society for Mining, Metallurgy and Exploration

SPEAKING ENGAGEMENTS

Edalati, E., Yuerong, M., Shih, B., Curd, E., Renshaw, M., Mejia, M.P., Wayne, R., Fraga, N., Zdon, A., Parker, S. (2020). "Environmental DNA and Biodiversity Assessment of Mojave Desert Springs." 2020 California Aquatic Bioassessment Workgroup and California Society for Freshwater Science Meeting. October 13.

Palacios, M., Edalati, K., Curd, E., Renshaw, M., Fraga, N., Zdon, A., Wayne, R., Parker, S. (2020). "Assessing Biodiversity of Mojave Desert Springs using Environmental DNA, Botanical Surveys, Geology and Ecoregion." Poster Presentation, 2020 California Aquatic Bioassessment Workgroup and California Society for Freshwater Science Meeting. October 13.

Rosen, S., Zdon, A. (2020). "PFAS in Eastern California." Webinar presented to Transition Habitat Conservancy and regional agencies and NGOs. May 12.

Zdon, A. (2019) "Current efforts for Baseline Understanding of Groundwater-dependent Ecosystems in Arid California," Oral Presentation, Los Angeles County Bar Association-Environmental Law Section Spring Symposium, Los Angeles, California (April 12, 2019).

Zdon, A. (2019) "Increasing our Understanding of Eastern California Springs: the Amargosa and Beyond." Oral Presentation, University of California White Mountain Research Station public lecture series, Bishop, California. (March 12, 2019).

Zdon, A. (2018). "Water – California's most precious resource," Oral Presentation, Oakland Museum of California, Oakland, California. (November 5, 2018).

Zdon, A. (2017) "Hydrologic Processes in a Shifting Climate in the Arid Southwest," Oral Presentation, 2017 University of California, Davis – California Department of Water Resources – Point Blue Conservation Science Riparian Summit, Davis, California. (October 18, 2017).

Zdon, A. (2017) "Spring Surveys for Land Trusts - Lessons Learned from a Regional Survey," Oral Presentation, 2017 California Council of Land Trusts,

2017 Land Conservation Conference, University of California, Davis (March 2017).

Davisson, M.L., A. Zdon (2015) "Constraints on the Recharge Sources, Flowpaths, and Ages of Groundwater in the Amargosa River Valley", Oral Presentation with Abstract, 2015 Jim Deacon Memorial Devil's Hole Annual Workshop, Ash Meadows National Wildlife Refuge, Nevada. (May 7, 2015).

Belcher, W., D. Sweetkind, C. Hopkins, M. Poff, A. Zdon, L. Davisson (2015) "Evaluating Groundwater Flow Paths in Lower Amargosa Valley, Nye County, Nevada and Inyo County, California: Conceptual Model." Oral Presentation with Abstract, 2015 Jim Deacon Memorial Devil's Hole Annual Workshop, Ash Meadows National Wildlife Refuge, Nevada. (May 7, 2015 - Joint presentation with U.S. Geological Survey).

Love, A.H., A. Zdon (2015) "Assessing Limited Water Resources - Water Resources Forensics." 25th Annual International Conference on Soil, Water, Energy, & Air, San Diego, CA. Oral Presentation presented March 24, 2015.

Zdon, A., A.H. Love (2015) "Legal and Regulatory Considerations for Land/Water Conservation Science." California Council of Land Trusts Land Conservation Conference, Sacramento, CA. Oral Presentation presented March 6, 2015.

Zdon, A. (2015). "Southern California Water: Issues Facing the Conservation Community." California Council of Land Trusts Land Conservation Conference, Sacramento, CA. Oral Presentation presented March 5, 2015.

Zdon, A., W. Belcher, D. Sweetkind, M. Poff, C. Hopkins (2015) "Hydrologic Characterization: A Crucial Component for Protecting Wildlife Habitat along the Amargosa Wild & Scenic River." Abstract and Oral Presentation, 2015. Amargosa Vole Working Group Meeting, Western Section of the Wildlife Society, Santa Rosa, CA. January 27. (Joint paper with U.S. Geological Survey).

Zdon, A. (2014) "Baseline Hydrologic Characterization of Springs in the California Desert: A Critical Component for Water Resource Management." Abstract and Oral Presentation, Devil's Hole Conference, Death Valley National Park. Presented April 30, 2014.

Zdon, A. (2014) "Understanding Your Water Resources." Workshop, California Council of Land Trusts Land Conservation Conference, Sacramento, California. March 5.

Zdon, A. (2013) "In the Footsteps of Early Researchers: Evolving Hydrologic Understanding in the California Desert." The 2013 National Ground Water Association Summit: The National and International

Conference on Groundwater, San Antonio, Texas. June 1, 2013. Oral Presentation with Abstract.

Love, A.H., Zdon A., Philipp, J.R. (2013) "Testing the Established Regional Hydrologic Conceptual Model in the Amargosa River Basin, California and Nevada." The 2013 National Ground Water Association Summit: The National and International Conference on Groundwater, San Antonio, Texas. June 1, 2013. Oral Presentation with Abstract.

Zdon, A. (2013) "Water: The Missing Element in Land Conservation." The 2013 California Land Conservation Conference, California Council of Land Trusts, Sacramento, California. March 19, 2013. Concurrent Session leader and presenter.

Zdon, A. (2013) "Baseline Hydrologic Investigation and Monitoring, Amargosa River Wild and Scenic River System, California and Nevada." The 2013 California Land Conservation Conference, California Council of Land Trusts, Sacramento, California. March 19, 2013. Oral presentation.