

NOTICE OF ENVIRONMENTAL COMMITTEE MEETING

Responsible for matters of stewardship of the District's property including: Urban Water Management Plans; Water Conservation Programs; Classis Watershed Education Grants; Watershed Management; Resource Management and other environmental related matter.

NOTICE IS HEREBY GIVEN that the San Lorenzo Valley Water District has called a regular meeting of the Environmental Committee to be held Thursday, **July 11, 2019 at 9:30 a.m.** at the Operations Building, 13057 Highway 9, Boulder Creek, California.

AGENDA:

1. Convene Meeting/Roll Call
2. Oral Communications:
This portion of the agenda is reserved for Oral Communications by the public for items that are not on the Agenda. Any person may address the Committee at this time, on any subject that lies within the jurisdiction of this committee. Normally, presentations must not exceed three (3) minutes in length, and individuals may only speak once during Oral Communications. No actions may be taken by the Committee on any Oral Communications presented; however, the Committee may request that the matter be placed on a future agenda. Please state your name and town/city of residence at the beginning of the statement for the record.
3. Old Business:
Members of the public will be given the opportunity to address each scheduled item prior to Committee action. The Chairperson of the Committee may establish a time limit for members of the public to address the Committee on agenda items.
 - A. RFP FOR HYDROGEOLOGIST
Review and discussion by the Committee regarding the proposals received for a Hydrogeologist Consulting Firm with the intent to recommend one to the Board.
4. New Business: None
Members of the public will be given the opportunity to address each scheduled item prior to Committee action. The Chairperson of the Committee may establish a time limit for members of the public to address the Committee on agenda items.
5. Informational Material: None
6. Adjournment

In compliance with the requirements of Title II of the American Disabilities Act of 1990, the San Lorenzo Valley Water District requires that any person in need of any type of special equipment, assistance or accommodation(s) in order to communicate at the District's Public Meeting can contact the District Office at (831) 338-2153 a minimum of 72 hours prior to the scheduled meeting.

Agenda documents, including materials related to an item on this agenda submitted to the Committee after distribution of the agenda packet, are available for public inspection and may be reviewed at the office of the District Secretary, 13060 Highway 9, Boulder Creek, CA 95006 during normal business hours. Such documents may also be available on the District website at www.slvwd.com subject to staff's ability to post the documents before the meeting.

Certification of Posting

I hereby certify that on July 2, 2019, I posted a copy of the foregoing agenda in the outside display case at the District Office, 13060 Highway 9, Boulder Creek, California, said time being at least 72 hours in advance of the meeting of the Environmental Committee of the San Lorenzo Valley Water District in compliance with California Government Code Section 54956.

Executed at Boulder Creek, California, on July 2, 2019.

Holly B. Hossack, District Secretary
San Lorenzo Valley Water District

EVALUATION SCORESHEET

Hydrogeologic Consultant for SLVWD

Evaluator: _____

Firm: EKI Environment & Water

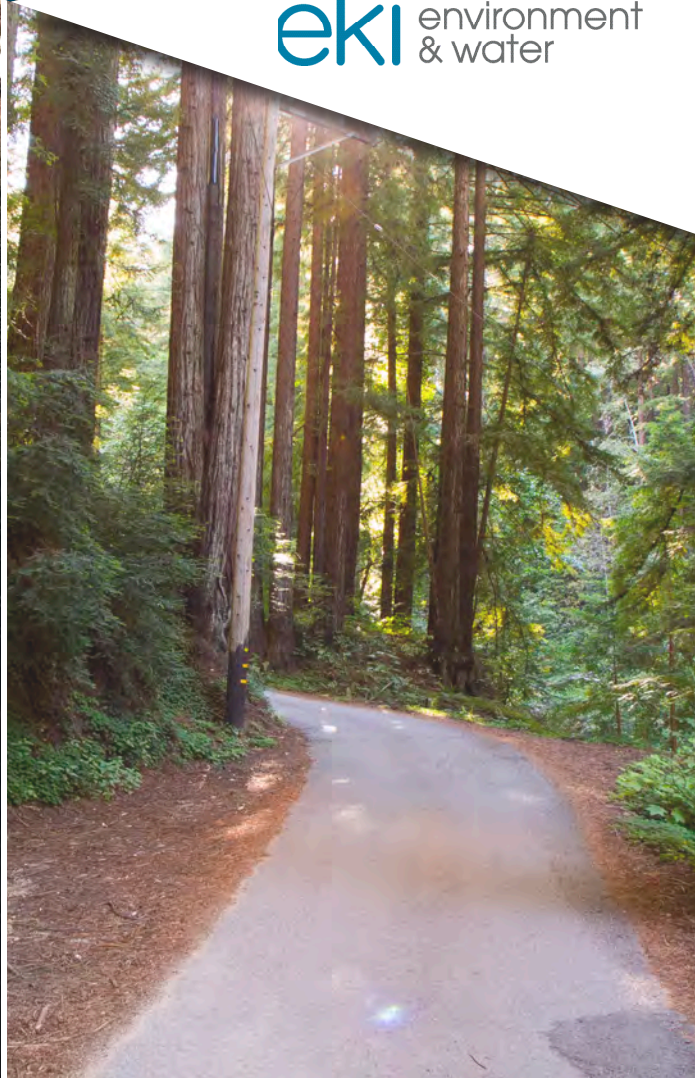
Required Information	Check (Pass/Fail)	Comments	
A. Cover Letter Include a cover letter attesting to its accuracy, signed by an individual authorized to execute binding legal documents on behalf on the proposing firm. Provide the name, address, email, telephone and facsimile numbers of the proposed Project Manager, who will serve as the primary contact for the company.			
B. Company Qualifications Provide a description of your company's recent and relevant experience with SGMA and related groundwater matters such as management areas and groundwater modeling. Experience with sustainable water supply management, board communication and public presentations.			
C. Experience Include a discussion of your company's experience involving MODFLOW and working for water agencies. Preference will be given to respondents that have experience wirking with SGMA and who demonstrate understanding of managing water supply in complex geologic environments.			
D. Key Project Staff Experience and Qualifications Include a listing of all key personnel (including subconsultants when applicable) involved in performing the work and their respective degree of involvement. A description of their background, qualifications, and recent similar experience and responsibility must also be included. Clearly link the staff and projects listed.			
E. Client References Provide client references, including contact person and current telephone numbers. References should focus on projects in which the personnel listed in Item D had relevant responsibilities.			
F. Current Fee Schedule Provide a current fee schedule for the classifications and activities anticipated to be employed in thie project. The Agency will relay on this fee schedule when negotiating the scope of work and budget (based on time and materials) for the contract.			
Completeness of the SOQ (Weighted score: Possible points provided in each criteria category.)			
Evaluation Criteria	Points	Comments	Weighted Score
1. Qualifications as they relate to this project (0-40 points) Candidate's range of experience on similar projects and with the full range of duties that may be included in a contract. Qualifications of proposed key personnel on similar projects and with the full range of duties that may be included in a contract. Communication skills. Fee schedule.			
Understanding and approach to the work to be done (0-30 points)			
3. Candidate's experience with similar kinds of work (0- 15 points)			
4. Overall clarity and presentation of the SOQ (0-10 points)			
5. Canadites Local Experience (0-5 points)			
Sum of points:			

**SAN LORENZO
VALLEY WATER
DISTRICT**

STATEMENT OF QUALIFICATIONS FOR

**As-Needed Hydrogeological
Consulting Services**

eki environment
& water



24 June 2019

San Lorenzo Valley Water District
13060 Highway 9
Boulder Creek, CA 95006
Attn: Holly Hossack, District Secretary
hhossack@slvwd.com

Subject: Statement of Qualifications for As-Needed Hydrogeological Consulting Services

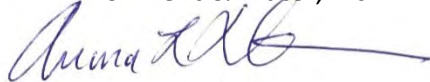
Dear Ms. Hossack:

EKI Environment & Water, Inc. (EKI) has assembled a highly experienced team to provide the San Lorenzo Valley Water District (SLVWD or District) with technical consulting services related to, among other things: (1) MODFLOW expertise, including MODFLOW experience specifically in the Santa Margarita Groundwater Basin (Basin), (2) Sustainable Groundwater management Act (SGMA) experience, and (3) experience helping water agencies effectively manage water supplies in complex geologic environments. The EKI Team is uniquely qualified to support SLVWD due to our:

- Proven leadership;
- Strong technical qualifications, including in-depth knowledge of the MODFLOW model review of the Basin and local SGMA implementation processes;
- Track record of successful technical and stakeholder outreach efforts in the Basin, in coordination with District staff;
- Effective communication skills; and
- Commitment to representing the District in SGMA and other related Basin processes.

EKI is very excited for the potential opportunity to develop a long-term working relationship with the SLVWD. Accordingly, we have discounted our rate schedule to make our SOQ as competitive as possible. Please do not hesitate to contact us with any questions regarding this proposal.

Very truly yours,
EKI Environment & Water, Inc.



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1. FIRM BACKGROUND

EKI Environment & Water, Inc. (EKI) is an employee-owned company that has provided comprehensive engineering, environmental, and water resources services to public and private sector clients throughout California and the United States since its founding in 1989. EKI's staff consists of more than 70 engineers, geologists, hydrogeologists, environmental scientists, computer-aided designers, and GIS and database specialists in our multiple offices throughout California (see Figure 1) and the United States. Our company has sustained steady, organic growth that is anchored by our senior staff, many of whom have worked at EKI for more than 15 years.



Figure 1. EKI's northern California office locations.

Over the past 30 years, EKI has established a strong reputation for effective project management and client satisfaction. EKI has never filed bankruptcy, had a contract or subcontract terminated in default, or had claims made against us that resulted in litigation or arbitration.

EKI is uniquely qualified to provide hydrogeological consulting services to the San Lorenzo Valley Water District (SLVWD or District). The EKI team has decades of experience using MODFLOW for local, basin-scale and regional modeling efforts. We also have broad expertise in Sustainable Groundwater Management Act (SGMA) implementation throughout California, including recent, highly relevant experience in the Santa Margarita Basin (Basin) conducting: (1) a groundwater model review and recommended improvements to support Groundwater Sustainability Plan (GSP) development and SGMA compliance, and (2) supporting the Santa Margarita Groundwater Agency (SMGWA) with public education workshops as part of SGMA outreach efforts.

2. PROJECT UNDERSTANDING AND APPROACH

The SLVWD is facing important challenges, including: (1) how to most effectively participate in the SMGWA's GSP development process; (2) how to maintain SLVWD surface water diversion rights and protect groundwater uses by public and private entities; and, (3) stewardship of interconnected surface water, groundwater, and terrestrial and aquatic ecosystems. As described below, EKI will support the District to effectively meet these challenges by designating a highly-qualified Project Manager (PM) who will work directly with the SLVWD Board of Directors and staff in the capacity of strategic technical advisor. When necessary to address specific issues, the PM will be supported by a strong bench of expert hydrogeologists, engineers, and scientists from within and outside EKI. By leveraging selected work efforts and taking advantage of efficiencies provided by technology, EKI will be able to perform the work in a cost-effective manner. Key aspects of EKI's approach to supporting SLVWD are summarized below.

Represent and Support SLVWD through GSP Development Process: SLVWD is a member of the SMGWA, which was formed in June 2017 by a Joint Exercise of Powers Authority (JPA). SLVWD holds two of 11 Board seats and will play an active role during GSP development. EKI's objective will be to represent SLVWD's interests throughout the GSP process, including providing

technical review of GSP sections and underlying models, etc. For example, SLVWD has conducted numerous studies to better understand the Basin and it is imperative that these studies and data be properly incorporated into the GSP process. We will also advocate for the GSP Implementation Plan to be cost-effective, while meeting the regulations and providing value. As described in the Case Study to the right, EKI has significant experience in this kind of role, and is currently performing strategic technical support for SGMA compliance for the Cuyama Valley Basin Water District in the Cuyama Valley Basin, for the Cordua Irrigation District in the North Yuba Subbasin, and for the Marina Coast Water District in the Salinas Valley Basin as part of Basin scale GSP processes. EKI has proven to be very effective in this role based on our experience developing 10 GSPs in some of the most technically and jurisdictionally complex basins throughout California

Identify Potential Management Areas: Based on the significant spatial complexities in the Basin’s hydrogeology, groundwater use, and jurisdictional boundaries, Management Areas will most likely be employed in the GSP. The SLVWD Service Area boundaries are potential Management Areas to consider. For example, SLVWD undertook efforts decades ago to protect recharge areas surrounding their Olympia and Quail Hollow well fields, including significant investment into land purchases. EKI will work with SLVWD to identify and delineate potential Management Areas, and advocate for the inclusion of these Management Areas within the GSP.

Identify Projects to Support Sustainability: Several SLVWD projects already exist in different stages of planning that may support and benefit groundwater sustainability (e.g., SLVWD’s stream flow gaging stations, improvements to SLVWD’s distribution system, water rights claims, habitat monitoring, and in-lieu recharge project plans). To the extent applicable, EKI will advocate for the inclusion of these projects in the GSP, and for the development of a framework wherein SLVWD will get the “credit” for the benefits provided by these projects.

CASE STUDY:

STRATEGIC TECHNICAL SUPPORT FOR THE CUYAMA VALLEY BASIN WATER DISTRICT

EKI is providing strategic technical support to Cuyama Valley Basin Water District (CVBWD) in its response to SGMA in the Cuyama Valley Basin, one of the most critically-overdrafted basins in the State. The District only holds 5 of 11 seats on the Cuyama Basin GSA, even though CVBWD landowners represent 95% of the groundwater use within the Basin and stand to experience significant reductions in water supply and agricultural production in the SGMA process. EKI is providing technical and strategic support to the CVBWD as part of the GSP development process through peer review of the GSP and model development work by the GSA’s consultant. EKI has provided an opinion on the validity of key GSP assumptions and findings related to the hydrogeologic conceptual model, sustainability criteria, and the numerical model being developed by the GSP consultants. EKI outlined steps for improving the model to support basin-wide GSP development and to provide for uncertainty analysis and adaptive management. We also identified an Alternative GSP Implementation Plan that is thoroughly compliant with the regulations and more reasonably implemented within the financial means of Basin landowners.

Identify New Supply Sources: The EKI Team has experience with well siting within the Basin. Additionally, our experience includes completion of feasibility studies and the development and permitting of groundwater and recycled water projects, as well as technical support for surface water and groundwater substitution water transfers. For example, EKI supported the City of East Palo Alto with its water supply strategy, including providing technical services related to their successful pursuit of the first-ever transfer of Individual Supply Guarantee on the Hetch-Hetchy system and supporting them to develop their local groundwater supplies through production well and treatment system design. We also have broad experience in water supply portfolio development, including water conservation, recycled water and non-potable reuse, and stormwater capture and reuse.

Sustainable Groundwater Management Considerations: Sustainable management criteria (SMCs) must be relevant to processes that are directly influenced by groundwater management actions (e.g., pumping or mitigation). The EKI Team will identify potential SMCs for key Sustainability Indicators (e.g., recommended baseflows and/or minimum groundwater levels) to help promote sustainability within SLVWD’s Service Areas. EKI will advocate for inclusion of these SMCs in the GSP, as well as review the SMCs for adjacent Management Areas to ensure that they will not have a negative impact on SLVWD’s ability to maintain sustainability.

Client Communication: EKI will support SLVWD staff and the Board of Directors through attendance at Board meetings and other routine communications. EKI excels at written and verbal communication, and at developing and presenting technical presentations that are understandable to diverse audiences. Additionally, EKI has significant experience participating in, presenting at, and informing Board of Directors through in-person meetings and teleconferences.

3. EXPERIENCE

MODFLOW

EKI has developed, reviewed, and employed primarily MODFLOW models in over 30 projects throughout California (Figure 2). In addition to MODFLOW, our subsurface modeling experience includes finite element models (IWFM and FEMFLOW3D), and analytical modeling tools such as WINFLOW. Our modeling approach benefits from integration with GIS for spatial analyses and subsurface characterization with programs such as TPROGS. Groundwater solute transport, geochemical, and temperature modeling applications have employed SEAWAT, SUTRA, MTD3D, SUTRA, MODPATH, PHAST, STANMOD, PHREEQC and VSTD codes. Unsaturated-zone modeling applications have included the use of soil moisture budget modeling and VSTD, IDC, SUTRA and HYDRUS. An example project is presented below:



Figure 2. Groundwater modeling work efforts.

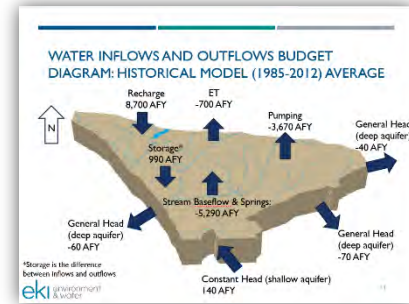
Santa Margarita Groundwater Model Assessment and Review

Team Members: John Fio, Christina Lucero, Anona Dutton, Martin Feeney

Date of Services: May 2018 to February 2019

Project Location: Santa Margarita Groundwater Basin, Santa Cruz County

- ✓ Basin Experience
- ✓ SGMA Implementation to Support GSP Development
- ✓ Groundwater Modeling/MODFLOW Experience
- ✓ Multi-Agency Communication



As a foundational effort for its local SGMA implementation, the SMGWA sought confirmation as to whether the existing MODFLOW groundwater flow model developed for the Santa Margarita Groundwater Basin would comply with the SGMA regulations. The EKI Team assessed the Santa Margarita Groundwater Model in the context of SGMA’s standards and objectives and provided the SMGWA with detailed recommendations as to how the model could be modified and improved to support GSP development and SGMA implementation in the Basin. Our work included coordination and input from local experts and agency consultants, and the review findings were presented to the SMGWA technical committee and interested Board members. These recommendations are being implemented as part of GSP development for the Basin.

Water Agencies

The EKI Team has past successes working with water supply and water management agencies within California, including BAWSCA, Daly City, City of Lathrop, California Water Service Company, Arvin-Edison Water Storage District, Irvine Ranch Water District, Sacramento County and many more. An example project is presented below:

Westside Basin Groundwater Management

Team Members: John Fio, Christina Lucero

Date of Services: 1998 to present

Project Location: Westside Groundwater Basin, San Francisco and San Mateo Counties

- ✓ Groundwater Modeling/MODFLOW Experience
- ✓ Multi-Agency Communication
- ✓ Sustainable Groundwater Management Considerations
- ✓ Conjunctive Use Planning



Groundwater pumped from the Westside Basin provides a substantial portion of the normal and dry year water supply for municipal and private water suppliers and users in San Francisco and San Mateo counties (e.g., the Cities of San Bruno, Daly City and South San Francisco). In recent years, basin management efforts have expanded to include a large-scale aquifer storage and recovery (ASR) project developed by the San Francisco Public Utilities Commission (SFPUC)

that supports regional reliability. As demands for water increase, coordinated groundwater and surface water management is critical to maintaining a reliable water supply for all beneficial uses and users in the basin. Since 1998, EKI staff have contributed significantly to the increased technical understanding and improved management of the Westside Basin.

In 2002, EKI staff developed the initial Westside Basin Groundwater Model, followed by updates in 2007, 2009, 2014, and 2017. Through adaptive management, these updates incorporated new data and led to insights that improved model performance and reliability, and basin characterization and management. In recent efforts (2018 and 2019) EKI is using the model to simulate ASR project operations and develop project accounting methods.

A critical aspect of our work was developing consensus between the various basin stakeholders and their technical representatives. This included facilitating the exchange of data between multiple parties, coordinating and responding to model reviews, and listening and integrating the input during the update process.

Water Supply Management in Complex Environments

The EKI Team combines ingenuity, collaboration and responsiveness to deliver integrated water supply management solutions in complex environments. Our team excels at stakeholder engagement, at navigating the political constraints of GSP development and GSA administration in large, multi-agency basins, and enjoys the challenging technical aspects of water supply management in complex geologic environments. Our work efforts have focused on managing SGMA compliance, maintaining quality and reliability of surface water supplies, and quantifying the benefits of groundwater banking and conjunctive use efforts. The projects below and in the SGMA section highlight the applicability and relevance of our experience.

Public Outreach to Support GSP Development in the Santa Margarita Groundwater Basin

Team Members: John Fio

Date of Services: December 2018 to February 2019

Project Location: Santa Margarita Groundwater Basin, Santa Cruz County

- ✓ **Basin Experience**
- ✓ **SGMA Implementation to Support GSP Development**
- ✓ **Multi-Agency Communication**



EKI participated in SMGWA’s February public community workshop 2 “Water Budgets: How Do We Balance All Needs?” by preparing two presentations which: (1) detailed SGMA’s requirements for presenting the Hydrogeological Conceptual Model, and (2) identified main components of the Santa Margarita Basin’s water budget and their representation within the Santa Margarita Groundwater Model. Additionally, EKI designed an interactive game to engage and inform the public on water budget components and accounting.

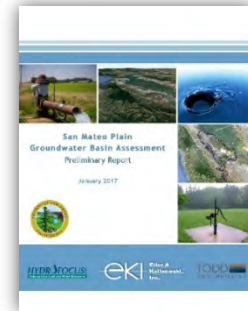
San Mateo Plain Subbasin Groundwater Assessment Study

Team Members: Anona Dutton, John Fio, Christina Lucero

Date of Services: 2016 to present

Project Location: San Mateo Plain Subbasin

- ✓ **Basin Experience**
- ✓ **SGMA Implementation to Support GSP Development**
- ✓ **Groundwater Modeling/MODFLOW Experience**
- ✓ **Multi-Agency Communication**



EKI lead a multi-disciplinary a team to develop the first-ever comprehensive groundwater basin assessment for the San Mateo Plain Groundwater Subbasin. This effort established a foundational understanding of the basin and is assisting the basin with future management and compliance with CASGEM.

Initial efforts included rigorous technical modeling and analysis, including compilation of disparate data sources into a single basin database, development of a hydrogeologic conceptual model, construction of a regional numerical groundwater model, a detailed assessment of potential threats to groundwater, and the development of a comprehensive basin water balance.

The Project Team also conducted an analysis of Bay Mud conductivity, developed modeling scenarios, and evaluated and outlined available basin management strategies, including both institutional and physical management options. EKI is now supporting the Basin in achieving CASGEM compliance, including identifying and conducting initial water level measurements across a potential monitoring well network.

The project was structured around strong public outreach and engagement and has included multiple stakeholder workshops led by EKI. Identification of data gaps, prioritization of modeling scenarios, and other key technical components of this project were informed through active, frequent engagement with basin stakeholders. Our successful public engagement process was profiled in an [article](#) by Stanford's Water in the West.

SGMA Experience

EKI has extensive experience with SGMA implementation, supported by decades of work conducting water supply portfolio analysis and development, groundwater modeling, and hydrogeologic investigations for numerous public and private entities.

As shown in Figure 3, EKI is working with entities throughout California to develop strategic responses to comply with SGMA, and on other groundwater characterization and resource issues including: supporting successful basin boundary modification requests; assisting in the formation and administration of GSAs; conducting extensive public engagement; preparing successful applications for Proposition 1 funding; performing groundwater modeling; assessing groundwater sustainable yield and overdraft issues as part of basin adjudications; preparing groundwater conditions evaluations and evaluations of projects and management actions; developing and analyzing the technical information required for GSPs; and developing GSPs at both the basin and sub-basin scale.

Our experience in a variety of roles, and during all SGMA implementation phases, provides EKI with a valuable perspective on what our clients must accomplish to successfully comply with SGMA. We have established a reputation for our solution-oriented approach to projects, supported by ongoing client communication and an established credibility with regulatory agencies such as the California Department of Water Resources (DWR) and State Water Resources Control Board (SWRCB). An example project is presented below:

SGMA Support in the White Wolf Subbasin

Team Members: Anona Dutton, Christina Lucero

Date of Services: 2015 to present

Project Location: White Wolf Groundwater Subbasin, Kern County

- ✓ **SGMA Implementation to Support GSP Development**
- ✓ **Groundwater Modeling Experience**
- ✓ **Multi-Agency Communication**
- ✓ **Sustainable Groundwater Management Considerations**

EKI is supporting Arvin-Edison Water Storage District (AEWSD), Tejon-Castac Water District (TCWD), Kern County, and Wheeler-Ridge Maricopa Water Storage District (WRMWS) with their strategic response to SGMA in the White Wolf Subbasin (WWB). Work to date has included the development and filing of a successful basin boundary modification (BBM) request to subdivide the Kern County Subbasin into two subbasins – the Kern County Subbasin and the WWB. DWR stated that EKI’s work supported “the best boundary modification request they had ever seen”.

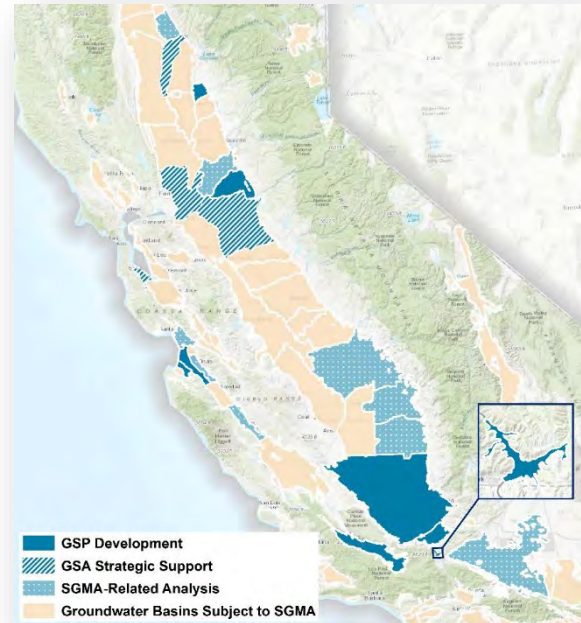


Figure 3. Groundwater basins in which EKI is supporting SGMA related work efforts.



EKI also successfully petitioned DWR to remove the “critically overdrafted” status from the newly-formed WWB, which is now a medium priority basin. In a parallel effort, EKI is supporting the Districts on an ongoing basis with SGMA compliance in the WWB, including supporting GSA formation and administration, successfully securing Proposition 1 funding, and developing a coordinated GSP.

EKI recommended use of DWR’s newly developed C2VSim-Fine Grid model to support WWB water budgeting efforts and to coordinate cross-boundary flow estimates with the neighboring Kern County Subbasin. EKI also developed a companion analytical water budget spreadsheet model which accounts for all surface water and groundwater flow throughout the WWB. Using these water budget results, we are currently working to verify C2VSim’s water budget for the WWB to support basin sustainable yield estimates and other GSP-related analysis.

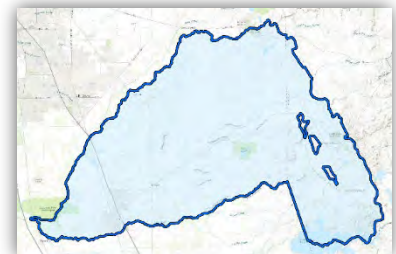
In support of sustainable groundwater management, EKI assisted the GSAs in identifying a dedicated monitoring network to achieve CASGEM compliance and support SGMA implementation. We have also conducted extensive analysis of water level and water quality trends, subsidence, Groundwater Dependent Ecosystems (GDEs) and imported water reliability to support development of sustainability criteria that will ensure sustainable management of the WWB.

Cosumnes Basin Work Group – SGMA Support in the Cosumnes Subbasin

Project Team Members: Anona Dutton, John Fio, Christina Lucero

Date of Services: 2017 to present

Client Contact: Tom Gohring, General Manager, Water Forum
(916) 808-1998



- ✓ **Basin Experience**
- ✓ **SGMA Implementation to Support GSP Development**
- ✓ **Groundwater Modeling/MODFLOW Experience**
- ✓ **Multi-Agency Communication**

The Cosumnes Work Group consists of Sacramento County, Galt Irrigation District, Clay Water District, City of Galt, Sloughhouse Resource Conservation District, Omochumne-Hartnell Water District, and the Amador County Groundwater Authority. In our role as strategic technical advisor, EKI is assisting the Work Group in developing and implementing a comprehensive strategy for the Multi-GSA Cosumnes Basin Workgroup for SGMA compliance, including development of a Proposition 1 application and preparation of a coordinated GSP.

EKI is initiating work to develop a Basin-wide hydrogeologic conceptual model and analysis of undesirable results, including compiling and reviewing water level and water quality data, understanding issues related to surface water / groundwater interactions along the Cosumnes River, and identifying key data gaps (e.g., lack of water quality data). We are also developing a numerical groundwater model of the Basin and leading data gathering efforts to support GSP and model development.

Specific Project Experience

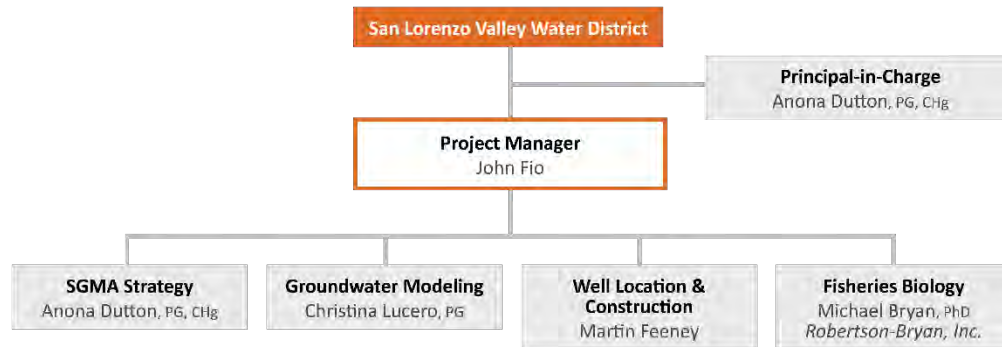
Additional examples of the EKI Team’s experience with groundwater model development, implementation, and review; ongoing SGMA compliance; and groundwater management efforts are listed below.

Client / Location	Project Description	Hydrogeologic Conceptual Model	Water Budget/ Safe Yield	Groundwater Modeling	Water Quality Assessment	Securing Grant Funding	Data Collection & Analysis	Public/ Stakeholder Engagement
Marina Coast Water District / Monterey Subbasin	SGMA GSP Development and Water Supply Strategy (groundwater augmentation, IPR/DPR, assess basin impacts from pumping)	•	•		•	•	•	•
City of Lathrop / Eastern San Joaquin Subbasin	SGMA support and Integrated Water System Master Planning, including IPR/DPR options; Basin boundary modification	•	•	•	•	•	•	•
Cuyama Basin Water District/ Cuyama Valley Subbasin	Technical and Strategic SGMA Support	•	•	•	•	•		•
California Water Service Company / Statewide	SGMA strategy for districts in groundwater basins statewide		•				•	
Reclamation District 2106 / Llano Seco Ranch / West Butte Subbasin	Comprehensive Groundwater Services (ASR evaluation, safe yield assessment, SGMA support)	•	•	•			•	
Cordua Irrigation District / North Yuba Subbasin	Comprehensive Groundwater Services (SGMA support and groundwater transfer)	•	•	•			•	•
Tejon-Castac Water District (TCWD) / Castac Basin	Comprehensive Groundwater Services (ASR evaluation, basin safe yield assessment, SGMA support – GSA formation)	•	•	•	•		•	•
TCWD; Wheeler Ridge-Maricopa Water Storage District; Arvin-Edison Water Storage District / White Wolf Subbasin	SGMA Support (GSA formation, Basin Boundary Modification, Comprehensive SGMA Strategy)	•	•		•	•	•	•
Arvin-Edison Water Storage District / Kern Subbasin	Technical and Strategic SGMA Support (GSP development)	•	•		•	•	•	•
Olcese Water District / Kern Subbasin	Technical and Strategic SGMA Support (GSP development)	•	•		•	•	•	

4. STAFF EXPERIENCE

EKI’s appointed **Project Manager, John Fio**, will be the sole liaison between SLVWD and the EKI Team. Mr. Fio has over 30 years of hydrologic experience, including groundwater-flow modeling, chemical fate and transport modeling and geochemical modeling, supporting SGMA compliance and developing GSPs, designing water management plans, and establishing water quality monitoring programs. John is very familiar with the Basin due to his prior work efforts on the Santa Margarita Groundwater Model assessment and participation in the public outreach Water Education Series.

John will be supported by a team of experts selected based on their technical experience, familiarity with SGMA, and experience with local hydrogeologic conditions. Key EKI Team members are listed in the chart below, and include:



Anona Dutton, PG, CHg will lead SGMA strategy efforts. Ms. Dutton has over 17 years of professional experience managing water resources projects, is deeply involved in implementation of SGMA throughout the State and is a recognized expert in her field. Her clients include the cities of Lathrop and East Palo Alto as well as GSAs and water districts throughout the State. A detailed list of Ms. Dutton’s similar projects including her experience working with capital improvement water projects is provided in her resume in Appendix A.

Christina Lucero, PG will lead groundwater modeling efforts. Ms. Lucero has 10 years of professional experience, and has successfully developed and implemented numerous groundwater models, including the Santa Margarita Groundwater Model assessment. Ms. Lucero created a flow and transport model and helped oversee monitoring well installation for the City of Lathrop and performed groundwater modeling to support the development of a new production well in East Palo Alto. A detailed list of Ms. Lucero’s similar projects is provided in her resume in Appendix A.

Martin Feeney, PG, CEG, CHg will be a subconsultant who substantial understanding of the complex hydrogeologic conditions based on decades of experience in the Basin. Martin will support well location selection and well construction efforts. Mr. Feeney has more than 35 years of groundwater consulting experience, significant experience in drilling and well construction technology, and has recent experience designing and constructing wells for the SLVWD. More information is provided below under Section 5.

Michael Bryan, PhD of RBI will be a subconsultant that will lead fisheries biology efforts. Dr. Bryan has 33 years of combined consulting and research experience focused on water quality, fisheries biology (including steelhead and salmon), and aquatic toxicology including CEQA/NEPA documents, Endangered Species Act consultations, water quality and aquatic ecology studies, and regulatory permitting. More information is provided below under Section 5.

EKI has additional water resources and engineering technical expertise fully capable of supporting SLVWD’s other on-call technical work including in water supply portfolio analysis and development, hydraulic modeling, water and wastewater planning, utility program management, and hydrogeologic investigations. EKI’s engineering services include program

management, planning and engineering, design, and construction management for utilities including potable water, wastewater, recycled water, and storm water utilities.

5. SUBCONSULTANT EXPERIENCE

EKI will be supported by Subconsultants: (1) Martin Feeney, hydrogeologist, and (2) Robertson-Bryan, Inc. (RBI), a multi-disciplinary consulting firm with expertise in aquatic and terrestrial biological resources. Mr. Feeney provides invaluable local geologic and hydrogeologic experience having provided continuous well siting, design, construction management, and well rehabilitation services to SLVWD for the past 20 years. RBI has extensive water and power resource planning, water quality, aquatic and terrestrial biological resources, and regulatory compliance expertise.

Martin Feeney, Consulting Hydrogeologist

Martin Feeney has provided hydrogeologic consulting services to SLVWD since 1999 and currently continues to provide these services. Mr. Feeney has predominately provided well siting, design, construction management and well rehabilitation services. He has also assisted the SLVWD in several basin-wide regional groundwater analyses. A selected list of Mr. Feeney's SLVWD projects include:

- 2000 – Design and Replacement of Quail Hollow Well 5 (Well 5A)
- 2001 – Design and Replacement of Quail Hollow Well 4 (Well 4A)
- 2004 – Quail Hollow Aquifer System Large Scale Aquifer Test (with Nick Johnson)
- 2005 – Rehabilitation of Manana Woods Well
- 2012 – Design and Replacement of Pasatiempo Well No. 5 (Well 5A)
- 2015 – Assessment of Pasatiempo Well No. 6
- 2017 – Rehabilitation of Pasatiempo Well No. 7
- 2018 – Replacement of Pasatiempo Well No. 6 (Well No. 8)
- 2019 – Assessment of Olympia and Quail Hollow Wellfields
- 2019 – Rehabilitation of Olympia No. 3 and Quail Hollow No. 5A

Degree of involvement: <25%

Point of Contact: Martin Feeney, PG, CEG, CHg

P.O. Box 23240, Ventura, CA 93002

831-915-1115

mfeeney@ix.netcom.com

Robertson-Bryan, Inc.

Robertson-Bryan, Inc. (RBI) is a multi-disciplinary consulting firm with expertise in aquatic and terrestrial biological resources, and regulatory compliance. Well-established relationships with resource agencies, water and irrigation districts, municipalities, and other public and private organizations throughout the state are a testament to the firm's ability to develop effective solutions that satisfy competing interests. Recent relevant experience includes:

- Yuba County Water Agency South Canal Diversion: In 2018, RBI led the development of project design, prepared CEQA documentation, and obtained the environmental permits for a fast-track project involving excavation of approximately 450 linear feet of the south

channel of the lower Yuba River adjacent to the YWA's South Canal Diversion facility to enhance water supply and fish passage.

- **Temperature Study – Sacramento Regional Wastewater Treatment Plant Discharge To The Sacramento River At Freeport:** RBI was the lead technical consultant responsible for development and implementation of a comprehensive study consisting of eight study elements to assess the potential thermal effects of the Sacramento Regional Wastewater Treatment Plant's (SRWTP) effluent discharge on aquatic life and habitat, including designated critical habitat for delta smelt, Chinook salmon, steelhead, and green sturgeon, in the lower Sacramento River.

Degree of involvement: <25%

Point of Contact: Michael Bryan, Ph.D.

9888 Kent Street, Elk Grove, CA 95624

(916) 714-1802

bryan@robertson-bryan.com

6. CLIENT REFERENCES

San Mateo Plain Subbasin Groundwater Assessment Study

Client: San Mateo County

Reference: Charles Ice, San Mateo County Environmental Health, (650) 399-6911

Team Members: John Fio, Anona Dutton, Christina Lucero

SGMA Foundational Work Efforts in the Santa Margarita Groundwater Basin

Client: SMGWA

Reference: John Ricker, County of Santa Cruz, (831) 454-2750

Team Members: John Fio, Anona Dutton, Christina Lucero, Martin Feeney

Westside Basin Groundwater Management

Client: City of Daly City

Reference: Patrick Sweetland, City of Daly City, (650) 991-8201

Team Members: John Fio, Christina Lucero

New 1500 Well Construction, New Well Design and Construction, & Well Siting Studies

Client: SVWD

Reference: David McNair, SVWD,
(831) 234-6339

Team Members: Martin Feeney

7. FEE SCHEDULE

Hourly rates by personnel classification are provided below. EKI understands that cost is an important issue for SLVWD. In recognition of that fact, we have discounted our rates. We are also committed to limiting costs associated with travel and expenses. Rates for indirect charges and other direct costs will be provided upon request.

EKI Environment & Water, Inc.	
Personnel Classification	Hourly Rate
Officer & Chief Engineer-Scientist	220
Principal Engineer-Scientist	212
Supervising I, Engineer-Scientist	205
Supervising II, Engineer-Scientist	200
Senior I, Engineer-Scientist	193
Senior II, Engineer-Scientist	185
Associate I, Engineer-Scientist	175
Associate II, Engineer-Scientist	165
Engineer-Scientist, Grade 1	155
Engineer-Scientist, Grade 2	145
Engineer-Scientist, Grade 3	135
Engineer-Scientist, Grade 4	125
Engineer-Scientist, Grade 5	115
Engineer-Scientist, Grade 6	105
Technician	100
Senior GIS Analyst	133
CADD Operator / GIS Analyst	118
Senior Administrative Assistant	125
Administrative Assistant	95
Secretary	80

Martin B. Feeney, PG, CEG, CHG	
Personnel Classification	Hourly Rate
Principal Hydrogeologist	195
Principal Hydrogeologist (field)	160
Project Hydrogeologist	175
Word Processor	70
Illustrator/GIS	80

Robertson-Bryan, Inc.			
Personnel Classification	Hourly Rate	Personnel Classification	Hourly Rate
Managing Partner	294	Project Engineer/Scientist II	197
Partner	285	Project Engineer/Scientist, I	179
Principal Engineer/Scientist	276	Staff Engineer/Scientist II	167
Resource Director	249	Staff Engineer/Scientist I	152
Associate	239	Technical Analyst	146
Sr. Engineer/Scientist II	233	Graphics/GIS	134
Sr. Engineer/Scientist I	224	Laboratory Compliance Specialist	130
Project Engineer/Scientist III	207	Administrative Assistant	96

Appendix A

Resumes

Anona L. Dutton, C.Hg.

Vice President / Principal-in-Charge
Director of Water Resources Practice

Ms. Dutton has over seventeen years of professional experience managing water resources projects. She has managed multi-million dollar efforts to secure reliable water supplies for water agencies and developers, including leading the technical efforts to minimize the water footprint of new and existing development, assessing groundwater and surface water supply yields, securing water transfer options, and evaluating the feasibility of developing new water supply sources such as recycled water, desalination water, and other non-potable sources.

Her work to support public sector clients has included Water Supply Assessments, Water System Master Plans, Urban Water Management Plans, and Water Conservation Plans. Ms. Dutton is also deeply involved in implementation of the Sustainable Groundwater Management Act (SGMA) throughout the State, including provision of strategic and technical support for Groundwater Sustainability Agency formation, basin boundary adjustments, Groundwater Sustainability Plan development, and securing grant funding.

Relevant Experience

LITIGATION SUPPORT

- **Adjudication Support in the Las Posas Valley, Ventura County.** Ms. Dutton has been retained as a technical expert for the comprehensive basin adjudication effort in the Las Posas Valley Groundwater Basin, located in Ventura County. The Las Posas Valley Groundwater Basin contains both urban and agricultural water users, as well as both groundwater and imported surface water use. Ms. Dutton is leading efforts in support of demonstrating our client's prescriptive rights to groundwater pumping within the available sustainable yield. EKI has detailed a history of documented overdraft conditions in the Basin and compared various estimates of reported sustainable yield. We have begun calculating return flow benefits as a result of our client's in-lieu use of surface water. Additionally, EKI is



Education

- M.S., Hydrogeology, Stanford University, 2000
- B.S., Environmental Sciences, Stanford University, 1998

Registrations/Certifications

- Professional Geologist in California (#7683)
- Certified Hydrogeologist in California (#841)
- LEED Green Associate
- Water Use Efficiency Practitioner – Grade 1

participating with a technical committee who has been tasked with establishing a water balance for the Basin. Initial water balance tasks include preliminary comparisons of both analytical- and numerical model-calculated water budgets.

SUSTAINABLE GROUNDWATER MANAGEMENT ACT IMPLEMENTATION

- **SGMA Compliance in the Cosumnes Subbasin.** Ms. Dutton was retained to provide strategic technical support to the Cosumnes Subbasin Working Group in its response to SGMA in the Cosumnes Subbasin, including supporting coordination among the seven GSAs, developing a technical understanding of basin conditions that will inform elements of the GSP, and securing Proposition 1 and Technical Support Services (TSS) grant funding. The Proposition 1 grant that Ms. Dutton authored received a 19/19 score and was recommended for full funding. Ms. Dutton is now leading GSP development efforts in the Cosumnes Subbasin, with particular focus on issues related to groundwater/surface water interaction along the Cosumnes River corridor, cross-boundary flow issues with the neighboring groundwater basins, sustainable yield assessment, and identifying opportunities to conduct managed aquifer recharge.
- **SGMA Compliance in the White Wolf Subbasin.** Ms. Dutton is providing strategic technical support to the White Wolf GSA in its response to SGMA in the newly created White Wolf Subbasin in Kern County, California. EKI supported the four GSA member agencies in a successful request to the Department of Water Resources (DWR) to dis sever the southern portion of the Kern County Subbasin into the White Wolf Subbasin based on technical analysis that demonstrated that the White Wolf Fault was a significant barrier to flow. DWR told TCWD that it was the best boundary revision request they had ever received. EKI is now supporting the White Wolf GSA with GSP preparation, including supporting stakeholder engagement efforts, groundwater modeling, CASGEM compliance, and securing Proposition 1 grant funding.
- **SGMA Compliance Support for Arvin-Edison Water Storage District.** Ms. Dutton provides technical support to Arvin-Edison Water Storage District (AEWSD) in groundwater and water quality-related litigation matters. She also provides strategic technical support to AEWSD in its response to SGMA in the White Wolf Subbasin and in the Kern County Subbasin, including with GSA formation and GSP preparation. As part of this effort, she is overseeing stakeholder engagement efforts, the development of a hydrogeologic conceptual model (HCM) of the 130,000-acre District; the development of a 20-year water budget that includes natural and imported water sources, groundwater pumping, the operation of local and regional water banks, and various water demands; an assessment of groundwater conditions; and, the development of sustainability criteria and projects and management actions. She is also acting as an extension of staff, attending meetings and providing peer review support for various technical documents and models being prepared by DWR, the United States Bureau of Reclamation (USBR), the Kern Groundwater Authority, and others. She is also supporting the

District's efforts to maintain water quality standards on the Friant-Kern Canal (FKC), including conducting in-depth investigations of groundwater quality trends over time, drafting policy papers and comment letters, and inventorying projects that impact water quality in the FKC.

- **SGMA Compliance Support for Wheeler Ridge-Maricopa Water Storage District.** Ms. Dutton is providing strategic technical support to Wheeler-Ridge Maricopa Water Storage District (WRMWS) in its response to SGMA in the White Wolf Subbasin and in the Kern County Subbasin, including with GSA formation and GSP preparation. As part of this effort, she is overseeing stakeholder engagement efforts, the development of a HCM of the 110,000-acre District an assessment of groundwater conditions; and, the development of sustainability criteria and projects and management actions. She is also acting as an extension of staff, attending meetings and providing peer review support for various technical documents and models being prepared by DWR, the Kern Groundwater Authority, and others.
- **SGMA Compliance Support for Tejon-Castac Water District.** Ms. Dutton is providing strategic technical support to Tejon-Castac Water District (TCWD) in its response to SGMA in the Castac Lake Valley Basin, the White Wolf Subbasin, and in the Kern County Subbasin, including with GSA formation and administration and GSP preparation. Work has included stakeholder engagement, collection and interpretation of pumping test and remotely-sensed land use data, quantitative evaluation of wetland water demands, integration of multiple data sets into a conceptual model of aquifer structure and properties, and development of a quantitative groundwater basin model for predicting site-specific hydrologic processes. Ms. Dutton is also supporting permitting for TCWD's recycled water/groundwater augmentation project.
- **SGMA Compliance Support for Olcese Water District.** Ms. Dutton is providing strategic technical support to Olcese Water District (OWD) in its response to SGMA in the Kern County Subbasin, including with GSP preparation. As part of this effort, she is overseeing the development of a HCM of the District and developing a 20-year water budget that includes natural and imported water sources, groundwater pumping, and various water demands. She is also acting as an extension of staff, attending meetings and providing peer review support for various technical documents and models being prepared by DWR, the Kern Groundwater Authority, and others. She is also supporting OWD in its pursuit of a basin boundary modification, including developing the technical argument and leading meetings with DWR.
- **SGMA Compliance Support for Cuyama Basin Water District.** Ms. Dutton is providing strategic technical support to Cuyama Basin Water District (CBWD) in its response to SGMA in the Cuyama Basin, one of the most critically-overdrafted basins in the State, including developing a technical understanding of basin conditions that will inform elements of the GSP, supporting its application for Proposition 1 grant funding, and supporting the GSP development process through peer review of efforts by the USGS and other consultants.
- **SGMA-Related Groundwater Assessment in the San Mateo Plain Subbasin.** Ms. Dutton led the development of the first-ever comprehensive groundwater basin assessment for the San

Mateo Plain Groundwater Subbasin (see [project website](#)). This effort includes developing a HCM and water balance for the subbasin, evaluating threats to water quality and sustainability, developing a numerical groundwater model for the basin and region, and evaluating various physical and institutional basin management options, including identifying potential locations to augment groundwater supplies with recycled water using ASR wells. This work is being done coincident with a strong public outreach process, which has included multiple stakeholder workshops led by Ms. Dutton. The work being conducted by EKI has been [profiled by Stanford's Water in the West](#).

- **Strategic SGMA Support for CalWater.** Ms. Dutton is providing strategic technical support to California Water Service Company in its response to SGMA in multiple basins throughout California. Her work includes developing a technical understanding of basin conditions that will inform elements of the GSP and the overall SGMA compliance strategy. She is also acting as an extension of staff, attending meetings and providing peer review support for various technical documents and models being prepared by DWR, local GSAs, and others. She is also involved with the development of policy papers that inform company-wide decisions making with respect to SGMA implementation in matters related to cost-share, conjunctive use, and water transfers.
- **Strategic SGMA Support for the City of Lathrop.** Ms. Dutton is providing strategic technical support to the City of Lathrop in its response to SGMA in the Eastern San Joaquin and Tracy Subbasins, including provision of support for GSA development and successfully supporting their basin boundary revision request which extricated them from a critically overdrafted groundwater basin. She is also managing the City's Integrated Water Resources Master Plan project, which includes an assessment of groundwater and surface water reliability.
- **Strategic SGMA Support for Cordua Irrigation District.** Ms. Dutton managed the development of a basin safe yield analysis and other technical information needed to support the execution of a groundwater substitution transfer by Cordua Irrigation District in the North Yuba Subbasin. Work included collection and interpretation of multiple data sets and development a conceptual model of aquifer structure, properties, and condition; re-creation and application of a quantitative model for predicting year-over-year water level responses to pumping and potential third party impacts; and presentations and negotiations with other interested parties. She is currently supporting the District with SGMA implementation, including public outreach and GSP development.

GROUNDWATER RESOURCE DEVELOPMENT AND MANAGEMENT

- **Water Strategy for City of East Palo Alto.** Ms. Dutton is managing the development and implementation of a comprehensive water strategy to address the water shortage crisis within the City of East Palo Alto, which is a Disadvantaged Community (DAC). She supported the City in negotiating a water transfer agreement for the first-ever transfer of Individual Supply Guarantee (ISG) within the San Francisco Regional Water System. She also managed

the successful installation and testing of a groundwater test well, including hydrogeologic investigation, water quality sampling, aquifer testing, and test well design and construction. She is assisting the City in the reactivation and permitting of its existing Gloria Way Well and overseeing the design of the groundwater treatment system for that well. Ms. Dutton worked closely with the City to secure \$3.0 million of Proposition 84 grant funding to support the City's groundwater development efforts; *the project description that EKI prepared on behalf of the City was the top-ranked project in the Bay Area IRWM region.*

- **Marina Coast Water District IPR/DPR Feasibility Assessment.** Ms. Dutton conducted a technical assessment of the feasibility for Marina Coast Water District to develop an indirect or direct potable reuse (IPR/DPR) project in Monterey Subbasin of the Salinas Valley Basin. As part of this assessment, she developed a hydrogeologic conceptual model of the local groundwater system, and conceived of and priced out options to augment potable water supplies with Salinas River storm flows and/or highly-treated municipal wastewater. Options included percolation of the source water or injection of the source water with aquifer storage and recovery (ASR) wells. EKI has now been retained to provide SGMA support MCWD, including a successful Proposition 1 funding request and GSP development.
- **Aquifer Storage and Recovery Potential Assessment.** Ms. Dutton has completed an assessment of the aquifer storage and recovery potential at a 20,000- acre property in Butte County California. As part of this task she developed a conceptual model of basin hydrogeology and evaluated the potential to store surface water in an underlying aquifer for later extraction and sale. She also oversaw the development of a groundwater model that was used to project the long-term viability of the local groundwater resources under various climatic and land use scenarios. Ms. Dutton is now providing strategic technical support to Reclamation District 2106 (which includes her client's property) in its response to SGMA.
- **Solano County Water Agency (SCWA) Water Conservation Study.** Ms. Dutton oversaw EKI's performance of a two-phase study for the SCWA, evaluating the effectiveness of SCWA's single-family residential water conservation programs and demonstrating measurable water savings. EKI analyzed a 6 million-record dataset of account-level water use from four cities' water billing systems to quantify the real impact of water conservation programs on water use and evaluate drought response on an account-level basis. EKI also used geospatial statistical and multi-criteria analysis techniques within ArcGIS to evaluate geographic trends in program participation and to identify opportunities for future water conservation potential. Based on these analyses, EKI developed recommendations for future program design and customer outreach and targeting. The studies also analyzed income-effect on water conservation participation, objectively identifying the demographics of Solano County households with significant remaining water conservation potential. The pilot study focused on the City of Vallejo and was expanded for the for the second phase to include additional cities and capture over 80% of the single-family residential accounts in Solano County.

- **BAWSCA Long-Term Reliable Water Supply Strategy.** Ms. Dutton managed the development of the initial phases of the Bay Area Water Supply and Conservation Agency's (BAWSCA) multi-year, multi-million-dollar Long-Term Reliable Water Supply Strategy (Strategy), which established the framework to develop millions of gallons per day of normal and drought year water to meet the projected needs of the BAWSCA region through 2035. The Strategy was the first study to document the normal and dry year needs of the BAWSCA region, and to identify specific local and regional projects that could be developed to meet that need. Ms. Dutton led the effort to coordinate the development of the Strategy with the 26 BAWSCA member agencies, including overseeing the technical evaluation of 65 potential water supply projects, including the development of key project information (e.g., yield, cost, environmental impacts, and feasibility) for these groundwater, recycled water, and water transfer projects. Ms. Dutton was also responsible for leading BAWSCA's effort to secure a dry-year water transfer. In that role, Ms. Dutton led the effort between BAWSCA and the East Bay Municipal Utilities District (EBMUD) to develop a Pilot Water Transfer Plan that assesses the cost, operational and institutional issues, and agreements necessary to affect a one-year pilot water transfer between BAWSCA and EBMUD. Ms. Dutton also represented BAWSCA in discussions with the Santa Clara Valley Water District (SCVWD), and multiple water sellers to identify potential opportunities to secure drought-year water supply for the BAWSCA agencies.
- Ms. Dutton has prepared numerous water resources and planning studies, including UWMPs for the Cities of Tracy, Lathrop, Menlo Park, San Bruno, Burlingame, East Palo Alto, and Redwood City, and for Valley of the Moon Water District, Westborough Water District and Estero Municipal Water District. She has prepared water system and water supply master plans for multiple private developments, and for the cities of Brisbane, Burlingame and Lathrop and for Purissima Hills Water District. She has prepared / is preparing comprehensive water conservation plans for Irvine Ranch Water District, West Basin Municipal Water District, and Central Basin Water District.
- Ms. Dutton has performed assessment of water supply alternatives for proposed new large-scale, master-planned communities located throughout California. Ms. Dutton has prepared projections of the water demand of these developments, estimated historic water use at the project sites, and evaluated the potential water supply, transport, and treatment options, including quantifying the volume of water available from each water source, its reliability during design drought scenarios, and the political and technical constraints associated with development of each water source. Source water reliability evaluations have been conducted for groundwater and the State Water Project, Central Valley Project, Stanislaus River, Russian River, Semitropic and the Hetch-Hetchy systems. For example, as part of a WSA analysis Ms. Dutton performed an assessment of water demand and water supply alternatives for the Tejon Mountain Village, a large-scale development located in Southern California. Ms. Dutton evaluated the potential to locally develop groundwater as a water supply source for the

Project, as well as assisted in the evaluation of surface water conveyance options. As part of the groundwater basin safe yield analysis that Ms. Dutton performed, she installed several deep groundwater wells and conducted aquifer pump tests. The resultant water level and aquifer property data were used, along with local streamflow, historic groundwater use, and precipitation data to develop a water balance, groundwater model, and safe yield estimate for the basin.

Selected Presentations

Dutton, Anona, *Technical and Strategic Considerations for Demonstrating Sustainability*. Law Seminars International – Sustainable Groundwater Planning in California. February 2018, Los Angeles, CA.

Dutton, Anona, *Surface Water Groundwater Interaction – How SGMA Changed the Rules*. Law Seminars International – Sustainable Groundwater Planning. July 2017, Sacramento, CA.

Dutton, Anona, *Implementation of SGMA in California*. ASCE Annual Conference. June 2017, Philadelphia, PA.

Dutton, Anona, *Strategic Considerations for Groundwater Sustainability Plan Development and Implementation*. January 2017, Los Angeles, CA.

Dutton, Anona, *Practical Implications of Sustainable Groundwater Management Act (SGMA) for Local Agencies and Land Use Planner*. November 2016, San Francisco, CA.

Dutton, Anona, *Regulating California's Thirst for Groundwater*. Association of Women in Water, Energy and Environment, September 2016, San Francisco, CA.

Dutton, Anona, *Practical Approaches to Groundwater Sustainability Plan development*. Law Seminars International Groundwater Regulation in California. June 2016, Sacramento, CA.

Dutton, Anona, *SGMA and What it Means for Sustainable Groundwater Management*. California Association of County Governments. December 2015, Sacramento CA.

Dutton, Anona, *SGMA and the New Basin Boundary Revision Regulations*. Law Seminars International Groundwater Regulation in California. October, 2015, Los Angeles, CA.

John L. Fio

Principal Hydrogeologist

John Fio has more than 30 years of hydrologic problem-solving experience. Mr. Fio employs models to quantify groundwater-flow, chemical transport, and groundwater surface-water interactions. He has developed and applied models for site, water district, and basin-wide investigations to calculate extraction effects on groundwater levels, groundwater storage, stream flow, and lake levels. His practical experience includes work with MODFLOW, MODPATH, ZONEBUDGET, GWM, FEMFLOW3D, IWFM, SUTRA, TPROGS, MT3D, GWT, and PHREEQC. During his career he has successfully established multiple groundwater level and water quality monitoring programs; conducted and analyzed aquifer tests; developed water management plans; evaluated groundwater quality effects of wastewater and recycled water disposal to land; and, determined water sources using chemical and age-dating techniques. Mr. Fio's professional experience includes ten years of research and project leadership with the U.S. Geological Survey, and more than 20 years of experience in private consulting. His work is published in 16 peer-reviewed journal articles and government reports.



Education

- M.S., Civil Engineering, University of California, Davis, 1987
- B.S., Soil and Water Science, University of California, Davis, 1984

Relevant Experience

- **Groundwater Model Review to Support SGMA Implementation in the Santa Margarita Basin.** The Santa Margarita Groundwater Agency plans to utilize the Santa Margarita Groundwater Model to support development of their Groundwater Sustainability Plan ("GSP"). They hired Mr. Fio to answer the following questions: (i) are model results reliable enough to support on-going groundwater management planning efforts in the basin; (ii) does the model meet DWR standards to support GSP development; and, (iii) what model upgrades, if any, are needed to support on-going work and GSP development. The effort included working with local experts, assimilation of numerous data and reports to confirm the model adequately represents the hydrogeologic conceptual model, completing a model post-audit to quantify model

performance, and conducting a thorough and intensive assessment of model sensitivity and uncertainty. A key product was a work plan of recommended model refinements to better support GSP development and the defensibility of model results.

- **Model Review, Update, and Implementation for Estimating Future Response to Project Pumping in the Monterey Peninsula Area.** In the Monterey area, a contentious water supply project was proposed that would employ subsurface ocean water intake system using slant wells near the coast. Mr. Fio was asked to review the model and update it using new information to better represent the conceptual hydrogeologic groundwater-flow system. He then evaluated the model's ability to match historical water levels and a recent pumping test. Mr. Fio employed the model to calculate water level changes, areal extent of ocean water captured, and the extent of seawater intrusion due to future slant well pumping. He quantified model uncertainty by exploring its sensitivity to assumptions and specified parameter values.
- **California Energy Commission Groundwater-Flow and Well Hydraulic Models.** Mr. Fio has assisted Energy Commission Staff in ten power plant permitting reviews (CPV Sentinel, Beacon Solar Power, Carrizo Energy Solar Farm, Blythe Solar Project, Palen Solar Plant, Solar Millennium Ridgecrest, Abengoa Mojave, Hydrogen Energy California Power Plant, Calico Solar Project, and Imperial Valley Solar), and one compliance project (High Desert Power). In all these projects, water for construction and operation – most notably water for power plant cooling – was a critical need and required thorough and defensible conclusions. In most of these projects, Mr. Fio was relied upon to review, critique, and implement the various groundwater-flow and well hydraulic models that simulated water budget and groundwater level changes in response to the proposed pumping and power plant water use. As part of his efforts, he reviewed model construction, assumptions, parameters, calibration, sensitivities, results, and validity. When appropriate, Mr. Fio recommended changes to the model approach and data inputs and employed the models to complete reliable analyses. He also quantified the uncertainty in the results and recommended mitigation measures in the project Conditions of Certification that could address the uncertainty. His written reports were integrated into Staff Assessments. Mr. Fio participated in public meetings and when necessary testified at evidentiary hearings. Mr. Fio also provided technical analyses and support to the Desert Renewable Energy Conservation Plan (DRECP) EIR/EIS development process where he described the affected environment and estimated potential groundwater and habitat impacts for an area that includes 107 identified basins located in the Mojave and Sonoran Desert regions of California.
- **Groundwater Flow and VOC Transport in Shallow Aquifers, Menlo Park Area.** Mr. Fio developed a groundwater-flow model of the San Francisquito Groundwater Sub-basin using geohydrologic data for Menlo Park and its surrounding areas. The model quantified the hydraulic relationships in aquifers beneath South San Francisco Bay. Results showed that pumping in both the Menlo Park area and western Alameda County can affect groundwater-

flow and constituent movement in shallow aquifers on either side of San Francisco Bay. He then utilized local geohydrological, geochemical, and stable isotope data to develop a focused, site-specific groundwater-flow model of a local contamination site; the regional model results were translated directly into the site-specific model. He employed the site-specific model to simulate contaminant transport by linking the flow model results to a modular three-dimensional transport model (MT3D) that simulates advection, dispersion, and chemical reactions during constituent transport. The integrated models simulated the potential for off-site constituent migration under a variety of possible alternative future land use and hydrologic conditions. As part of this modeling effort, multiple post audits that compare projected and observed conditions during the period 2003-2015 showed the model is reliable. The California EPA Department of Toxic Substances Control (DTSC) provides regulatory oversight, and was presented as part of the Enviro Expert series and a recording can be viewed at: <https://www.youtube.com/watch?v=F1IW4NPXWyU>

- **Groundwater Model Review to Support SGMA in the Cuyama Basin.** Mr. Fio conducted peer review of various pre-existing studies and groundwater models that have been developed for the Cuyama Basin with a focus on identifying model uncertainty and its influence on model-calculated water budget and water level trends. He then developed an evaluation of the groundwater system in the Cuyama basin and identified recommended modifications to the available model. Those findings were integrated into plans to develop the updated model to support Groundwater Sustainability Planning efforts in the Cuyama Basin.
- **Westside Groundwater Basin Groundwater Flow Modeling, San Francisco and San Mateo counties.** Since 1998, as a consultant to Daly City, Mr. Fio has provided key technical analyses and consensus building efforts toward improved management of the Westside Groundwater Basin located in San Francisco and San Mateo Counties. The basin is a source of drinking water for the City of San Francisco, City of Daly City, Town of Colma, City of South San Francisco, and City of San Bruno. John was a key contributor toward development of the basin management plan and oversaw development and technical acceptance of the groundwater-flow model utilized to quantify basin hydrogeology. The effort to achieve model consensus required extensive coordination and effective communication with multiple basin stakeholders and their technical representatives. The model has since been employed to design and analyze proposed groundwater development projects in the City of San Francisco and an in-lieu conjunctive use project in San Mateo County to increase drinking water supply reliability for the greater San Francisco Bay area.
- **Groundwater Flow Model Analyzing the Hydraulic Continuity of San Francisco Bay Area Aquifers.** As part of the first comprehensive groundwater basin assessment of the San Mateo Plain Subbasin, Mr. Fio developed a regional groundwater-flow model to quantify conditions beneath San Francisco Bay and cross-boundary flows between adjacent basins located in San Francisco, San Mateo, Santa Clara and Alameda counties. The calibrated model was utilized to estimate expected yields and likely hydraulic effects from aquifer pumping on existing

groundwater users in the region and assist future basin management and compliance with SGMA. The model calculates groundwater level and storage changes during the period 1991-2015, and model sensitivity analyses identified data gaps and model uncertainty to direct the prioritization of future data collection and aquifer testing activities. Data sets were also developed under Mr. Fio's guidance to represent projected changes in groundwater recharge because of climate change effects on rainfall, temperature, and run-off.

- **Santa Ynez River Basin and River Model Technical Committee.** While employed by Hydrologic Consultants, Inc., John Fio was part of a technical team that quantified interactions between flow and salinity in the river and groundwater systems. The team developed interacting models that described reservoir operations, surface-water and groundwater systems to account for pumping, changes in reservoir salinity, streambed leakage, water-use by vegetation, dissolution of soil salts, and salt movement within the subsurface. Mr. Fio's responsibilities included: updating and implementing a reservoir operations and water quality model of Cachuma Reservoir; developing streamflow-salinity relations for different geographic regions of the basin using stream gauging, stream salinity, and geologic data; and, updating groundwater models simulating the riparian aquifer system, the valley-plain aquifer system, and the entire basin. The model was used to simulate salt-loading from the dissolution and precipitation of salts in the unsaturated zone above the water table.
- **Water Characterization Study, Menlo Park, CA.** Using the regional San Mateo Plain Groundwater Flow Model that he developed, Mr. Fio estimated the long-term sustainable yield expected from an existing site production to evaluate its potential as a future municipal water supply. Specifically, Mr. Fio examined the model-calculated effects of increased site well extractions well for potential undesirable results as defined by the Sustainable Groundwater Management Act.
- **Geochemical Model Analysis to Determine Water Reuse Options for New Development, Cloverdale, CA.** The Riverdale Ranch planned on utilizing treated wastewater for irrigation on park and median areas. Mr. Fio assessed the potential influence of this water use on the volume and quantity of water table recharge beneath the project, recharge quality changes, and connections with underlying groundwater and the Russian River. He employed a water budget accounting model to simulate monthly groundwater recharge, and the geochemical model PHREEQC to simulate chemical reactions and resulting constituent loads in the monthly recharge. The analysis showed annual groundwater recharge and constituent loads beneath the site would increase, but the constituent loads to the Russian River would increase by less than 0.1%.
- **Cal Water South San Francisco District Water Supply and Facilities Master Plan.** The California Water Service Company provides water to various San Mateo County communities located along the Peninsula of South San Francisco Bay. As a subcontractor to CDM, John Fio conducted groundwater and water-supply reliability studies for several California Water

Service Company districts (the South San Francisco, Mid-Peninsula, and Bear Gulch Districts) which are all located in San Mateo County and include the cities of South San Francisco, San Mateo, San Carlos, Redwood City, Atherton, and Menlo Park. Mr. Fio utilized soil moisture accounting methods, groundwater-flow models, water level data, and geologic information to quantify water balances and project future groundwater level and storage volume trends with respect to current and projected land and water use conditions (increased demand, emergency back-up water supply, conjunctive use, and recycled water). He completed detailed assessments of existing well water quality with respect to current and anticipated future state and federal drinking water standards, including temporal trends in increasing constituent concentration levels such as nitrates, iron, manganese, organic contaminants and salts. He retrieved soil and groundwater quality information from county and state databases and integrated the information with aquifer productivity, water quality, and land use data to identify favorable locations for new wells.

- **Numerical modeling of proposed injection wells, Ironhouse Sanitary District.** Mr. Fio developed the conceptualized understanding of subsurface hydrogeologic and water quality conditions, and then employed MODFLOW to construct a numerical model to quantitatively represent groundwater hydraulics beneath the Ironhouse Sanitary District wastewater treatment facility and its surrounding area, MODPATH to simulate groundwater-flow paths and conduct time-of-travel calculations, and PHREEQC to assess chemical reactions that may occur from mixing recycled water and native groundwater and the likelihood for chemical clogging of the well screen and surrounding aquifer. A variety of scenarios were run to assess injection well hydraulic and water quality effects, and the results helped the client determine feasibility of proposed recycled water injection.
- **Groundwater recharge and drinking water supply quality, South Westside Basin, San Mateo County, CA:** The Westside Basin groundwater model is an important consensus building tool and an overarching platform for directing data collection and estimating water budgets for water supply and management efforts. We initially developed the model in 2002, and since then have performed several updates. The most recent update was completed in 2017, and part of the update verification effort employed particle tracking (MODPATH) was employed to simulate groundwater-flow paths and recharge source areas to municipal supply wells. Additionally, stable water isotopes (oxygen-18 and deuterium), nitrogen isotopes, and high-precision age dating (tritium and helium-3) results for well-water samples were utilized to verify flow paths and quantify the relationships between land use and dissolved constituents in groundwater. The ionic and isotopic composition of supply well-water samples indicated they produce composite water types that represent groundwater from multiple aquifer depths. The simulated water-table capture zones represent the recharge areas to pumping municipal supply wells, and results indicated that the highest nitrate concentrations in well water are measured in samples from wells that capture water in the shallow aquifer that originates beneath areas potentially influenced by historical feed lots; whereas, substantially

lower nitrate concentrations are measured in wells that capture primarily intermediate and deep aquifer groundwater.

- **Model Options for SGMA Support in the Cosumnes Subbasin.** Mr. Fio contributed to the Groundwater Sustainability Plan (GSP) portion of the Proposition 1 grant application focusing on groundwater modeling development to support basin-wide evaluation of water budgets and management actions necessary to support GSP development. He is currently assessing existing models' development activities in adjacent basins to identify the most reliable, defensible, and effective modeling approach and input data sets to further the SGMA goals for the Cosumnes Subbasin.
- **Dublin San Ramon Sanitary District's East bay Municipal Utility District Recycled Water Authority Salt Migration Study Review.** John Fio was hired to complete a technical review of an existing Salt Migration Study and to assist answering key technical questions and concerns. Fio helped complete a focused review of unsaturated zone, geochemical, and hydrogeological modeling; evaluated model selection, methodology and assumptions; assessed linkages between models and model results; and identified problematic assumptions. He reviewed the modeling assumptions affecting the study results and determined that the geochemical modeling and sensitivity testing was needed to address uncertainties in chemical reactions, salt transport, and extraction well capture. As part of the review his team provided recommendations for testing model assumptions, assessing model accuracy, and improving the overall general quality of the study.
- **Delineation of Contributing Sources to Drainflows in Panoche Water District.** John Fio worked with Panoche Water District personnel to gather and process extensive water delivery, crop, drain-flow and drain-water quality data. These data were incorporated into a Geographic Information System and database. Mr. Fio helped delineate subareas based on depth to groundwater and presence of drainage systems and develop a groundwater-flow model to identify upslope areas contributing to downslope drainflow.
- **Evaluation of Fate and Transport of Selenium and Salts in Soils and Groundwater in the Laboratory and in Agricultural Fields.** The U.S. Geological Survey San Joaquin Valley Studies Section conducted laboratory and field-scale investigations to assess the fate and transport of selenium and salts in soils and groundwater. The information was used to develop recommendations for management of irrigation water and agricultural drainage in the western San Joaquin Valley. Hydrologic data and groundwater flow modeling were used to quantify the movement of salts and selenium to subsurface drains. Mr. Fio's responsibilities included designing and conducting laboratory analyses; groundwater flow and solute transport modeling; and interpreting results and writing reports.
- **Groundwater Model Evaluation Used to Determine Pumping Effects within the North Platte River Basin.** John Fio employed an existing numerical groundwater-flow model and operation research techniques to examine potential increased pumping effects within the basin. He

provided written and oral testimony on hydrogeologic conditions and incorporated the information with water use estimates from other experts into several groundwater models to compute monthly changes in subsurface flows. Technical experts incorporated his results into a surface-water operations model and determined development impacts on downstream water users. Mr. Fio provided his deposition on two occasions; the case was settled before trial.

- **Newhall Groundwater Banking Assessment.** Mr. Fio led the development of a groundwater-flow model to assess the feasibility of using groundwater recharge ponds and feasible recovery volumes for a proposed eastern San Joaquin Valley groundwater banking project. The groundwater-flow model was required to hydraulically integrate possible groundwater storage changes beneath the facility, changes in water inflow and outflow to the nearby river, and local and regional recharge and pumping activities. Model development included a combination of regional and site-specific data compilation and assessment. The calibrated model was applied to assess several water-management scenarios.
- **Northeastern Nevada and Western Utah: Heat Flow and Geochemical Analysis of Groundwater and Springs.** Southern Nevada Water Authority planned to utilize northern Nevada groundwater from deep fractured-rock aquifers as a source of supplemental supply. Mr. Fio helped evaluate hydrogeologic and geochemical processes affecting groundwater and spring flow and quality in northeastern Nevada and western Utah. To assess possible effects of varying groundwater temperature on spring flow, he conducted heat transport and density-dependent groundwater flow simulations to evaluate the relative sensitivity of discharge to temperature variations and fluid pressure changes. Spring chemistry data was employed to investigate the source water feeding select springs and support the modeling results.

Presentations and Publications

SGMA

Fio JL and Sweetland P, 2017, Technical Consensus and Multi-Party Sustainability Planning, Westside Groundwater Basin, Groundwater Resources Association of California SGMA Conference - Tools for Developing Groundwater Sustainability Plans, May 3-4 2017, Modesto California.

Hydrogeology of the San Francisco Bay Area

Metzger LF and Fio JL, 1997, Ground-water development and the effects on ground-water levels and water quality in the Town of Atherton, San Mateo County, California. U.S. Geological Survey Water-Resources Investigations Report 97-4033, 31p.

Fio JL and Leighton DA, 1995, Geohydrologic framework, Historical Development of the ground-water system, and general hydrologic and water-quality conditions in 1990, south San Francisco Bay and Peninsula area, California, U.S. Geologic Survey Open-File Report 94-357, 46 p.

Leighton DA, Fio JL, Metzger LF, 1995, Database of well and areal data, South San Francisco Bay and Peninsula area, California. U.S. Geological Survey Water-Resources Investigation Report 94-4151, 47 p.

Numerical Modeling – Groundwater flow and contaminant transport

Fio JL, 1997, Geohydrologic effects on drainwater quality. *Journal of Irrigation and Drainage Engineering*, ASCE 123(3).

Fio JL and Leighton DA, 1994, Effects of ground-water chemistry and flow on quality of drainflow in the western San Joaquin Valley, California. U.S. Geological Survey Open-File Report 94-72, 28 p.

Fio JL, 1994 Calculation of a water budget and delineation of contributing sources to drain flows in the western San Joaquin Valley, California. U.S. Geological Survey Open-File Report 94-45, 28 p.

Barlow PM, Wagner BJ, Belitz K, Fio JL, 1993, Effects of Management alternatives on the shallow, saline ground water in the western San Joaquin Valley, California, U.S. Geological Survey Water Fact Sheet Open-File Report 93-665.

Fio JL and Deverel SJ, 1991, Ground-water flow and solute movement to drain laterals, western San Joaquin Valley, California. 2: Quantitative hydrologic assessment. *Water Resources Research* 27(9): 2247-2257.

Fio JL, Fujii R, Deverel SJ, 1991, Evaluation of selenium mobility in soil using sorption experiments and a numerical model, western San Joaquin Valley, California. U.S. Geological Survey Open-File Report 90-135.

Fio JL and Deverel SJ, 1990, Interaction of shallow ground water and subsurface drains: implications for selenium transport and distribution in the western San Joaquin Valley, California. *Groundwater* 28(5): 788-789.

Fio JL and Deverel SJ, 1989, Ground-water flow to subsurface drains in the western San Joaquin Valley, California. U.S. Geological Survey Second National Symposium on Water Quality, Orlando, Florida, November 12-17, 1989, abstracts and technical sessions, U.S. Geological Survey Open-File Report 89-409, p. 25.

Fio JL and Deverel SJ, 1988, Ground-water flow to subsurface agricultural drains in the western San Joaquin Valley, California. *Transactions of the American Geophysical Union* 69 (44).

Geochemistry and Salt Migration

Deverel SJ, Fio JL, Dubrovsky NM, 1994, Distribution and mobility of selenium in groundwater in the western San Joaquin Valley of California in Benson S and Frankenburger W (eds.) "Selenium in the Environment." Marcel Decker: New York.

Fio JL, Fujii R, Deverel SJ, 1991, Selenium mobility and distribution in irrigated and nonirrigated alluvial soils. *Soil Science Society of America Journal* 55: 1313-1320.

Deverel SJ and Fio JL, 1991, Ground-water flow and solute movement to drain laterals, western San Joaquin Valley, California. 1: Geochemical Assessment. *Water Resources Research* 27(9): 2233-2246.

Fio JL and Fujii R, 1990, Selenium speciation methods and application to soil saturation extracts from San Joaquin Valley, California. *Soil Science Society of America Journal* 54: 363-369.

Fujii R and Fio JL, 1988, Partitioning and speciation of soluble and adsorbed selenium in soils. Agronomy Abstracts, Amer. Soc. Agron. Annual meetings, Anaheim, California, p. 196-97.

Monitoring

Leighton DA and Fio JL, 1995, Evaluation of a monitoring program for assessing the effects of management practices on the quantity and quality of drainwater from the Panoche Water District, Western San Joaquin Valley, California. U.S. Geological Survey Open-File Report 95-731, 25 p.

Puckett LK, Alemi MM, Fan AM, Fio JL, Hansen D, Wallender W, Wernette F, 1992, Long-term monitoring plan, San Joaquin Valley Drainage Implementation Program.

Christina E. Lucero, P.G. Hydrogeologist

Ms. Lucero has 10 years of hydrogeologic consulting experience. Her skills include numerical groundwater model development, construction and application; geologic research; spatial analyses of geohydrologic and water quality data using Geographic Information Systems (GIS); and oversight of monitoring well construction and associated water level monitoring and well-water sampling activities. Her SGMA-related work has focused on the development of basin setting information and groundwater flow model development and analysis.



Relevant Experience

SUSTAINABLE GROUNDWATER MANAGEMENT ACT (SGMA) IMPLEMENTATION

- **San Mateo Plain Groundwater Subbasin Assessment.** Ms. Lucero helped refine and calibrate a regional MODFLOW groundwater-flow model to calculate groundwater level and storage changes during the period 1991-2015 for applications to support groundwater management efforts in SanMateo County. She then analyzed various scenarios representing potential future water management within the Basin. The objective is to establish a groundwater model to assist the Basin with future management and compliance with SGMA.
- **Groundwater Model Review to Support SGMA in the Santa Margarita Basin.** Ms. Lucero aided in reviewing the pre-existing Basin groundwater model to help determine its applicability for use under SGMA. She determined the model's aquifer properties sensitivity to both historical water levels and stream baseflows.
- **Castac Lake Groundwater Basin GSA Groundwater Sustainability Plan (GSP) Development.** Ms. Lucero is currently aiding in GSP development for the Castac Basin GSA. She has helped develop a Stakeholder Communication and Engagement Plan and aided in Castac Basin GSA website development. She is currently working on updating the Data Management System (DMS) and will use the information contained within the DMS to articulate the Basin Setting within the GSP. Finally, she has been

Education

- B.S., Geology, University of California, Davis, 2010

Registrations/Certifications

- Professional Geologist, CA (#9262)

working on updating the analytical model for the Basin to quantify groundwater storage and calculate basin sustainable yield.

- **White Wolf Subbasin GSA GSP Development.** Ms. Lucero is currently aiding in Proposition 1 Grant Management and GSP development for the White Wolf GSA. She has drafted the Plan Area and Basin Setting portions of the GSP, which included developing two cross-sections across the Basin, defining current groundwater conditions, detailing the current and proposed future land use and its implications for sustainable groundwater management, and identifying preliminary data gaps. She is currently aiding the GSA in Proposition 1 Grant invoicing, preparing for the first stakeholder workshop in which Basin Setting information will be presented to the public, working to fill identified data gaps, and inventorying and establishing a monitoring network to be used during GSP implementation.
- **Cosumnes Subbasin GSP Development.** Ms. Lucero is currently aiding in GSP development for the Cosumnes Subbasin by developing four cross-sections located through the middle of- and along the boundaries of the Subbasin to aid with numerical model grid mesh and layering refinements.
- **Adjudication Support in the Las Posas Valley Groundwater Basin.** Ms. Lucero is currently aiding the EKI technical expert team with an ongoing adjudication effort in which we will calculate return flow benefits to prove prescriptive rights for our client. She has inventoried historical documents to detail a history of documented overdraft conditions in the Basin and has reviewed existing documentation on groundwater flow model- and analytical model-calculated water budgets. Additionally, she is actively engaged with the technical committee who has been tasked with establishing a water balance for the Basin.

GROUNDWATER MODELING

- **Westside Basin Numerical Groundwater Flow Model Update.** Beginning in 2010, Ms. Lucero helped update the Westside Basin numerical groundwater flow model utilized to quantify basin hydrogeology. She provides Geographic Information System (GIS) support for the model and incorporates newly available data to update and extend the model. The model has historically been employed to design and analyze proposed groundwater development projects in the City of San Francisco and an in-lieu conjunctive use project in San Mateo County to increase drinking water supply reliability for the greater San Francisco Bay area. Additionally, in 2015, Ms. Lucero conducted particle tracking to estimate recharge areas for monitoring and supply wells.
- **Model Review, Update and Implementation for Estimating Future Response to Project Pumping.** Ms. Lucero conducted a model review, update, and implementation for estimating future response to project pumping. She updated and employed an existing MODFLOW groundwater-flow model to calculate the cone of depression caused by proposed coastal slant wells for a proposed desalination project. Additionally, she used MODPATH to

determine the areal extent of ocean water that would be captured, and identify areas where seawater intrusion would be affected due to future project pumping. The modeling analysis was used in preparation of the Draft EIR/EIS for determining potential project impacts on groundwater resources.

- **City of Lathrop Wastewater Treatment Facility Groundwater Monitoring.** As part of the City of Lathrop's wastewater treatment plant operations consolidation, Ms. Lucero helped oversee monitoring well installation, hydropunch sampling, soil sampling, and monitoring well water quality sampling. Using the monitoring well and hydropunch data, she established an area of groundwater containing elevated TDS concentrations beneath a field which historically received recycled water application. She created a hypothetical flow and transport model beneath the wastewater treatment plant and land application field to model future flow and attenuation of the groundwater containing elevated TDS concentrations. Results from the modeling were used to establish a Salinity Mitigation Plan.
- **Groundwater Modeling to Support a New Production Well, East Palo Alto, CA.** Ms. Lucero employed a MODFLOW groundwater-flow model to determine the area of drawdown caused by proposed pumping from a new production well in East Palo Alto. Using the results of the groundwater modeling, other impacts to groundwater related issues such as drawdown caused in nearby production wells, subsidence, salt water intrusion, and cumulative effects from other pumping production wells were also examined.
- **Groundwater Modeling to Estimate Pumping Rates, Menlo Park, CA.** Using borehole logs in the Menlo Park area, Ms. Lucero approximated conductance using lithologic characteristics. She then employed a hypothetical groundwater flow model using MODFLOW to simulate pumping scenarios from various aquifer layers. Using the range in estimated transmissivities, she determined viable pumping well extraction rates by model layer.
- **Ironhouse Sanitary District.** The District operates a wastewater treatment facility on a hydrogeologically complex site adjacent to the San Joaquin River. Mrs. Lucero helped develop a hypothetical groundwater flow model for injecting tertiary treated wastewater at two locations beneath Ironhouse's mainland facility. A variety of scenarios were run to assess injection well feasibility. Using MODFLOW and MODPATH, Mrs. Lucero examined each scenario's water levels and subsequent groundwater flow paths and travel times. Modeling results helped the client determine preliminary feasibility of recycled water injection.

ENVIRONMENTAL

- **Dutch Slough Groundwater Characterization for Wetland Restoration.** She helped establish a groundwater monitoring network in Delta agricultural fields proposed for conversion to natural wetland. This included oversight of monitoring well installation, water level measurement collection, and groundwater quality sampling. In order to establish baseline conditions for water leaving the agricultural fields, Ms. Lucero lead an additional water

quality sampling effort in various ditches and creeks adjacent to the fields. She interpreted the data, compared to applicable contaminant levels, and summarized all findings in quarterly monitoring reports. This baseline data is being used in determining potential significant impacts to groundwater flow and surface water quality in the Dutch Slough Restoration EIR.

- **City of Lone Wastewater Treatment Facility Water Quality Analysis.** Ms. Lucero helped complete a water quality analysis to determine potential wastewater treatment pond seepage to a nearby Creek and domestic wells. Ms. Lucero oversaw the installation of a new monitoring well located adjacent to a storage pond. Additionally, she collected water quality and stable water isotope samples from monitoring wells, wastewater treatment ponds, domestic wells, Sutter Creek, and the main reservoir water source for the City of Lone. She performed mixing calculations in order to determine the relative percent groundwater and pond water found in Sutter Creek and domestic wells based on stable isotope concentrations. Finally, she helped create a MODFLOW model of the area which was calibrated to a stock pond pumping test. Model setup included measuring the geometry of the stock pond for model integration and collecting background water levels in monitoring wells prior to the pump test.
- **California Energy Commission.** Ms. Lucero completed water quality data mining, compilation, and analyses to assess spatial and temporal correlations as part of the Hydrogen Energy California Power Plant project. She also employed ArcGIS to construct hydrogeologic maps. Mrs. Lucero is contributed to the groundwater and water supply analyses on the Desert Renewable Energy Conservation Plan (DRECP). Her activities include summarizing permitted energy projects and groundwater basin descriptions for determining potentially affected groundwater environments and impacts to groundwater resources under various project alternatives.
- **Groundwater Quality Monitoring Program.** Ms. Lucero helped implement a groundwater quality monitoring program of domestic wells in the Central Coast. She conducted and oversaw groundwater sampling of specialty constituents including isotopes and age dating. Then she compiled groundwater nitrate concentration distribution and aided in drafting the groundwater characterization report.
- **Sacramento-San Joaquin Delta Subsidence Evaluation.** Ms. Lucero evaluated subsidence in relation to land use and lithology and estimate hydraulic gradients in the Sacramento-San Joaquin Delta, CA.

Publications

Deverel SJ, Leighton DA, **Lucero C**, Ingram T, 2017, Simulation of Subsidence Mitigation Effects on Island Drain Flow, Seepage, and Organic Carbon Loads on Subsided Islands Sacramento-San Joaquin Delta. San Francisco Estuary and Watershed Science 15(4). jmie_sfews_36873.

<https://escholarship.org/uc/item/4q340190>.

Deverel S, Jacobs P, **Lucero C**, Dore S, Kelsey TR, 2017, Implications for Greenhouse Gas Emission Reductions and Economics of a Changing Agricultural Mosaic in the Sacramento-San Joaquin Delta. *San Francisco Estuary and Watershed Science* 15(3). jmie_sfews_36506. <http://escholarship.org/uc/item/99z2z7hb>.

Deverel SJ, **Lucero CE**, and Bachand S, 2015, Evolution of Arability and Land Use, *Sacramento-San Joaquin Delta, California*. *San Francisco Estuary and Watershed Science* 13(2). jmie_sfews_27914. <http://escholarship.org/uc/item/5nv2698k>.

Deverel SJ, Ingram T, **Lucero C**, and Drexler JZ, 2014, Impounded Marshes on Subsidized Islands: Simulated Vertical Accretion, Processes, and Effects, Sacramento-San Joaquin Delta, CA USA. *San Francisco Estuary and Watershed Science* 12(2). jmie_sfews_12893. <http://escholarship.org/uc/item/0qm0w92c..>



Michael D. Bryan, Ph.D. Partner/Principal Scientist

Dr. Michael Bryan has 33 years of combined consulting and research experience focused on water quality, fisheries biology, and aquatic toxicology. Dr. Bryan’s fisheries and water quality experience extends to managing and serving as principal scientist for California Environmental Quality Act (CEQA) /National Environmental Policy Act (NEPA) documents, Endangered Species Act consultations, water quality and aquatic ecology studies, and regulatory permitting—particularly municipal wastewater NPDES permitting. Dr. Bryan’s research background provides a strong foundation for conducting specialized water quality and fisheries studies, including experimental design, study implementation, data analysis, and project documentation.

Years of Experience:
33

Education:

Ph.D., Environmental Toxicology and Fisheries Biology, Iowa State University, 1993

Professional Affiliations:

- American Fisheries Society
- Society of Environmental Toxicology and Chemistry, Northern California Chapter Member

Expertise:

- NPDES Report of Waste Discharge and Permit Negotiations
- Wastewater Studies
- Toxicity Reduction Evaluation (TRE)/Toxicity Identification Evaluation (TIE)
- CEQA/NEPA Documentation
- Effluent and Receiving Water Quality Monitoring and Assessment
- Mixing Zone and Dilution Studies
- Metals Water-Effect Ratio Studies
- Fisheries Biology/Aquatic Ecology
- Endangered Species Act Consultations
- Evaluations of Fish Passage at Barriers and Screens

Dr. Bryan applies his extensive knowledge of fisheries and water quality in his management and technical oversight of CEQA/NEPA assessments for water supply and conveyance, flood control, and wastewater treatment and disposal projects. Dr. Bryan has developed a deep understanding of CVP/SWP operations, and the fish resources and water quality of the American River, Sacramento River, and Sacramento-San Joaquin Delta system. In the wastewater arena, Dr. Bryan assists municipal wastewater dischargers with developing reports of waste discharge, permit renewal, and special studies. In addition, Dr. Bryan is a leader in the development of site-specific water quality standards as a means of effectively resolving regulatory issues.

REPRESENTATIVE PROJECT EXPERIENCE

NPDES Permitting / Wastewater Discharger Studies

NPDES Permit Renewal

Provides technical and strategic services to negotiate waste discharge requirements in NPDES permits for wastewater treatment plants (WWTPs) issued by state regional water quality control boards (RWQCB). This includes conducting detailed reviews and preparing detailed comments on tentative NPDES permits to establish a record for administrative appeals, as well as face-to-face negotiations with RWQCB staff and other resources agencies, including California Department of Fish and Wildlife, National Marine Fisheries Service, and Department of Public Health staff, over permit terms. Also prepares discharger presentations and provides public testimony at NPDES permit adoption hearings. These services have been provided for:

- El Dorado Irrigation District – Deer Creek and El Dorado Hills WWTPs (1996–present)
- Sacramento Regional County Sanitation District (1997–present)
- City of Roseville – Dry Creek and Pleasant Grove Creek WWTPs (1998–present)
- City of Placerville – Hangtown Creek Water Reclamation Facility (1999–present)
- City of Brentwood WWTP (2003–present)
- Mountain House Community Services District – Mountain House WWTP (2006–present)
- City of Stockton Regional Wastewater Control Facility (2008–present)
- Placer County – Sewer Maintenance District 1, Sewer Maintenance District 3, Sheridan, and Applegate WWTPs (1998–2011)

- City of Ione (2010–2012)
- Nevada County – Lake Wildwood, Lake of the Pines, and Cascade Shores WWTPs (2003–2009)
- Colusa Industrial Properties (2007–2008)
- City of Santa Rosa (2005–2007)
- Los Angeles County Sanitation Districts – Los Coyotes Water Reclamation Plant and Long Beach Water Reclamation Plant (2002–2005)
- City of Lincoln/Del Webb – Lincoln Wastewater Treatment and Reclamation Facility (2000–2005)
- City of Vacaville – Easterly WWTP (1999–2011)
- Ironhouse Sanitary District WWTP (2006–2013)

Thermal Plan Exceptions

Principal-in-charge and technical lead to conduct special studies in support of obtaining Clean Water Act section 316(a) exceptions to California Thermal Plan temperature objectives applied in NPDES permits and facilitate the exceptions' approval by the Central Valley Regional Water Quality Board (RWQCB) and fish resource agencies – California Department of Fish and Wildlife, National Marine Fisheries Services, and U.S. Fish and Wildlife Service. Has developed or is currently developing exceptions as follows:

- California Department of General Services (DGS). Completed study evaluating the temperature-related effects the Central Heating and Cooling Plant discharges to the Sacramento River on migrating fish. Based on this study, its findings, and concurrency on findings by the fish resource agencies, the RWQCB issued a Thermal Plan Exception to DGS, resulting in a cost-effective solution to DGS's temperature compliance issue.
- City of Brentwood Wastewater Treatment Plant. Completed study in 2010 evaluating the temperature regime of Marsh Creek under the influence of the discharge and whether the regime could continue to support the indigenous aquatic life, as part of developing information to support Thermal Plan exceptions. Developed alternative temperature limitations to protect the Marsh Creek aquatic life and also resolve the temperature compliance issue. Completed a second study in 2018 re-evaluating the temperature regime in Marsh Creek based on data collected since 2010, to support renewal of the Thermal Plan exceptions and alternate limitations in the wastewater treatment plant NPDES permit.
- Sacramento Regional County Sanitation District. Completed extensive field studies in 2012 that directly assessed the effects of the Sacramento Regional Wastewater Treatment Plant (SRWTP) discharge on the movement of lower Sacramento River fishes past the SRWTP outfall. Worked closely with staff from the fishery agencies (CDFW, NMFS, USFWS) and Central Valley Regional Water Board to design the 2012 field study and interpret findings. Developed reports addressing how changes in near-field and far-field temperatures of the river affect fish and other aquatic life in support of renewing Thermal Plan exceptions for this discharge. Currently updating reports in support of maintaining Thermal Plan exceptions upon NPDES permit renewal in 2021.
- Mountain House Wastewater Treatment Plant. Completed studies evaluating the effects of the Mountain House Wastewater Treatment Plant discharge on Old River within the Sacramento-San Joaquin Delta. The study involved interpreting modeling of the near-field and far-field temperature regime to assess the effect of the discharge on the temperature regime and the aquatic life residing in this portion of the Delta in support of obtaining a new Thermal Plan exception for this discharge.

Sacramento Regional Wastewater Treatment Plant Temperature Study

Principal-in-charge responsible for development and implementation of a comprehensive study consisting of eight study elements to assess the potential thermal effects of the Sacramento Regional Wastewater Treatment Plant's (SRWTP) effluent discharge on aquatic life and habitat, including designated critical habitat for delta smelt, Chinook salmon, steelhead, and green sturgeon, in the lower Sacramento River. The study was developed in coordination with a working group consisting of USFWS, NMFS, California Department of Fish and Game, and Central Valley Regional Water Quality Control Board staff and examined the potential for the SRWTP discharge to have direct or indirect thermal effects on ESA-listed delta smelt and anadromous fishes. Provided oversight of consultation with the USFWS to obtain a letter of not likely to adversely affect delta smelt or its critical habitat, with NMFS to obtain a biological opinion and incidental take statement for ESA-listed anadromous fishes, and

facilitation of obtaining a U.S. Army Corps of Engineers Section 10 Rivers and Harbors Act permit. Also responsible for overseeing study design and development, coordination with USFWS and NMFS staff regarding seasonal migrations of delta smelt and anadromous salmonids, and overseeing the analysis and reporting of the potential direct and indirect thermal effects of the SRWTP discharge on aquatic biota, including delta smelt, Chinook salmon, steelhead, and green sturgeon, of the lower Sacramento River. Prepared synthesis of findings from the eight study elements into a single report to develop conclusions regarding near-field and far-field effects of thermal discharge.

Antidegradation Analyses

Principal-in-charge for conducting antidegradation analyses for municipal wastewater dischargers consistent with state and federal policies and guidance, in support of new or expanded discharge capacity. Antidegradation analyses completed include:

Surface Water

- City of Brentwood Wastewater Treatment Plant – expansion
- Ironhouse Sanitary District Wastewater Treatment Plant – new discharge
- Placer County Sewer Maintenance District 1 Wastewater Treatment Plant – upgrade and expansion
- City of Galt Wastewater Treatment Plant – new summer discharge and expansion
- El Dorado Hills Wastewater Treatment Plant – upgrade and expansion

Groundwater

- Ironhouse Sanitary District Master Reclamation Permit
- City of Roseville Aquifer Storage and Recovery

Toxicity Reduction Evaluations (TREs)

Principal-in-charge for TREs performed for municipal wastewater dischargers, including the preparation of TRE work plans and action plans required by NPDES permits, interpretation of toxicity test results, and negotiations with regional water quality control board staffs to conclude the TRE. Dischargers for which TREs have been or are being performed include:

- City of Stockton Regional Wastewater Control Facility, *Selenastrum capricornutum* and *Ceriodaphnia dubia*
- Town of Windsor Wastewater Treatment, Reclamation and Disposal Facility, *Selenastrum capricornutum* and *Ceriodaphnia dubia*
- City of Davis Water Pollution Control Plant, *Selenastrum capricornutum*
- City of Woodland Wastewater Treatment Plant, *Selenastrum capricornutum* and *Ceriodaphnia dubia*
- City of Brentwood Wastewater Treatment Plant, *Ceriodaphnia dubia*
- City of Lodi Water Pollution Control Facility, *Ceriodaphnia dubia*
- City of Atwater Regional Wastewater Treatment Facility, *Selenastrum capricornutum*
- City of Turlock Regional Water Quality Control Facility, *Ceriodaphnia dubia*
- El Dorado Irrigation District Deer Creek Wastewater Treatment Plant, *Ceriodaphnia dubia*
- Lehigh Southwest Cement Company Permanente Quarry, *Ceriodaphnia dubia*

Water-Effect Ratio Studies

Principal-in-charge for conducting water-effect ratio (WER) studies for municipal wastewater dischargers consistent with U.S. EPA and state guidance. Studies include:

- Hangtown Creek Water Reclamation Facility – Zinc WER
- Deer Creek Wastewater Treatment Plant – Copper WER and Zinc WER
- El Dorado Hills Wastewater Treatment Plant – Copper WER
- Town of Windsor Wastewater Treatment, Reclamation, and Disposal Facility – Copper WER
- Placer County Sewer Maintenance District 1 – Aluminum WER
- City of Colfax Wastewater Treatment Plant – Copper WER
- City of Galt Wastewater Treatment Plant – Copper WER and Zinc WER

- City of Atwater Regional Wastewater Treatment Facility – Zinc WER

Receiving Water Temperature Studies

Principal-in-charge on studies conducted to evaluate seasonal temperature regimes and compliance with receiving water limitations stipulated in NPDES permits. Provided oversight in study plan development, managed field staff, and managed preparation of study reports for studies on the following receiving waters.

- Deer Creek – El Dorado County, CA for El Dorado Irrigation District
- Hangtown Creek – Placerville, CA for City of Placerville
- Old Alamo Creek, New Alamo Creek, and Ulatis Creek – Solano County, CA for City of Vacaville
- Marsh Creek – Contra Costa County, CA for City of Brentwood
- Sacramento River – for Sacramento Regional County Sanitation District and California Department of General Services
- Dry Creek and Pleasant Grove Creek – Placer County, CA for City of Roseville
- Atwater Drain – Atwater, CA for City of Atwater
- Dredger Cut, Highline Canal, and White Slough – San Joaquin County, CA for City of Lodi

Effluent and Receiving Water Quality Assessments

Principal-in-charge on effluent and receiving water quality assessments for the following dischargers:

- Hangtown Creek Water Reclamation Facility – City of Placerville
- El Dorado Hills Wastewater Treatment Plant – El Dorado Irrigation District
- Deer Creek Wastewater Treatment Plant – El Dorado Irrigation District
- Sewer Maintenance District 1 Wastewater Treatment Plant – Placer County
- Sewer Maintenance District 3 Wastewater Treatment Plant – Placer County
- Sheridan Wastewater Treatment Plant – Placer County
- City of Stockton Regional Wastewater Control Facility
- Easterly Wastewater Treatment Plant – City of Vacaville

Assessments documented effluent and receiving water concentrations of over 180 constituents, including all California Toxics Rule/National Toxics Rule constituents, to determine whether contaminant-specific waste discharge requirements are warranted in the dischargers' NPDES permits.

Stockton Nitrate Study

Served as Principal-in-charge of study for the City of Stockton's Regional Wastewater Control Facility (RWCF) to determine whether the discharge of nitrate plus nitrite to the San Joaquin River at concentrations greater than the drinking water maximum contaminant level (MCL) would be consistent with California's mixing zone policies. Provided oversight of the study design and workplan to guide data collection, analyses, and reporting. Study consisted of a comprehensive literature review of impacts to the San Joaquin River, Delta, and drinking water exports from nutrients levels and stoichiometry, phytoplankton quantity/composition, and *Microcystis aeruginosa*. Modeled Delta hydrology to determine the proportion of water at drinking water intake locations constituted by RWCF effluent, monitored submerged/emergent vegetation, benthic macroinvertebrate community, water quality parameters (including nutrients), and algae community composition and biomass upstream and downstream of the RWCF outfall over a one-year period. Used field data to assess the impact of the RWCF discharge (specifically nitrate load) on the phytoplankton, benthic macroinvertebrate community, and submerged/emergent vegetation within the study reach. Presented assessment to Central Valley Regional Water Quality Control Board in support of NPDES permit renewal.

Vineyard Surface Water Treatment Plant - Sacramento County Water Agency

As principal-in-charge, assisted RMC Water and Environment for the permitting of a temporary surface water discharge of test water resulting from the startup of a large (80 mgd) water treatment plant in southern Sacramento County. RBI prepared a technical report characterizing projected effluent quality of the testing and startup discharges, and assessment of potential effects to the small ephemeral stream channel (Gerber Creek), the

receiving water for temporary discharges lasting approximately 6 months with discharge rates varying up to 15 mgd. RBI assisted with preparation of permit application requirements for consistency with the Central Valley Regional Water Quality Control Board's "limited threat general NPDES permit," which was an adopted streamlined permit procedure at the time of the project. The permit strategy involved development of a request, with supporting justification, of a temporary exception for the discharge to exceed applicable state water quality objectives for trihalomethane compounds. RBI also prepared the assessments of potential impacts to hydrology, water quality, and fisheries and aquatic resources for an amended CEQA Initial Study and Mitigated Negative Declaration that was prepared for the project.

Port of Stockton Stormwater Administrative Order on Consent and NPDES Permit Negotiation and Monitoring Review

Developed and negotiated stormwater toxicity monitoring requirements in the U.S. EPA's Administrative Order to achieve reasonable and scientifically defensible requirements. Led RBI's contribution to negotiations during renewal of the Port's 2011 MS4 NPDES Permit. Directed technical assessment of Port's water quality monitoring data that RBI used as the basis for negotiating an amendment to the 2011 NPDES permit that substantially reduced the stormwater monitoring burden of the Port. Provided lead oversight, technical review, and interpretation of water quality and bioassay laboratory reports from stormwater monitoring events in support of maintaining compliance with the Administrative Order and NPDES Permit. Directed toxicity identification evaluations (TIEs), when needed.

Seasonal Coliform Bacteria Limitations

Negotiated alternative winter coliform bacteria limitations to be included in NPDES permits, which involved extensive technical analyses, technical report preparation, and negotiations with Central Valley Regional Water Quality Control Board policy and permitting staff and Department of Health Services (now Department of Public Health) technical staff. Dischargers assisted include: El Dorado Irrigation District's Deer Creek Wastewater Treatment Plant and Placer County's Sewer Maintenance District 1 Wastewater Treatment Plant.

Ecological, Water Quality, and Hydrologic Evaluation of Deer Creek

Project manager and technical lead on a study documenting the ecological, water quality, and hydrologic conditions of Deer Creek upstream and downstream of the Deer Creek Wastewater Treatment Plant discharge. Conducted reconnaissance survey, developed experimental approach, and supervised/participated in field data collection. Documented fish and benthic macroinvertebrate taxa. Prepared final project report, which served, in part, as the basis for NPDES permit renewal.

Receiving Water Dissolved Oxygen Studies

As principal-in-charge and project manager, evaluated the effects of municipal wastewater treatment plant effluent discharges on downstream dissolved oxygen profiles using U.S. EPA's STREAMDO IV model. Studies conducted on Deer Creek for El Dorado Irrigation District, and Old Alamo, New Alamo, and Ulatis creeks for the City of Vacaville.

Basin Plan Amendments / Use Attainability Analyses

Site-Specific Objectives - pH, Turbidity, and Temperature

Principal-in-charge and lead water quality/aquatic ecology specialist for development of site-specific amendments to the Central Valley Regional Water Quality Control Board (RWQCB) Water Quality Control Plan (Basin Plan) for Deer Creek pH, turbidity, and temperature. Developed supporting technical studies/information, drafted RWQCB Staff Report/Functional Equivalent Document, and prepared responses to peer review and public comments.

Region-Wide Basin Plan Objectives - pH and Turbidity

Provided technical and strategic services to the Central Valley Regional Water Quality Control Board, on behalf of Central Valley dischargers, to develop and adopt region-wide amendments to the Central Valley Region Water Quality Control Plan (Basin Plan) for pH and turbidity. Work tiered from the development of site-specific objectives for pH and turbidity for Deer Creek.

Aquatic Life Use Attainability Analysis - Old Alamo Creek

Examined the suitability of Old Alamo Creek to support anadromous salmonids by examining the available instream and riparian habitat, flow regime, thermal regime, water quality, and existing fish and benthic macroinvertebrate communities and participated in preparation of the Use Attainability Analysis (UAA) report. The UAA supported de-designating the cold freshwater habitat and cold migration beneficial uses assigned to Old Alamo Creek.

Municipal and Domestic Supply (MUN) Use Attainability Analysis - New Alamo Creek and Ulatis Creek

Principal-in-charge for the preparation of a Use Attainability Analysis (UAA) of the MUN use of New Alamo and Ulatis creeks, located in Solano County, consistent with U.S. EPA guidance. The project consisted of assembling hydrologic and water quality characteristics of the watersheds and documenting the extent of MUN use historically occurred or could be attained in the creeks. The UAA supported development of site-specific objectives for trihalomethane compounds for the protection of human health.

Site-Specific Objectives - Chloroform, Dibromochloromethane, and Dichlorobromomethane

Principal-in-charge and co-author of technical report for the development of site-specific objectives (SSOs) for three trihalomethane (THM) compounds for New Alamo and Ulatis creeks, Solano County. SSOs were developed to be protective of human health-related uses and resolve the THM criteria compliance issues resulting from the City of Vacaville's Easterly Wastewater Treatment Plant discharge. Also participated in the review and drafting of key sections of the Regional Water Quality Control Board's (RWQCB) Staff Report supporting a Basin Plan amendment for the SSOs, and meetings with RWQCB and U.S. Environmental Protection Agency Region 9 staff overseeing the SSO development and approval.

Municipal and Domestic Supply (MUN) Use Attainability Analysis - Atwater Drain

Principal-in-charge for the preparation of a Use Attainability Analysis report for Atwater Drain, located in Merced County, to evaluate the suitability of its MUN designation. Required the evaluation of watershed land use, hydrology, and water quality information, as well as the documentation of past and current diversions from the drain.

Municipal and Domestic Supply (MUN) De-Designation - Twelve Constructed/Modified Water Bodies in Sacramento River Basin

Principal-in-charge for the preparation of the environmental review section and CEQA checklist for the Basin Plan Amendment Staff Report prepared by the Central Valley Regional Water Quality Control Board to de-designate the MUN beneficial use from twelve constructed and/or modified water bodies in the Sacramento River Basin that receive treated municipal wastewater from the cities of Biggs, Colusa, Live Oak or Willows. The environmental review evaluated the impact to water quality and other beneficial uses of the receiving waters and environment that would occur from implementation of the Basin Plan amendment relative to existing conditions and the cumulative condition.

Central Valley Salt and Nitrate Management Plan Substitute Environmental Documentation

Principal-in-charge for the preparation of the environmental impact analysis of the effects of the CV-SALTS proposed Central Valley Salt and Nitrate Management Plan (SNMP). The SNMP includes several policies and recommended permitting strategies to be developed by the Central Valley Regional Water Quality Control Board into amendments to the Water Quality Control Plans for the Sacramento River and San Joaquin River Basins and Tulare Lake Basin. The amendments would address modifications to permitting discharges of salts to surface water and groundwater, and discharges of nitrate to groundwater within the Central Valley. The environmental review consisted of a detailed evaluation of the direct and indirect impacts, and cumulative environmental impacts to all CEQA Appendix G Environmental Checklist resources, including water quality, air quality, hydrology, biological resources, and public services and housing.

Other Water Quality Studies

Freshwater Mussels Study

Principal-in-charge for a multi-agency collaborative study developed for the Central Valley Clean Water Association (CVCWA) to evaluate the presence or absence of freshwater mussels in Central Valley POTW receiving waters. In 2013, the U.S. Environmental Protection Agency (USEPA) promulgated new ammonia criteria for freshwater ecosystems, which incorporated new toxicity data developed for unionid freshwater mussels, non-pulmonary snails, and other freshwater organisms not available at the time the previous 1999 ammonia criteria were developed. This resulted in the 2013 EPA recommended ammonia criteria being notably more stringent than the 1999 criteria, thereby resulting in compliance issue for some POTWs. This study, which is being implemented in several phases, was undertaken in response to a California Water Code Section 13267 information request issued by the Central Valley Regional Water Quality Control Board to collect information to aid the Board in implementing the 2013 ammonia criteria in NPDES permits for POTWs, based on the presence or absence of freshwater mussels in their receiving waters.

South Fork American River Watershed Assessment

Principal-in-charge responsible for compilation and evaluation of available water quality data collected in the South Fork American River watershed. Project used a geographic information systems approach to prioritize sub-basins within the watershed for future water quality monitoring and restoration.

Sediment Total Maximum Daily Load (TMDL)

Project manager and technical lead for providing fisheries and water quality expertise to assist the Imperial Irrigation District with participating in the development of a silt TMDL for the Alamo River, the main tributary to the Salton Sea, Imperial Valley, CA. Using available scientific literature, characterized the effects of suspended sediments on freshwater aquatic life. Reviewed and provided comments on the Draft Problem Statement prepared by the Colorado River Basin Regional Water Quality Control Board.

Effluent Discharge Impact Assessment

Project manager and technical lead on evaluation of potential impacts to human health and aquatic life from discharging tertiary-treated municipal wastewater treatment plant effluent into Folsom Reservoir or Lake Natoma as part of dry year water conservation measures under the Sacramento Area Water Forum Proposal. Met with California Department of Health Services (now Department of Public Health) staff to discuss the proposed action and its potential effects on human health associated with downstream municipal purveyor diversions.

Folsom Dam Temperature Control Device (TCD) Assessment

Project manager and technical lead for assessing the potential impacts of operating a TCD at the urban water supply intakes at Folsom Dam. Identified seasonal impacts to Lower American River water temperatures and fish resources, and the quality of raw and finished urban water supplies diverted from Folsom Dam and the Lower American River.

Sediment Contaminant Monitoring

Project manager and technical lead for a North American-wide sediment contaminant monitoring survey designed to define the range of polydimethylsiloxanes in surface sediments of marine and freshwater systems receiving large municipal wastewater discharges. Supervised preparation of site-specific sampling plans, developed an experimental approach for the overall project, prepared a comprehensive quality assurance project plan, and contributed to preparation of project reports. Study served as the basis for subsequent bioassays and ecological risk assessments.

Ecological Risk Assessment

Directed the aquatic assessment of component of a probabilistic ecological risk assessment that quantified the potential risk posed to wildlife and aquatic populations from opening and operating a gold mine in northern Washington.

Stormwater Quality Monitoring

Project manager and technical lead for the Laguna West stormwater runoff water quality mitigation-monitoring project, Sacramento County. Developed the experimental design and field operating procedures, statistically analyzed laboratory bioassay and contaminant data, directed activities for field personnel, and wrote project progress and final reports.

Fisheries Biology

Biological Assessment - New Mountain House Wastewater Treatment Plant Outfall in Old River

Prepared a Biological Assessment addressing the potential effects on Endangered Species Act-listed anadromous fish species that could result from placing a new diffuser outfall into the Old River, and operating the outfall to discharge up to 5.4 mgd of treated municipal effluent at buildout. Developed conservation measures to be implemented as part of the project to avoid/minimize effects on listed fishes. Worked closely with National Marine Fisheries Service in preparing the associated Biological Opinion.

Biological Assessment - Ironhouse Sanitary District Wastewater Treatment Plant Outfall in the Sacramento River

Prepared a Biological Assessment addressing the potential effects on Endangered Species Act-listed anadromous fish species that could result from placing a new diffuser outfall into the San Joaquin River, and operating the outfall to discharge up to 8.6 mgd of treated municipal effluent at buildout. Developed conservation measures to be implemented as part of the project to avoid/minimize effects on listed fishes. Worked closely with National Marine Fisheries Service in preparing the associated Biological Opinion.

Biological Assessment - City of Chico Wastewater Treatment Plant Expansion

Prepared a Biological Assessment for project to address potential project construction and operational effects on ESA listed fish species and their habitats that could result from placing a new diffuser outfall in the Sacramento River and operating the outfall to discharge up to 12 mgd of treated municipal effluent. Developed conservation measures to be implemented as part of the project to avoid/minimize effects on listed fishes.

Cosumnes River Flow Augmentation Project

Lead fisheries consultant on project that provides up to 5,000 acre-feet of American River water annually routed through the Folsom South Canal to pre-wet the lower Cosumnes River channel to provide earlier and more prolonged hydraulic continuity throughout the lower river during the fall-run chinook salmon spawning season. Assessed potential fish resource impacts of implementing the project on the fish resources of the lower American River, Cosumnes River, and Mokelumne River.

Aquatic Biological Resources Assessment of Hangtown Creek

Principal-in-charge for study design and implementation of fish sampling (electrofishing), benthic macroinvertebrate sampling, habitat assessment, and temperature monitoring. Benthic macroinvertebrate sampling was conducted using the California Department of Fish and Game California Stream Bioassessment Procedure. Study focused on evaluating the thermal effects of the Hangtown Creek Wastewater Treatment Plant's discharge on the aquatic ecology of Hangtown Creek.

Putah Creek Flow Restoration Project

Served as principal-in-charge of the Putah Creek fisheries assessment to determine how the project, developed to address debris buildup below the Putah Creek Diversion Dam through dam and channel modifications, could incorporate elements to achieve a secondary objective of protecting, maintaining, and possibly enhancing Putah Creek's aquatic habitats and fish resources.

Lower Yuba River CALFED Project

Co-Principal-in-charge and technical lead for developing a local-level Implementation Plan for Lower Yuba River anadromous fish habitat restoration. Project involved working with the Lower Yuba River Fisheries Technical Working Group, which has representatives from all state and federal fishery agencies, to perform a comprehensive

review of available fishery, ecological, and hydrologic information and to develop a conceptual model for the Yuba River aquatic ecosystem. This model is a framework to guide the refinement, evaluation, and prioritization of restoration actions proposed by CALFED Bay-Delta Program's Ecosystem Restoration Program Plan, U.S. Fish and Wildlife's Anadromous Fish Restoration Program, California Department of Fish and Game's 1991 Plan, and other fish management plans already developed for the river. The conceptual model identifies testable hypotheses related to key ecosystem processes, habitat conditions, stressors, and fish population trends and behavior, including habitat use. Based on this work, restoration actions, pilot projects, and studies are prioritized for near-term and long-term implementation in a manner consistent with long-term ecosystem and watershed management goals.

Lower American River Operations Working Group Participant

Provided technical assistance to staff from U.S. Bureau of Reclamation, California Department of Fish and Game, U.S. Fish and Wildlife Service, and National Marine Fisheries Services in evaluating alternative Folsom Dam shutter operational scenarios for the summer/fall period to maximize thermal benefits to Lower American River fall-run chinook salmon and steelhead, and to balance benefits to these two species.

CDFG/YCWA Interim Settlement Agreement

Initiated and led the development of a California Department of Fish and Game-Yuba County Water Agency (YCWA) Interim Settlement Agreement and Interim Study Plan for the Lower Yuba River. Facilitated negotiations between CDFG and YCWA, which were conducted to reach agreement on several issues, including minimum instream flow, water temperature, and flow fluctuation requirements associated with operation of the Yuba River Development Project. This process ultimately culminated in the Lower Yuba River Accord. The Accord resolved a nearly 20-year legal and political fight over water rights and fisheries flows. The Accord received the State's highest environmental award.

Lower American River Salmon Mortality Model Development

Project manager and technical lead for refinement of the U.S. Bureau of Reclamation's Lower American River early life stage fall-run chinook salmon mortality model. Compiled historic data defining temporal distributions of immigration and temporal and spatial distributions of spawning. Worked with Reclamation computer programmers to make code changes that resulted in an improved model that reflected the best available biological data for the river's fall-run chinook salmon population.

Lower Sacramento River and Delta Tributaries Technical Team Appointee

Appointed to the Lower Sacramento River and Delta Tributaries Technical Team, as part of the Anadromous Fish Restoration Program of the Central Valley Project Improvement Act. Developed technical reports outlining the key factors currently limiting chinook salmon and steelhead populations in the Lower American and Yuba rivers. Worked cooperatively with California Department of Fish and Game and U.S. Fish and Wildlife Service biologists on the project.

Central Valley Project Restoration Technical Liaison

Served as a technical liaison between the Northern California Power Agency, a contributor to the Central Valley Project (CVP) Restoration Fund, and the state and federal fish resource agencies charged with applying these funds to restore Central Valley anadromous fish populations. Developed a strategic process for establishing a shared understanding among these and other stakeholders regarding CVP restoration goals, objectives, and criteria for prioritizing expenditures from the CVP Restoration Fund to achieve basin-wide, fish population-restoration goals.

Bay/Delta Fisheries Report

Prepared a technical report for the Northern California Power Agency that identified the major factors that have contributed to recent declines in San Francisco Bay/Sacramento-San Joaquin Delta fishery resources. The factors contributing to recent declines of anadromous and resident fish populations were ranked according to their relative importance or contribution to observed population declines.

Sacramento Splittail Distribution and Relative Abundance Study

Project manager and technical lead for a large interagency (Department of Water Resources, California Department of Fish and Game, U.S. Bureau of Reclamation, U.S. Fish and Wildlife Service, U.C. Davis, State Water Contractors, and Interagency Ecological Program) gill net survey that documented the distribution and relative abundance of Sacramento splittail in the Sacramento and San Joaquin rivers and Delta. Developed the experimental design and field operating procedures for the project, and supervised field personnel. Performed all statistical analyses of catch data, and prepared the project report.

CEQA/NEPA and Permitting

City of Stockton Regional Wastewater Control Facility EIR

Principal-in-charge for preparation of the City of Stockton Regional Wastewater Control Facility Modifications Project EIR, which evaluated effects of modifications to the treatment plant processes on effluent discharge and Delta receiving water quality, and potential construction impacts. Collaborated with the City and subconsultant, Ascent Environmental, to develop a Mitigation Monitoring and Reporting Program (MMRP) consistent with the San Joaquin County Multi-Species Habitat Conservation and Open Space Plan. Also, lead author of the fisheries assessment portion of the EIR. Provided support to City staff at the Scoping Meeting and City Council meeting at which the EIR was certified and the MMRP adopted.

Yuba County Water Agency South Canal Diversion

Principal-in-charge of CEQA, environmental permitting, and fish screen alternatives evaluation stakeholder process services provided to the Yuba Water Agency related to its South Canal Diversion located on the lower Yuba River. Led the development of project design, preparation of CEQA documentation, and securing environmental permits for a fast-track facilities repair project involving excavation of approximately 450 linear feet of the south channel of the lower Yuba River adjacent to the YWA's South Canal Diversion facility to enhance water supply and fish passage in 2018. Managed completion of the Initial Study/Mitigated Negative Declaration and securing Clean Water Act Section 401 certification from the Central Valley Regional Water Quality Control Board, Streambed Alteration Agreement from California Department of Fish and Wildlife, and Clean Water Act Section 404 authorization from the U.S. Army Corps of Engineers (and associated Biological Opinion from National Marine Fisheries Service). Coordinated all aspects of environmental compliance and permitting with YWA management, its legal counsel, and resources agencies to facilitate completion of the project.

Currently leading a stakeholder process designed to select the preferred alternative for an improved fish screen at YWA's South Canal Diversion. Led several workshops with stakeholders, including National Marine Fisheries Service, California Department of Fish and Wildlife, YWA management staff and consulting engineers, and YWA member units that receive South Canal water, to develop consensus for the selected fish screen alternative. The process has involved the review and evaluation of 14 alternative fish screen facilities. Managed development of alternatives evaluation criteria and a scoring matrix to facilitate identifying the preferred alternative, which will then undergo CEQA review and permitting.

Reinitiation of Consultation on the Coordinated Long-Term Operation of the Central Valley Project and State Water Project EIS

Co-author of the Water Quality section and supporting technical appendices for the 2019 EIS evaluating four alternatives for long-term operation of the Central Valley Project and State Water Project. Evaluation included interpreting CALSIM and DSM2 modeling output to determine effects of water operations on Delta and San Francisco Bay water quality constituents of concern, including electrical conductivity, chloride, bromide, mercury, selenium, nutrients, and organic carbon. Also evaluated potential effects of program elements, including additional tidal habitat restoration areas and an expanded aquatic weed pesticide application program.

Bay Delta Conservation Plan/California WaterFix EIR/EIS

Principal-in-charge for development and preparation of the water quality chapter for the Bay Delta Conservation Plan (BDCP)/California Waterfix EIR/EIS. Provided strategic input regarding assessment of the plan's effects on water quality in the Sacramento-San Joaquin Delta and primary tributaries. Developed thresholds of significance

for assessing water quality effects and participated in development of the water quality assessment framework, which integrated use of CALSIM II, DSM2, and other models used to assess water quality impacts resulting from the implementation of the nine BDCP alternatives and three WaterFix alternatives. Directed assessments of multiple constituent-specific assessments, including bromide, chloride, electrical conductivity, and Microcystis blooms. Worked with multiple local, state, and federal agencies to resolve issues and participated in stakeholder and public outreach efforts. Provided support to the California Department of Water Resources for the water rights petition hearings before the State Water Resources Control Board, including preparation of testimony and participation as an expert witness for water quality at the hearing.

EchoWater Project EIR

Served as principal-in-charge for the preparation of the water quality and aquatic biological resources sections of the EchoWater Project EIR prepared for the Sacramento Regional County Sanitation District. The water quality impact analysis evaluated the effects of the proposed upgrades to the Sacramento Regional Wastewater Treatment Plant on the water quality of the Sacramento River and Sacramento-San Joaquin Delta, and associated beneficial uses. The aquatic biological resources impact analysis evaluated the effects of the proposed project on the aquatic biological resources of the Sacramento River and Delta, with particular emphasis on effects of the changes in contaminant concentrations and temperature in these water bodies.

Tahoe Regional Planning Agency Shoreline Plan EIS

Principal-in-charge for preparation of the fish and aquatic biological resources section of an EIS that evaluated the potential environmental impacts on fisheries habitat and aquatic biological resources that could result from implementation of each of the four Lake Tahoe Shoreline Plan alternatives. The assessment specifically evaluated the effects of the implementation of the Shoreline Plan alternatives on prime fish habitat, disturbance during spawning, substrate removal, obstructions to fish migration, native riparian vegetation removal, introduction of invasive aquatic weeds related to boating activity, and disruption of littoral drift processes.

Tertiary Filtration, Ultraviolet Disinfection, and Biosolids Dewatering Project CEQA Initial Study/Mitigated Negative Declaration - City of Galt

As principal-in-charge, assisted the City of Galt (under contract to West Yost Associates) with environmental compliance documentation, NPDES permit acquisition, and environmental permitting for the proposed Phase 1 upgrade of selected unit processes at the wastewater treatment plant. Phase I of the project provides upgraded facilities (i.e., add tertiary treatment and ultra-violet disinfection) and will initiate a new discharge in the summer (previously permitted as a seasonal (winter) discharge). Phase II of the project involves further upgrades of the treatment facilities (improved nitrogen removal) and expansion in capacity from 3.0 million gallons per day (mgd) to 4.5 mgd. RBI prepared the CEQA Initial Study/Mitigated Negative Declaration (IS/MND) for the Phase 1 upgrades and necessary construction-related permits.

Ironhouse Sanitary District Wastewater Treatment Plant Expansion and Upgrade - CEQA and Permitting

As principal-in-charge, assisted the Ironhouse Sanitary District (ISD) with environmental compliance, NPDES permit acquisition, and environmental permitting for the proposed expansion and upgrade of the ISD municipal wastewater treatment plant that serves the communities of Oakley, Bethel Island, and outlying communities. RBI prepared the water quality and the fishery and aquatic resources chapters of the environmental impact report, which was prepared by Jones & Stokes. RBI developed thresholds of significance for interpreting the effects of anticipated receiving water quality changes on aquatic resources. Addressed Endangered Species Act issues related to listed fish species.

RBI was instrumental in securing authorization of a new NPDES permit for ISD's proposed surface discharge outfall in the San Joaquin River at Jersey Island. RBI led the consulting team to negotiate and secure the NPDES permit through the Central Valley RWQCB and prepared the key elements of the Report of Waste Discharge. In addition, RBI assisted ISD in securing environmental permits to authorize the dredging and dredge-material disposal necessary to construct and install a new surface discharge outfall pipe and diffuser in the San Joaquin River. RBI

prepared the sampling and analysis plan for sediment and dredge material characterization, and secured authorization under the Central Valley RWQCB's general waiver of waste discharge requirements for dredge material disposal to land. RBI provided monitoring and ongoing permit implementation services to ISD for the construction project.

Ironhouse Sanitary District Highway 4 Pipeline Project CEQA Compliance

As principal-in-charge, worked with the ISD in implementing a strategic phased approach to CEQA compliance for ISD's proposed construction of a new sanitary sewer gravity trunk, and forcemain conveyance pipelines and recycled water pipeline within its service area. Phase 1 involved the upfront identification of potential project development constraints, regulatory requirements, and identification of the appropriate CEQA documentation and process. Phase 2 of the project involved preparation of an Initial Study/Mitigated Negative Declaration to meet CEQA requirements and support future regulatory permitting. Additionally, RBI managed technical subconsultants for the conduct of botanical rare plant surveys, and air quality, noise and cultural resource assessments.

Placer County Sewer Maintenance District 1 Wastewater Treatment Plant Upgrade and Expansion - CEQA Initial Study/Mitigated Negative Declaration

Principal-in-charge of the hydrology and water quality section of the Initial Study/Mitigated Negative Declaration for the Sewer Maintenance District 1 Wastewater Treatment Plant Upgrade and Expansion project, and assisted with the biological resources section of the document by preparing the impact assessment for fisheries and aquatic resources. RBI assessed potential construction-related impacts and direct and cumulative long-term operations-related impacts of treatment plant upgrades and the increased effluent discharge rate to Rock Creek and Dry Creek, and water bodies further downstream. RBI assessed the potential water quality impacts on a constituent-by-constituent basis, incorporating key information from the antidegradation analysis and other technical reports that RBI had prepared for Placer County under separate contracts for work on the plant's NPDES permitting compliance.

Sacramento Regional Wastewater Treatment Plant 2020 Master Plan EIR

Lead consultant for preparing water quality and fishery and aquatic habitat chapters of the EIR. Responsible for coordinating all hydrologic and water quality modeling, and the use of modeled output for impact assessment purposes. Contributed to development of alternatives to be evaluated and thresholds of significance for the water quality and fisheries/aquatic habitat resources. Also assisted in conducting stakeholder and technical workshops associated with development of the 2020 Master Plan.

Lake of the Pines Wastewater Treatment Plant Upgrade EIR

Lead consultant for preparing the water quality/hydrology and fishery and aquatic resources chapters of the EIR, which was prepared by EDAW for Nevada County. Contributed to development of alternatives to be evaluated and developed thresholds of significance for the water quality/hydrology and fisheries chapters. Also assisted in conducting stakeholder and technical workshops associated with development of the facilities Master Plan.

City of Chico Wastewater Treatment Plant Expansion EIR

Lead consultant for preparing the fishery and aquatic resources chapter of the EIR, which was prepared by Jones & Stokes. Contributed to development of alternatives to be evaluated and developed thresholds of significance for the chapter. Also assisted in refinement of water quality assessments used to make determinations regarding potential impacts to aquatic resources in the Sacramento River.

Del Webb Tehama Project

Lead consultant for preparing the fishery and aquatic resources chapter of the EIR, which was prepared by Impact Sciences. Conducted site surveys and habitat characterizations. Consulted with National Marine Fisheries Service to obtain a concurrence letter of not likely to adversely affect steelhead using adjacent water bodies.

Hangtown Creek Wastewater Treatment Plant Upgrades IS/MND

Principal-in-charge for preparing an Initial Study/Mitigated Negative Declaration in support of planned upgrades to the Hangtown Creek Wastewater Treatment Plant. This environmental document was prepared to meet CEQA

requirements and to support application for a State Revolving Fund loan to fund, in part, the planned improvements.

Lower Cascade Canal Modernization Project EIR

Lead technical consultant for preparing the aquatic biological resources chapter of the EIR. Responsible for conducting detailed fisheries habitat and hydraulic assessments on the Lower Cascade Canal and presenting information to stakeholders. Contributed to the development of alternatives to be evaluated and thresholds of significance for determining impacts.

City of Lincoln Wastewater Treatment and Reclamation Facility EIR

Provided technical review and oversight for the fisheries and aquatic biological resources chapter of EIR. Assisted project team with addressing potential impacts and preparing supplements and addendums to EIR. Consulted with National Marine Fisheries Service on anadromous fish issues, including Endangered Species Act issues, related to new wastewater discharges to Auburn Ravine.

Deer Creek Wastewater Treatment Plant Expansion EIR

Lead author for water quality and fisheries chapters of the EIR, prepared for the El Dorado Irrigation District, which involved compiling and assessing effluent and receiving water quality data and evaluating acute and chronic bioassay testing results.

Eastern Sacramento County Replacement Water Supply Project EIR

Lead consultant for preparing the water quality and fishery and aquatic resources chapters of the EIR, which was prepared by EDAW for Sacramento County. Contributed to development of alternatives to be evaluated and developed thresholds of significance for the water quality and fisheries chapters. Performed detailed analysis of effects on American River and tributary water quality and compliance with water quality standards that would result from inputting remediated groundwater into the system. Also assessed effects on fish resources in the American, Cosumnes, and Mokelumne rivers of using up to 5,000 acre-feet of remediated water, annually, to pre-wet the Cosumnes River channel to provide earlier and more prolonged hydraulic continuity throughout the lower river during the fall-run chinook salmon spawning season.

Suction Dredging Permitting Program Supplemental EIR, California Department of Fish and Game

Principal-in-charge of water quality and toxicology impacts assessment for the Initial Study and supplemental EIR, which was prepared by Horizon Environmental. The EIR addresses the potential project-level environmental impacts of statewide suction dredging activity regulations. The focus of the analysis was on effects of dredging-related discharge of mercury in streams that have remnant contamination from historic gold mining activity.

El Dorado Irrigation District Water Supply Master Plan EIR

Lead technical consultant for preparing the hydrology, water quality, and aquatic biological resources chapters of the programmatic EIR. Responsible for evaluating Master Plan demands and District operations to meet projected demands to determine how such operations could impact these resources. Provided strategic guidance for integrating other District facilities into the assessment to produce a more real-world assessment.

EDWPA Supplemental Water Rights Project EIR

Directed the development of the water quality chapter for the El Dorado County Water and Power Authority (EDWPA) Supplemental Water Rights Project EIR. The proposed project is to establish permitted water rights allowing diversion of 40,000 AFA water from the American River basin to meet planned future water demands in the EID and GDPUD service areas and other areas located within El Dorado County that are outside of these service areas. The assessment addressed effects of the proposed project on American River watershed, Sacramento River, and Delta water quality.

Sacramento Area Water Forum Proposal EIR

Prepared the fisheries and surface water quality chapters of the EIR and regularly presented technical information on effects of reservoir operations and water management on fish resources and water quality to the Water Forum,

a coalition of 46 stakeholders representing agriculture, business, public agencies, and environmental groups collectively developing a strategic water-planning platform for the greater Sacramento area. Served as liaison between hydrologic/water temperature/salmon mortality modelers, Fischer-Delta (water quality) modelers, and other technical staff and CEQA consultants/City-County management staff responsible for preparing the EIR. Contributed to preparation of a Habitat Management Program (HMP) for the Lower American River, designed to preserve the wildlife, fisheries, recreational, and aesthetic values of the Lower American River, as well as mitigate for any potential impacts of the Water Forum Proposal.

Natoma Pipeline Replacement and Folsom Water Treatment Plant Expansion Project EIR/EA

Managed preparation of fisheries sections of the EIR/EA. The project involved analyzing the construction and operational impacts associated with pipeline replacement and water treatment plant expansion, as well as a 7,000 AFA increment of additional water planned to be diverted from Folsom Reservoir. Worked closely with modelers to develop hydrologic simulations to depict hydrologic effects of the project. Assessed output from the hydrologic, temperature, and salmon mortality models to identify project-specific and cumulative impacts to reservoir, river, and Delta fish resources. The project required compliance with federal and state regulations, including the Endangered Species Act and Clean Water Act.

Narrows II Powerhouse Intake Extension Mitigated Negative Declaration/Initial Study

Technical lead for assessing the potential effects on the fish resources of Englebright Reservoir and the Lower Yuba River from drawing water into the Narrows II Powerhouse from a lower elevation within Englebright Reservoir as a result of extending the current intake structure. Prepared a technical report on findings, with an emphasis on temperature-related effects on Lower Yuba River anadromous fish resources.

Placer County Water Agency and Northridge Water District Groundwater Stabilization Project EIR

Managed preparation of fisheries chapter of the EIR. Analyzed the hydrologic effects of the project as they would affect Folsom Reservoir seasonal storage levels, lower American and Sacramento River flows, and Delta inflow/outflow, and water temperatures, and the potential for such changes to impact fish resources in these water bodies. Worked closely with modelers to develop hydrologic simulations to depict hydrologic effects of the project.

Long-Term Reoperation of Folsom Dam and Reservoir EIR

Fisheries lead to determine the feasibility of indefinitely extending Sacramento Area Flood Control Agency's Folsom Dam and Reservoir Reoperation Agreement with the U.S. Bureau of Reclamation. Worked closely with modelers to develop hydrologic simulations to depict hydrologic effects of the project. Output from hydrologic, temperature, and salmon mortality models was assessed to identify project-specific and cumulative impacts to reservoir, river, and Delta fish resources. Additional activities included meeting with National Marine Fisheries Service, U.S. Fish and Wildlife Service, and California Department of Fish and Game to determine the need for consultation under the federal and state endangered species acts and determination of potential impacts to fishery resources throughout the Central Valley Project resulting from integrated reservoir operations.

CVP Water Supply Contracts EIS/EIR

Lead author for the fisheries and water quality chapters of the joint programmatic EIS/EIR prepared for the Central Valley Project (CVP) Water Supply Contracts under Section 206 of Public Law 101-514. Evaluated hydrologic, river and reservoir water temperature, and salmon mortality model output to determine potential impacts to CVP reservoir, lower American and Sacramento rivers, and Delta fish resources that could result from diverting a portion of the water from Folsom Reservoir. Worked closely with project engineers to design the hydrologic modeling studies and determine output needed to conduct the necessary environmental assessments. Also participated in development and evaluation of project alternatives capable of fulfilling project purposes, with an emphasis on water supply, affected hydrology, and environmental constraints.

Hamilton City Pumping Plant Fish Screen Improvement Project EIR/EIS

Developed technical approach to assessing the effects of the proposed project and its alternatives on fisheries and aquatic habitats. Lead author for all fisheries sections of the EIR/EIS. Fisheries and aquatic habitat chapter received U.S. EPA's highest review score. Key issues included analyses of alternative means of simultaneously

protecting fish (including the endangered winter-run chinook salmon) while re-establishing reliability in Glenn-Colusa Irrigation District's diversions from the Sacramento River. This project involved many state and federal agencies, including California Department of Fish and Game, U.S. Bureau of Reclamation, U.S. Fish and Wildlife Service, National Marine Fisheries Service, U.S. Army Corps of Engineers, California Department of Water Resources, and the State Reclamation Board.

Interim Reoperation of Folsom Dam and Reservoir EIR/EA

Evaluated the potential impacts of interim reoperation on the fish resources of Folsom, Trinity, and Shasta reservoirs; the Lower American, and Sacramento rivers; and the Sacramento-San Joaquin Delta, with an emphasis on anadromous salmonids. Assessments were based on output from U.S. Bureau of Reclamation's hydrologic, temperature, and salmon mortality models. Also performed an evaluation to determine the optimal shutter configuration at Folsom Dam to maximize beneficial use of Folsom Reservoir's coldwater pool for downstream temperature control. Assessed effects of seasonal temperature regimes that would occur under various shutter configurations on Lower American River steelhead and fall-run chinook salmon.

CONTACT: P.O. Box 30020, Santa Barbara, CA 93130
805-643-7710, 831-915-1115
mfeeney@ix.netcom.com

EDUCATION: M.A., Environmental Planning (Groundwater), California State University, 1987
Graduate Program, Water Science, University of California, Davis, 1981-1982
Secondary Teaching Credential, University of California, Santa Barbara, 1979
B.S., Earth Science (Geology), University of California, Santa Cruz, 1976

QUALIFICATIONS: Professional Geologist, California, No. 4634
Certified Engineering Geologist, California, No. 1454
Certified Hydrogeologist, California, No. 145
Certified Groundwater Professional, NGWA, 1994

EXPERIENCE: Mr. Feeney has more than 26 years experience in groundwater consulting. After employment as a well-site geologist in the oil industry and again as an engineering geologist, Mr. Feeney was a founding Principal of Staal, Gardner and Dunne, Inc. (later became Fugro West, Inc.) and managed this firm's Monterey County office for 9 years. Mr. Feeney later was a member of the firm, Balance Hydrologics, Inc. Mr. Feeney is currently a private consultant. Mr. Feeney's experience in groundwater supply issues includes well siting and design, preparation of project specifications and contractor supervision, well maintenance and repair, water treatment, groundwater modeling (both flow and solute-transport), perennial yield analysis, artificial recharge (surface and injection), water quality assessments, regulatory compliance and groundwater modeling.

Mr. Feeney has significant experience in drilling and well construction technology. During his career Mr. Feeney has designed and managed the construction of over 40 municipal wells with diameters up to 24-inches and discharge rates of up to 6,000 gpm at locations around the world.

Selected representative project experience includes:

**WATER SUPPLY
PROJECTS:**

Seaside Basin Injection/Recovery Study, Monterey County, MPWMD

This evaluation considered the development of a conjunctive use program to direct surplus runoff of the Carmel River into semi-consolidated aquifers in the Seaside area. The scope included the evaluation of groundwater injection wells to affect seasonal groundwater storage. Work included designing injection tests, overseeing modifications to the wells to allow effective testing, evaluating the tests to quantify aquifer properties and likely environmental effects, and simulating likely pressures and geochemical responses.

Coastal Water Project, Monterey County, California American Water Company

Mr. Feeney currently is retained by Cal-Am as special technical advisor to RBF Engineers, Inc. to assist with hydrogeologic issues associated with the Coastal Water Project. This project includes the development of approximately 8,000 acre-feet per year of desalinated supply and 2000 acre-feet per year of aquifer storage and recovery (ASR) supply. Mr. Feeney provides assistance in feedwater development methods and ASR well engineering.

Point of Diversion Study, Monterey County, California-American Water Co.

The feasibility of diverting subsurface flow from the Carmel River rather than direct diversion from the reservoirs was evaluated. The change would allow existing treatment facilities and pipelines to be utilized while providing important fisheries and riparian habitat benefits as well as reduced treatment costs. The scope included re-evaluating the geometry of the uppermost Carmel River alluvial aquifer, adapting the existing groundwater model to incorporate the proposed changes in point diversion, and assisting the local water district in modifying its operational models and in-stream flow simulations.

San Tomas Injection Well Project, Santa Clara Valley Water District. To offset the loss of surface recharge capacity, the District installed an injection well. Work included performed aquifer testing, numerical aquifer parameter estimation, and groundwater flow and geochemical interaction modeling. Developed specifications and supervised construction and testing of injection well. Conducted long-term injection testing and assessed well performance, which included detailed plugging analysis and assessment of project expansion possibilities.

North Monterey County Hydrogeologic Study - Monterey County

The northern portion of Monterey County is a mixed area of uplifted granitic bedrock, alluvial deposits, eolian sands, and tidal estuaries. The hydrogeologic setting is complex and hydraulically linked to the adjacent areas of the Pajaro and Salinas Groundwater Basins. The area supports a mix of agricultural and residential land uses developed entirely on groundwater. The study included the assessment of the water supply conditions including current water balance and water quality issues. The study concluded that overdraft in the area was severe and the water quality issues of seawater degradation and nitrate contamination were wide-spread and increasing. The work was supported by the development of a GIS coverages for the area and the integration of these coverages into the MCWRA's GIS system.

Arroyo Seco Cone Area Investigation, Monterey County

The investigation quantified the interaction between the surface flows of the Arroyo Seco cone area and the underlying groundwater system. Under consideration was the development of spreading basins to allow the use of Arroyo Seco surface water flows for artificial groundwater recharge. The project included: hydrogeologic exploratory drilling/well construction; construction and testing of a pilot recharge basin; and observation of a recharge cycle through one winter season. The investigation concluded that while percolation rates were very high, the proposed project could not cost effectively increase the volume of recharge over natural recharge rates due to the limited availability of groundwater storage and the short seasonal duration of flow of the Arroyo Seco. Project included the utilization of GIS technology for integration of geologic and hydrogeologic data sets.

Desalination Project, Marina Coast Water District. Marina Coast Water District built the first operating desalination facility in mainline California. Work included design and supervision of construction of the project's seawater intake and brine disposal wells. Additional work included performance of aquifer and injection testing and analysis, detailed groundwater flow and transport modeling as part of feasibility analysis, and assessment of injection well plugging phenomena.

Consulting Hydrogeologist

Sand City Desalination Plant Saline Intake and Brine Disposal Monterey Peninsula Water Management District —, Monterey County

In order to satisfy increased water demands, the MPWMD has proposed the construction of a 3.0 MGD seawater desalination facility that will extract water from coastal dune sands through the use of Ranney collectors. The feasibility of this approach was investigated and the conclusion reached that three Ranney collectors at the site would be capable of producing the required design flow. Also investigated was the use of Ranney collectors to inject brine into the shallow subsurface offshore. The project included drilling, well construction, aquifer testing and solute/flow modeling. It successfully demonstrated that Ranney collectors would be suitable for use and that brine injection was feasible.

Seaside Basin Hydrogeologic Update, Monterey Peninsula Water Management District. Provided analysis of basin conditions; including hydrogeologic setting, water levels, water quality, seawater intrusion, basin production, and basin management options.

Pilarcitos Creek Study -San Mateo County

Anticipating the listing of certain species of fish that migrate up coastal streams, the Coastside Water District, in conjunction with San Francisco Water Department, contracted for a study of the feasibility of modifying the method of diversion from Pilarcitos Creek. The study included the review of reservoir operations, analysis of distribution system, evaluation and modeling of the District's wellfield, and the assessment of fisheries conditions in specific reaches of the creek. The report concluded that it was feasible to shift diversions to the wellfield from the reservoir and that this would result in the re-establishment of up to 2 miles of additional fisheries habitat. However, the overall benefit of the proposed modification was not clear as the modification would have no effect on the more-critical impacted fisheries habitat downstream of the District's property.

**EXPERT/3rd PARTY
REVIEW
PROJECTS**

Salinas Valley Hydrogeologic Conference "White Paper".

Mr. Feeney was a one of eight participants in a 'blue-ribbon' committee convened by the MCWRA to address the hydrogeologic issues facing the Salinas Valley. As part of two day conference, the committee evaluated available data regarding seawater intrusion, the overall water balance and water quality issues. The committee reached general consensus and prepared a report recommending a solution to the water supply shortfall.

Soquel Creek Water District IGSM Development -- Technical Advisory Committee (TAC) Member.

Mr. Feeney was retained by Soquel Creek Water District to participate in a TAC reviewing the development of the IGSM model by a consultant for the District. This recently completed model, shares its southern boundary with the Pajaro IGSM model. Water level and water quality conditions within the northern portion of PVWMA area are linked between the two models.

Consulting Hydrogeologist

Pajaro Valley Water Management Agency – Groundwater Model Development Project – TAC Chairperson

The USGS was contracted to convert the Pajaro Valley Water Management Agency's (PVWMA) existing groundwater model from the IGSM code to MODFLOW2000 code. Mr. Feeney was retained by PVWMA to chair and as a participant in the advisory TAC that supervised the conversion of the model. This task entailed review and acceptance of a revised hydrostratigraphic model of the Pajaro Basin, review and acceptance of the water balance and recharge assumptions. The conversion project is on-going and a working, calibrated model has been completed.

Seaside Groundwater Basin Watermaster – Groundwater Model Development Project – TAC Chairperson

As part of the court decree, the Seaside Groundwater Basin Watermaster (Watermaster) was tasked with developing a groundwater model of the basin for management purposes. Mr. Feeney was retained to chair a panel of modeling experts to evaluate the existing groundwater models of the basin and the need for a new model. This review focused on the need and desired uses for a model, identification of data gaps that may limit model utility and validity, the suitability of flow versus solute transport models, and generalized approaches to the modeling effort. The results of the review resulted in the selection and modification of an existing model to meet the Courts requirement.

National Water Resources Institute – TAC Panel Member– Los Osos Sewer and Reclaimed Reuse Water Project

Mr. Feeney was asked to serve as the groundwater expert on the National Water Resources Institute (NWRI) panel reviewing the proposed Los Osos Sewer and Reclaimed Reuse Water Project. This expert review is required by Department of Public Health. The proposed plan would establish a local wastewater plant and then use the waste water for irrigation supply thereby potentially offsetting seawater intrusion. The review focused on the feasibility of the plan and the potential impacts and benefits of implementation.

National Water Resources Institute – TAC Panel Member– Monterey Regional Water Pollution Control Agency –Reclaimed Water Recharge Project in the Seaside Basin.

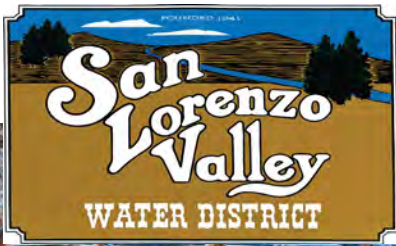
Mr. Feeney was again asked to serve as the groundwater expert on a NWRI panel reviewing the Monterey Regional Water Pollution Control Agency's proposed Reclaimed Water Recharge Project in the Seaside Basin. This project proposes to take highly-treated wastewater and use it for recharge in the Seaside Basin – either through percolation or direct injection. The review focused on the feasibility of the plan and the potential impacts and benefits of implementation. The panel is on-going.

PROFESSIONAL AFFILIATIONS:

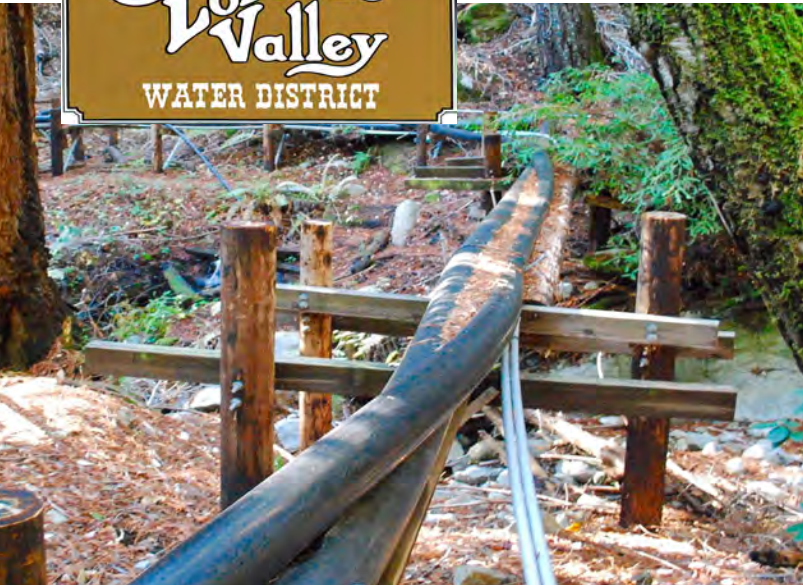
Groundwater Resources Association
Association of Groundwater Scientists and Engineers
American Institute of Hydrology
Monterey Bay Geologic Society



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June 24, 2019



Response to As-Needed Hydrogeological Consulting Services



**Luhdorff &
Scalmanini**
Consulting Engineers

June 24, 2019

Holly Hossack, District Secretary
San Lorenzo Valley Water District
13060 Highway 9
Boulder Creek, CA 965006

Subject: Response to As-Needed Hydrogeological Consulting Services

Dear Ms. Hossack:

To derive the greatest value from your On-Call As-Needed Consulting Hydrogeologist, Luhdorff & Scalmanini Consulting Engineers (LSCE) is proposing a team that has proven success delivering on-call groundwater-related services within California for nearly 40 years. The information presented in this proposal addresses the specific elements requested in the RFQ for the On-Call As-Needed Consulting Services, and the table of contents on the following page identifies the proposal's main sections and organization.

- ▶ **Strong, local presence to promote responsiveness and communication.** This team has worked on a variety of similar challenging projects involving surface water and groundwater resource management, including considerable work in the Santa Margarita Groundwater Basin, and we have offices located in relatively close proximity enabling close internal coordination. LSCE will successfully perform the broad range of hydrogeological services that will be critical for effective long-term management of the San Lorenzo Valley area groundwater resources.
- ▶ **A cohesive team to promote collaboration that leads to better solutions.** Our Key staff, Peter Leffler and Eddy Teasdale, have a long history of working in and familiarity with the Santa Margarita Area: Peter Leffler has considerable experience working in the Santa Margarita Groundwater Basin from the mid-1990s to early 2000s. He worked on a range of studies that included: groundwater model development, water balance evaluation, installation of test wells and production wells, evaluation of artificial recharge and water transfer options, and annual reports. From 2016 to 2018, Mr. Eddy Teasdale worked on numerous hydrogeological and engineering projects in the basin. Local projects included conjunctive use, recycled water and indirect potable reuse, stormwater treatment and recharge and annual groundwater reports.
- ▶ **Proven on-call performance to provide you with surety of delivery.** We know the nature of on-call contracts. On-call hydrogeological contracts we are actively involved in typically involve projects and tasks with urgent or undefined conditions and uncertain resource needs. By establishing a team that has a deep bench, and a balanced mix of expertise in studies and design, we can mobilize quickly and be responsive, flexible, and cost effective in our approach – because that is the nature of on-call work.

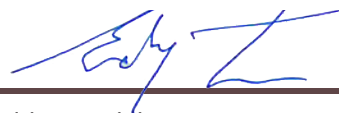
In summary, we believe LSCE provides the ideal blend of technical knowledge and expertise, groundwater modeling experience, combined with extensive expertise, knowledge, and experience with Sustainable Groundwater Management Act/Groundwater Sustainability Plan regulations, Best Management Practices, and preparation of GSPs.

We view our role as providing an extension of your staff and share the importance of meeting your goals as our highest priority. We look forward to the opportunity to demonstrate our high level of expertise, project delivery, and client service to San Lorenzo Valley Water District (SLVWD).

Sincerely,
Luhdorff & Scalmanini, Consulting Engineers



Peter Leffler, PG, CHG Principal Hydrogeologist



Eddy Teasdale, PG, CHG, Senior Hydrogeologist



Cover Letter

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Appendix A: Staff Resumes

1. Background

General Description of Background & Years in Business

Formed in 1980, LSCE is a consulting company with 44 staff persons based at our main office in Woodland and satellite offices in Oakland, Chico, and Merced. Our focus is on the investigation, development, use, protection, and management of groundwater resources. LSCE is certified as a Small Business Enterprise (SBE), and our professional staff are experienced in all aspects of groundwater ranging from hydrogeologic interpretation, hydrologic modeling, GIS, and database design, to well and pump station design and construction. LSCE provides a full complement of groundwater resources services, including conjunctive use planning, artificial recharge, analyses of groundwater - surface water (GW-SW) interaction, land subsidence analyses, groundwater modeling, and water budget development. LSCE routinely conducts analyses for water budget development and hydrogeologic characterizations, similar to those required for this RFQ. LSCE's hydrologic modeling capabilities are a result of extensive experience in the development, calibration, application, and analysis of groundwater flow and transport

models (analytical, numerical, and empirical). A comprehensive understanding of the hydrogeologic system is critical to the success of a hydrologic modeling project, and LSCE excels in hydrogeologic interpretation and conceptualization. Additionally, LSCE's experience in regional characterization of groundwater conditions and understanding of the many geologic, hydrologic, legal, and institutional factors affecting groundwater provide a vital perspective for groundwater management projects. See www.lsce.com for more information.

LSCE understands that SLVWD seeks the necessary support to conduct technical work as needed related to the groundwater resources in your area. LSCE is pleased to bring a long history of work conducted in the area, extending from many decades ago to today. We are highly familiar with the provisions of the Sustainable Groundwater Management Act (SGMA) through extensive involvement in SGMA-related work in groundwater basins across California, and we understand the essential requirements that will be needed to successfully perform on-call hydrogeological consulting services for SLVWD.

Past Bankruptcy Filings & Litigation

LSCE has never filed for bankruptcy and has not had any claims made against the firm in the last 5 years.

Specialties

LSCE provides a wide range of planning, design and construction services to support groundwater resources management, including, but not limited to the following specialties relevant to SLVWD's on-call service needs.

- ▶ Hydrogeologic Conceptual Models
- ▶ Groundwater Flow and Transport Modeling
- ▶ Groundwater-Surface Water Interactions
- ▶ Streamflow Depletion and Groundwater Dependent Ecosystems
- ▶ Well Design and Rehabilitation
- ▶ Groundwater Management Planning
- ▶ Hydrogeological Assessments
- ▶ Source Water Quality Assessments
- ▶ Water Availability Analyses
- ▶ Regulatory, Permitting, Water Rights and Environmental Requirements
- ▶ Cost Estimating
- ▶ Support Agency Partnering, Outreach and Stakeholder Outreach
- ▶ Prepare Reports, Develop and Prepare for Meeting and Project Management
- ▶ Sustainable Management Criteria and Develop Measurable Objective and Minimum Thresholds
- ▶ Development of Monitoring Networks and Protocols
- ▶ Identification of Projects and Management Actions

Successful On-Call Contracts

LSCE has provided on-call and as needed hydrogeological services to many public agencies. LSCE's 39-year project experience has been shaped largely by delivering on-call contracts, whether it is a \$10K hydrogeological impact assessment for the City of Modesto or a \$300K on-call contract for SFPUC. Our approach to delivering your assignments is built around an experienced Project Manager, Peter Leffler to lead negotiations and administration of task orders in collaboration with Eddy Teasdale. The nature of on-call assignments typically involves operating with limited information, on rapid turnaround and close collaboration with your in-house team. LSCE understands the nature of on-call assignments and offers a team with a range of technical expertise that understands and can support your needs big or small.



Example of long-term client relationships

2. Experience

LSCE has completed a diverse array of groundwater studies and we are currently involved in several on-call hydrogeological consulting contracts in several groundwater basins throughout California. This section summarizes recent work relevant to the requested services outlined in the RFQ.

Groundwater Management

LSCE has extensive experience with groundwater management services, including developing numerous Groundwater Management Plans (GMPs) in accordance with the California Water Code. LSCE has developed basin management objectives (BMOs), established appropriate

monitoring protocols for detecting changes in groundwater levels, groundwater quality, and land subsidence, and delineated recharge areas for various management areas in the state. The skill set and hydrogeological and water resources understandings used for GMPs directly translates to the requirements for SGMA and developing Groundwater Sustainability Plans (GSPs).

Groundwater Modeling

LSCE has extensive groundwater modeling experience and has utilized many different modeling platforms for analysis of both groundwater quantity (flow modeling) and groundwater quality (transport modeling). LSCE has developed many local area models to simulate groundwater flow and transport, assess groundwater conditions, and evaluate potential projects and management actions needed to achieve sustainable groundwater management. LSCE has also used existing peer-reviewed published models from DWR and the USGS to develop water budgets and provide model inputs for new local refined models in various regions throughout California. LSCE has also developed many local area and regional (basin) scale models to simulate groundwater flow and solute transport for assessing groundwater conditions and evaluating potential projects and management actions relevant to achieving sustainable groundwater management. LSCE is currently developing several basin scale groundwater models for use in GSPs, including in Madera, Chowchilla, and Westside subbasins; and we have also developed or reviewed groundwater models used to support two Alternatives to GSPs (Napa Valley, Niles Cone). LSCE is also experienced working with USGS and DWR regional models (e.g., California Central Valley wide models such as the Central Valley Hydrologic Model (CVHM) and C2VSIM) in developing water budgets and to provide model inputs for new local refined models. Mr. Leffler and Mr. Teasdale have been involved in development and/or review of several of the groundwater models developed for GSP purposes. LSCE's modeling expertise can be utilized to support the utilization and peer review of existing groundwater models for use in the Santa Margarita Groundwater Basin.



Overall, LSCE will bring the required local, groundwater management-related experience, and groundwater modeling-related experience.

Projects Completed by LSCE

The following 5 projects demonstrate LSCE’s recent, relevant experience involving groundwater resource related projects in California, where we have performed projects in all of the service areas requested in the SLVWD RFQ. LSCE will leverage proven planning tools and practical lessons learned to support your ongoing efforts to efficiently evaluate future solutions saving you time and money.

Additionally, we have listed recent groundwater projects in Table 1 (Section 3) to illustrate the extent of LSCE’s groundwater-related experience. Table 1 lists some of the projects we have completed and aspects of each project that relate to required work for SLVWD.

Project 1 - SGMA and GSP-Related Services for Madera and Chowchilla Subbasins

Key Staff: Pete Leffler, Pavan Dhaliwal

LSCE has been working for Madera County since 2017 and continues to work for the County on tasks related to the preparation of two separate GSPs (and other SGMA-related tasks) for the Madera and Chowchilla Subbasins. Key aspects of these services completed to date for each subbasin include:

- ▶ Data compilation involving acquiring and receiving data from public and local entities on all data types needed for the GSP analyses (e.g., groundwater level, water quality, well locations, well construction details, groundwater pumping, water use, land use)
- ▶ Identification of GSP data gaps and future needs
- ▶ Preparation of hydrogeologic conceptual models for both subbasins using information obtained through the data request and based on previous studies, supplemented by additional work related to new cross-section development and updating the aquifer parameter database
- ▶ Description of the geologic setting and hydrostratigraphy, subbasin lateral and vertical boundaries, evaluation of existing geologic cross-sections, preparation of new geologic cross-sections, interpretation of groundwater levels and development of maps of groundwater level contours, storage change, groundwater quality, land subsidence, and groundwater-surface water interaction
- ▶ Identification of Management Area considerations and highlighting advantages and disadvantages of designating Management Areas for the GSP
- ▶ Evaluation of groundwater components of the historical basin-wide water budgets and estimates of overdraft including groundwater system inflows and outflows and groundwater storage change over a representative hydrologic base period
- ▶ Successful preparation of DWR Proposition 1 grant applications totaling five million dollars for GSP preparation and groundwater monitoring facilities
- ▶ Groundwater model simulations of potential projects and management actions to achieve basin sustainability.
- ▶ Evaluation of sustainable management criteria including setting interim milestones, measurable objectives, and minimum thresholds

Relevant Project Features to SLVWD:

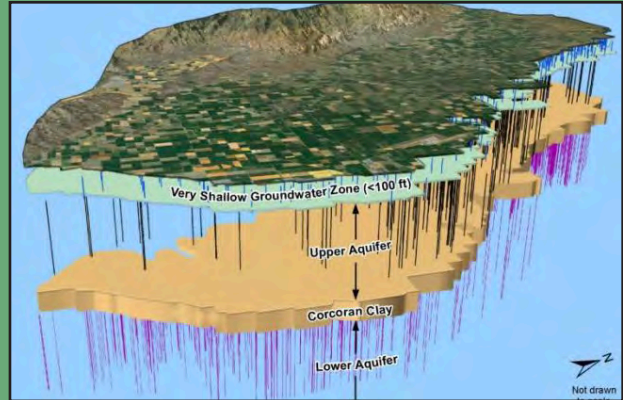
- ▶ Groundwater Modeling
- ▶ Sustainable Yield Analysis
- ▶ Groundwater-Surface Water Interactions
- ▶ Groundwater Monitoring
- ▶ Complex Geological Environments
- ▶ Data Gap Analysis and Monitoring Network
- ▶ Evaluation of Groundwater Management Areas
- ▶ Grant Funding
- ▶ Annual Reporting
- ▶ Development of measurable objectives and minimum thresholds
- ▶ Peer-Review of Hydrogeological Reports
- ▶ Interagency Coordination

Project 2 - Technical Support for GSP Preparation for the Westside Subbasin

Key Staff: Eddy Teasdale, Pavan Dhaliwal, Mohamed Nassar, Nick Newcomb, Vicki Kretsinger Grabert

Since 2014 to present, LSCE has provided Westlands Water District with technical support for groundwater related tasks and development. Key aspects of these services include:

- ▶ Compiling existing hydrogeologic data (lithology, well construction, groundwater pumping, land use, surface water deliveries, subsidence) from the Westside Subbasin and surrounding GSAs
- ▶ Development of a hydrogeologic conceptual model of the Westside Subbasin used in quantifying groundwater conditions, historical water budgets, and groundwater flow directions
- ▶ Construction and calibration of a new basin wide numerical groundwater flow and solute transport model using MODFLOW-OWHM
- ▶ Development of a data management system that incorporates monitoring data and produces GIS-based information for electronic submittals to stakeholders and regulatory agencies
- ▶ Successful preparation of DWR Proposition 1 grant applications totaling 2.5 million dollars for GSP preparation and groundwater monitoring facilities



Relevant Project Features to SLVWD:

- ▶ Groundwater Modeling
- ▶ Sustainable Yield Analysis
- ▶ Groundwater-Surface Water Interactions
- ▶ Complex Geological Environments
- ▶ Evaluation of Groundwater Management Areas
- ▶ Annual Reporting
- ▶ Peer-Review of Hydrogeological Reports
- ▶ Interagency Coordination
- ▶ Groundwater Monitoring

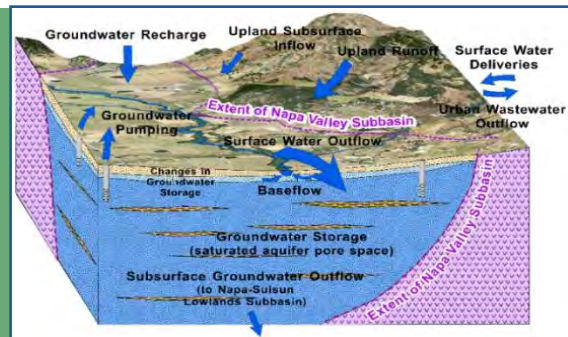
Project 3 - Napa County Groundwater and Surface Water Studies

Key Staff: Vicki Kretsinger Grabert, Mohamed Nassar



LSCE has been working for Napa County since 2009 and the work is ongoing. Key aspects of these services include:

- ▶ SGMA assistance including preparation and submittal of a GSP alternative demonstrating existing sustainable groundwater management and submittal of two annual SGMA reports
- ▶ Gathering available groundwater-related data, developing water resources data management system, identifying data gaps, and providing recommendations for water resources monitoring
- ▶ Developing updated hydrogeologic conceptualization and characterization of conditions including eight geologic cross-sections
- ▶ Refining and further characterizing areas of greater recharge potential
- ▶ Installation of shallow, dual-completion groundwater monitoring facilities and stream gauges to evaluate GW-SW interactions
- ▶ Presentation of analyses and interpretations through reports and associated GIS and graphical products
- ▶ Designation of a Management Area and related SGMA report, including documentation for a numerical groundwater flow model
- ▶ Critical review of water demand and supply availability for groundwater users



Relevant Project Features to SLVWD:

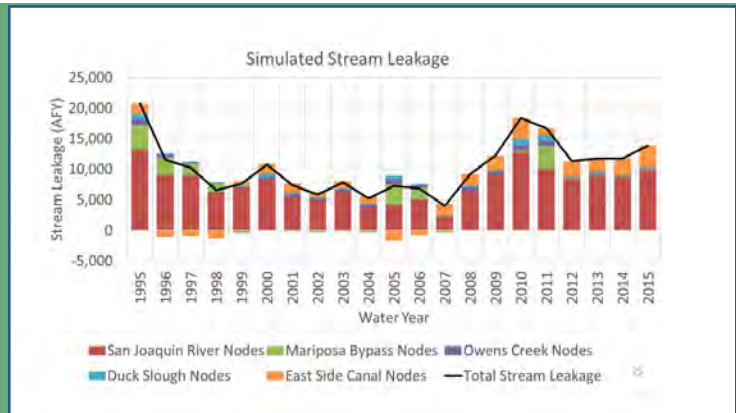
- ▶ Groundwater Modeling
- ▶ Groundwater-Surface Water Interactions
- ▶ Complex Geological Environments
- ▶ Evaluation of Groundwater Management Areas
- ▶ Annual Reporting
- ▶ Peer-Review of Hydrogeological Reports
- ▶ Interagency Coordination
- ▶ Groundwater Monitoring

Project 4 – Turner Island Water District

Key Staff: Eddy Teasdale

LSCE has been providing hydrogeological technical support services for Turner Island Water District (TIWD), whose agency is represented within two Subbasins, the Merced and Delta-Mendota Subbasins. Specific technical tasks LSCE is currently involved in includes:

- ▶ Aquifer testing
- ▶ SGMA assistance including peer-review of GSP chapters
- ▶ Development of TIWD water budgets
- ▶ Broad technical assistance to improve understanding and management of water resources
- ▶ Gathering available groundwater-related data, developing water resources data management system, identifying data gaps, and providing recommendations for water resources monitoring
- ▶ Review updated hydrogeologic conceptualization and characterization of conditions including eight geologic cross-sections
- ▶ Refining and further characterizing areas of greater recharge potential.
- ▶ Analysis of the potential for groundwater-surface water interactions
- ▶ Identify potential grant funding opportunities
- ▶ Presentation of analyses and interpretations through reports and associated GIS and graphical products
- ▶ Review of a Management Area and related SGMA report, including documentation for a numerical groundwater flow model



Relevant Project Features to SLVWD:

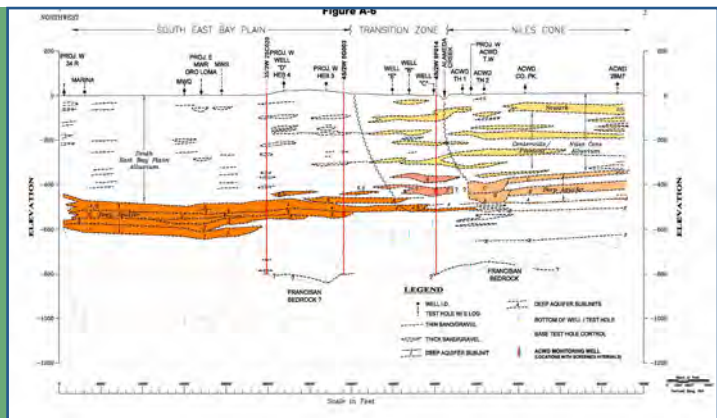
- ▶ Groundwater Modeling
- ▶ Groundwater-Surface Water Interactions
- ▶ Complex Geological Environments
- ▶ Evaluation of Groundwater Management Areas
- ▶ Peer-Review of Hydrogeological Reports
- ▶ Interagency Coordination
- ▶ Groundwater Monitoring

Project 5 – City of Hayward On-Call Services

Key Staff: Peter Leffler, Vicki Kretsinger Grabert

LSCE has been providing hydrogeologic and engineering consulting services to the City of Hayward since the 1990s. This as-needed work included:

- ▶ Hydrogeologic studies
- ▶ Production well and pump station design work related to five emergency groundwater supply wells maintained by the City.
- ▶ Detailed technical review of the Alternative (to GSP) submitted by Alameda County Water District for the Niles Cone Groundwater Basin (which encompasses a portion of the City of Hayward) to address SGMA requirements.
 - ▶ Evaluated application of the basin groundwater model to address SGMA requirements
 - ▶ Reviewed geological and hydraulic field data to evaluate the basin boundary between Niles Cone and East Bay Plain, and the representation of that boundary in the groundwater model
 - ▶ Reviewed the Niles Cone Basin water balance related to SGMA requirements
 - ▶ Reviewed the Niles Cone Basin proposed sustainable management criteria relative to SGMA requirements
- ▶ Key findings of our review noted several technical issues associated with the Alternative, which were subsequently submitted to DWR as comments on the Alternative. After preparation of a response to the initial comments by ACWD, LSCE reviewed the response and prepared additional comments for submittal to DWR.
- ▶ Provide technical review/comments on key documents (Annual Reports)



Relevant Project Features to SLVWD

- ▶ Geologic and Hydrogeologic Technical Review
- ▶ Groundwater Monitoring
- ▶ Groundwater Modeling and Monitoring
- ▶ Groundwater Sustainability Support
- ▶ SGMA Expertise
- ▶ Interagency Coordination



3. Staff Experience

This section includes a summary of LSCE’s key related expertise (Table 1). Resumes for all staff are included as Appendix A. We tailored our choice of staff based on their local experience and breadth of expertise for services you may need. Moreover, LSCE’s depth of groundwater expertise provides us with the capability and capacity to respond to SLVWDs on-call needs, including your goals for cost-effective defensible work, and timely schedule.

Table 1. Project Personnel Experience

Clients	LSCE Team Member	Sustainable Groundwater Management	Groundwater Sustainability Planning	Regulatory Assistance and Permitting Services	Hydrogeologic Assessments	Project Administration and Management	Project Quality Assurance and Quality Control
City of Modesto	Teasdale		✓	✓	✓	✓	✓
Napa County	Kretsinger Grabert	✓	✓	✓	✓	✓	✓
Solano County Water Agency	Kretsinger Grabert	✓	✓	✓	✓	✓	✓
Cal Am, Monterey Peninsula Water Supply Project	Leffler	✓	✓	✓	✓	✓	✓
Scotts Valley	Leffler, Teasdale, Kretsinger Grabert	✓	✓	✓	✓	✓	✓
City of Santa Cruz	Teasdale	✓	✓	✓	✓	✓	✓
Soquel Creek	Teasdale, Kretsinger Grabert			✓	✓	✓	✓
Madera County	Leffler	✓	✓	✓	✓	✓	✓
Turner Island Water District	Teasdale	✓	✓	✓	✓	✓	✓
Santa Maria	Leffler	✓	✓	✓	✓	✓	✓
Westlands Water District	Teasdale, Kretsinger Grabert	✓	✓	✓	✓	✓	✓
City of Hayward	Leffler, Kretsinger Grabert	✓	✓	✓	✓	✓	✓
Meadowbrook Dairy	Teasdale	✓	✓	✓	✓	✓	✓
Delta Mendota Subbasin	Teasdale, Kretsinger Grabert	✓	✓	✓	✓	✓	✓
Scotts Valley Water District	Teasdale				✓	✓	
Central Valley Salinity Coalition	Kretsinger Grabert			✓	✓	✓	✓
East Bay Plain	Leffler, Kretsinger Grabert	✓	✓	✓	✓	✓	✓
Kaweah Delta Water Conservation District	Leffler	✓	✓		✓	✓	✓

Key Project Leaders

Pete Leffler, PG, CHG, Principal Hydrogeologist

Mr. Leffler is a licensed Professional Geologist and Certified Hydrogeologist and has 30 years of professional groundwater consulting experience in California, including the last five years with LSCE, 13 years with Fugro Consultants, and 9 years with Todd Engineers (now Todd Groundwater). Mr. Leffler is currently involved in LSCE's efforts in providing consulting services to clients to comply with the SGMA legislation and GSP regulations in several basins in California. During his tenure at Todd Engineers from 1993 to 2001, he served as project hydrogeologist for several projects completed for Scotts Valley Water District, including: water balance evaluation, groundwater modeling, evaluation of artificial recharge and water transfer options, test well and production well oversight, and preparation of annual reports. Over the past 30 years, Mr. Leffler has been involved in many other groundwater basin characterization, water balance, modeling, and/or sustainable yield studies, including Kaweah Groundwater Subbasin, Cummings Groundwater Basin, Tehachapi Groundwater Basin, Tracy Groundwater Subbasin, Santa Maria Groundwater Basin, Antelope Valley Groundwater Subbasin, and Westside Groundwater Basin. He is currently involved in GSP preparation for Chowchilla Groundwater Subbasin, Madera Groundwater Subbasin and the East Bay Plain Groundwater Subbasin, which includes both technical studies and preparation/delivery of presentations to basin stakeholders and the general public.



Eddy Teasdale, PG, CHG, Senior Hydrogeologist

Eddy Teasdale is a Senior Hydrogeologist with more than 20 years of experience and is skilled in a wide range of hydrogeologic disciplines, including the development of basin-scale hydrogeologic conceptual models, assessment of natural recharge and sustainable yield analyses; groundwater resources development and management; recycled water recharge planning, design, permitting, and implementation; artificial recharge; contaminant hydrogeology; soil and groundwater assessment and remediation; groundwater well siting, design,



construction and testing; and groundwater adjudication litigation support. He has managed and served as the lead hydrogeologist on complex projects that have required close interaction with multiple stakeholders and large project teams. He is an expert in quantitative hydrogeologic analysis, including groundwater modeling, aquifer testing, well field design, and environmental fate of dissolved compounds. As a project manager on multi-disciplinary groundwater studies and plans, he works closely with clients to develop strategies that balance the competing needs of certainty/reliability, transparency to third-party reviewers, and financial/schedule constraints. In addition to providing technical direction, Eddy is diligent about project controls, budget and schedule tracking, and client communications. While working for Kennedy/Jenks Consultants (KJC) he directed a team in reviewing and assessing groundwater basins for the potential development of local water supply for SLVWD, which included assessing the project requirements regarding number of Aquifer Storage and Recovery (ASR) wells, treatment system and available water for recharge.

Key Support Personnel

Vicki Kretsinger Grabert, PH-GW, President/Senior Principal Hydrologist

Vicki has more than 30 years of experience in regional groundwater resource management and quality assessments, including groundwater supply sufficiency and availability assessments, design of monitoring networks and programs, long-term groundwater quality monitoring and protection programs for twelve agricultural coalitions in the Central Valley, and groundwater technical assistance to the Central Valley Salinity Coalition since 2009. In 2011, and prior to the 2014 Sustainable Groundwater Management Act (SGMA), she worked with a Napa County Groundwater Resources Advisory Committee for two and a half years to educate the Committee on the County's groundwater resources and to aid County staff and the Committee in community outreach and education efforts. She was the principal-in-charge of the preparation of the Napa Valley Subbasin Alternative to a Groundwater Sustainability Plan (December 2016). In 2017 to 2018, she was the principal-in-charge of the groundwater flow model development for the assessment of the potential for



streamflow depletion in an area of the Napa Valley Subbasin, preparation of SGMA-related reports on an area of the Subbasin that is now a designated SGMA Management Area, and preparation of the SGMA-required Annual Report for the Subbasin. In 1992, she became the Founding President of the Groundwater Resources Association of California (GRA), served as a director for 23 years and has since been an emeritus director. She co-led the Groundwater Caucus for the Department of Water Resources California Water Plan Update 2013. She is a member of DWR’s Practitioner Advisory Panel that is providing input to DWR on SGMA implementation. In 2018, she contributed input on the Berkeley Law/ UC Water paper on groundwater-surface water interactions under SGMA. In 2019, she reviewed and provided input on the Stanford Water in the West guidance for groundwater quality under SGMA.

Mohamed Nassar, PhD, Project Engineer

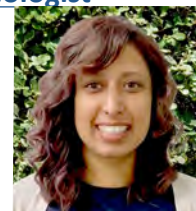
Dr. Nassar’s areas of specialization include modeling of groundwater flow, saltwater intrusion, solute fate and transport, groundwater age, and multicomponent reactive transport in natural media and parameter estimation of mathematical models given different kinds of observation data (head, age, and solute concentration), and groundwater sustainability through quantification and simulation of groundwater age at regional scales. Dr. Nassar is also experienced in using geostatistical tools to help support a wide range of groundwater resource applications, including recharge analysis, well



interference impacts, water quality issues, and groundwater-surface water interactions.

Pavan Dhaliwal, Project Hydrogeologist

Ms. Dhaliwal has over five years of professional experience in data analysis, data collection, groundwater flow, and solute transport modeling. Ms. Dhaliwal is well versed in statistical plume analysis, GIS mapping, geochemical modeling and data analysis, groundwater flow modeling, and data collection. Ms. Dhaliwal engages in groundwater level and quality data processing to identify flow patterns, geochemical trends, and potential relationships to management practices.



Nick Newcomb, Project Hydrogeologist

Nick has eight years of professional experience in hydrogeology and numerical modeling. He has a background in hydrogeologic conceptualization, regional and local scale groundwater flow and solute transport modeling, and monitoring program design and implementation. He has diverse modeling experience that has included studies analyzing pumping induced impacts on groundwater-surface water interaction and montane meadows, local and regional scale solute transport, groundwater overdraft, and subsidence. Recently, Nick has been involved in the development of numerical flow and transport models used to provide technical support for GSP preparation in the Westside and Delta-Mendota Subbasins.



Table 2. LSCE Team Staff Qualifications

LSCE Team Members	Years of Experience	Highest Degree	Registration/License	Years with LSCE	SGMA Support	GSP Experience	Groundwater Modeling	Groundwater Management Tasks	Litigation Support	Board Presentations	Well Siting Evaluations
Key Project Leaders											
Peter Leffler	30	MS	PG, CHG	5	✓	✓	✓	✓	✓	✓	✓
Eddy Teasdale	20+	MS	PG, CHG	2	✓	✓	✓	✓	✓	✓	✓
Key Support Personnel											
Vicki Kretsinger Grabert	35+	MS	PH-GW	35	✓	✓	✓	✓	✓	✓	✓
Mohamed Nassar	10+	PhD		5	✓	✓	✓				
Pavan Dhaliwal	5	MS		5	✓	✓	✓		✓		
72 Nick Newcomb	5	MS		5	✓	✓	✓				

4. Subconsultant (NA)

LSCE will utilize no sub-consultants for this proposed work.

5. Client References

LSCE continues to deliver successful projects within a variety of constraints similar to that of SLVWD. We encourage you to call these references to confirm our demonstrated commitment to client satisfaction.

References for Peter Leffler:

Doug Welch, General Resources Manager
Chowchilla Water District
327 South Chowchilla Boulevard, Chowchilla, CA
93610
(559) 665-3747; dwelch@cwdwater.com

Jan Lee, Water Resources Manager
City of Hayward
777 B Street, Hayward, CA 94541
(510) 583-4701; Jan.Lee@hayward-ca.gov

Stephanie Anagnoson, Director of Water & Natural Resources
Madera County
200 W. 4th st., Suite 3100 Madera, CA 95637
(559) 675-7703 ext. 2265; stephanie.anagnoson@maderacounty.com

References for Eddy Teasdale:

Mr. Larry Harris, Water Resources
Turner Island Water District
1269 West I Street, Los Banos, CA
(559) 285-5940; lharris@murdoc.com

Mrs. Katarina Campbell, Supervisor of Water Resources
Westlands Water District
3130 N. Fresno Street, Fresno, CA 93703
(559) 779-0930; kcampbell@wwd.ca.gov

Mr. Robert Davalos, Senior Engineer
City of Modesto
1010 Tenth Street, 4th Floor, Suite 4600
(209) 571-5869; rdavalos@modestogov.com

6. Fee Schedule

LSCE's 2019 Fee Schedule is included on the following page, as per The Hydrogeologist RFQ- Question and Answer correspondence issued by SLVWD on June 18, 2019. As specified in the June 24, 2019 RFQ, our 2019 Fee Schedule is considered the base year fee schedule, and an inflation factor of 3% will be applied to each subsequent year.



SCHEDULE OF FEES - ENGINEERING AND FIELD SERVICES 2019

Professional:	
Senior Principal	\$215/hr.
Principal Professional	\$210/hr.
Supervising Professional	\$200/hr.
Senior Professional	\$187/hr.
Project Professional	\$145 to 170/hr.
Staff Professional	\$130 to 140/hr.
Technical:	
Engineering Inspector	\$130/hr.
ACAD Drafting/GIS	\$130/hr.
Engineering Assistant	\$100 to 120/hr.
Scientist	\$100 to 120/hr.
Technician	\$100 to 120/hr.
Clerical Support:	
Word Processing, Clerical	\$75/hr.
Digital Communications Specialist	\$90/hr.
Project Admin/Accounting Assistant	\$90/hr.

Vehicle Use	\$0.55/mi.
Subsistence	Cost Plus 15%
Groundwater Sampling Equipment (Includes Operator)	170.00/hr
Copies	.20 ea.

Professional or Technical Testimony	200% of Regular Rates
Technical Overtime (if required)	150% of Regular Rates
Outside Services/Rentals	Cost Plus 15%
Services by Associate Firms	Cost Plus 15%

Appendix A: Staff Resumes

Key Project Leaders

Pete Leffler
Eddy Teasdale

Key Support Personnel

Vicki Kretsinger Grabert
Mohamed Nassar
Pavan Dhaliwal
Nick Newcomb



EDUCATION

M.S., Hydrology/Hydrogeology, University of Nevada, Reno, NV	1989
B.S., Geology, University of Illinois, Champaign, IL	1986

PROFESSIONAL EXPERIENCE

Luhdorff & Scalmanini, Consulting Engineers <i>Principal Hydrogeologist</i>	2015 - Present
Fugro Consultants, Inc. <i>Associate Hydrogeologist</i>	2002 - 2014
Todd Engineers <i>Senior Hydrogeologist</i>	1993 - 2002
Harding Lawson Associates <i>Project Hydrogeologist</i>	1992 - 1993
Lowney Associates <i>Staff Hydrogeologist</i>	1990 - 1992

PROFESSIONAL REGISTRATIONS

CA Professional Geologist No. 6475	1996
CA Certified Hydrogeologist No. 462	1996

PROFESSIONAL AFFILIATIONS

- Groundwater Resources Association of California
- National Ground Water Association
- Geological Society of America
- American Geophysical Union

Specialization

Over thirty years of groundwater consulting experience in California. Representative assignments include groundwater basin hydrogeologic characterization, water balances, modeling, and safe yield analyses; preparation of SGMA groundwater sustainability plans; monitoring well, test well, and production well design, construction, and aquifer testing; mutual well interference and subsidence evaluation; dewatering studies; groundwater impact studies to support CEQA analyses; surface water–groundwater interaction studies; technical expert witness work including reports, deposition, and trial testimony; assessment of groundwater flow and well yields in fractured bedrock; evaluation of percolation pond capacity; and aquifer storage and recovery feasibility studies.

Representative Professional Assignments

Antelope Valley Groundwater Basin Adjudication –Served as an expert witness on behalf of Los Angeles County water purveyors with regard to determination of basin safe yield. Provided deposition and trial testimony on issues related to mountain front recharge, bedrock permeability, and groundwater flow through bedrock as a source of recharge to basin alluvium. Work completed included preparation of an expert report, a deposition, and trial testimony. This phase of the trial was decided in client’s favor by the judge.

Chowchilla Subbasin – A data collection and analysis study was completed in 2017 to compile and organize all available groundwater, surface water, and climatic data for the subbasin, provide a data gap assessment, prepare a preliminary hydrogeologic conceptual model (HCM), prepare a conceptual water budget model, and provide recommendations for filling data gaps. Ongoing work includes preparation of a groundwater sustainability plan (GSP) for the critically overdrafted subbasin to meet DWR SGMA requirements. The project includes updates to the HCM, preparation of basin boundary and GSA water budgets, development of a groundwater model, development and application of sustainable management criteria, and other required components of the GSP.

Madera Subbasin – A data collection and analysis study was completed in 2017 to compile and organize all available groundwater, surface water, and climatic data for the subbasin, provide a data gap assessment, prepare a HCM, prepare a conceptual water budget model, and provide recommendations for filling data gaps. Ongoing work includes preparation of a GSP for the critically overdrafted subbasin to meet DWR SGMA requirements. The project includes updates to the HCM, preparation of basin boundary and GSA water budgets, construction and calibration of a groundwater model, development and application of sustainable management criteria, and other required components of the GSP.

City of Hayward – Provided detailed technical review of a SGMA Alternative to a GSP prepared by Alameda County Water District for the

Representative Professional Assignments

Niles Cone Groundwater Basin. Detailed technical review comments were prepared and included with an overall submittal to DWR prepared by the City of Hayward. Upon receipt of responses to our comments from ACWD, additional technical review was provided for submittal to DWR.

Tehachapi-Cummings County Water District – Completed a hydrogeologic conceptual model for the Cummings Groundwater Basin located near Tehachapi, California. The study involved a hydrogeologic characterization of the basin, a water balance study, groundwater quality analysis, and preparation of a groundwater model. A subsequent phase of work conducted in 2014 involved updating the water balance and groundwater flow model.

Monterey Peninsula Water Supply Project – Currently serving as a technical expert witness for California American Water in California Public Utilities Commission proceedings regarding a proposed desalination plant in Monterey County. Work completed so far has included preparation of written testimony and providing verbal testimony for three separate proceedings related to proposed use of slant wells on the beach for a subsurface source water intake and evaluation of potential impacts from slant well pumping on the Salinas Valley Groundwater Basin. Also serving as a member of the hydrogeologic working group that was established by the settling parties to evaluate technical data collected to study project feasibility.

Selected Publications

Nevada Water Resources Association, Annual Conference, Presentation, “Technical Aspects of Surface Water – Groundwater Interaction”, February 2, 2011.

American Ground Water Trust, San Joaquin Valley Groundwater Overdraft Forum, Presentation, “Paso Robles and Pending Groundwater Oversight”, November 18, 2013.

U.S. Society of Irrigation and Drainage Professionals, Groundwater Water Issues and Water Management – Strategies Addressing the Challenges of Sustainability, Presentation, “Conjunctive Management of Groundwater and Surface Water in Chowchilla Water District”, March 6, 2014.

Association of Ground Water Agencies/American Ground Water Trust, Annual Conference, Everything Aquifers and Groundwater Management, Presentation, “Advantages of Using Surface Water Models and Groundwater Models for Basin Water Budget Determination”, February 13, 2018.

Association of California Water Agencies, Panel Member for Attorneys Program, “Are Adjudications an Alternative? How SGMA and Groundwater Adjudications Will Work Together or Not”, May 10, 2018.



Specialization

Mr. Teasdale has over 20 years of experience working on geological and hydrogeological investigations in the United States and internationally (England, Ireland, North Africa, and Guam). Projects have involved complex, comprehensive geology, hydrogeology, conveyance, flood control, and environmental issues. He has worked in all major aquifer types (alluvial basins, volcanic, carbonate and bedrock terrains). He is an experienced project manager who has successfully managed large, complex projects. He has extensive experience in writing technical reports and working with local, state, and federal regulatory agencies including presenting project information and resolving project issues. Mr. Teasdale's primary areas of technical expertise are in hydrogeologic characterization and groundwater modeling. Mr. Teasdale has served as a subject matter expert for the Professional Geologist and Certified Hydrogeologist exams for the Department of Consumer Affairs in California since 2006. He has assisted in the development, review, grading, and appeals process for the annual hydrogeologist certification exam. Participation in the six-member expert team is by invitation only and participants are required to be both licensed and certified in their specialties in addition to having demonstrated extensive applied experience in their respective fields. Mr. Teasdale is the current President of the North Sacramento Valley Groundwater Resources Association and is a member on the technical advisory committee for the Butte County Well Drillers Advisory Group.

Representative Professional Assignments

Federal - U.S. Bureau of Reclamation (USBR), U.S. Army Corps of Engineers (USACE), U.S. Environmental Protection Agency (US EPA), and the United States International Boundary and Water Commission (USIBWC) USN and USAF

State of California - California Department of Water Resources (DWR), and California Department of Toxic Substances Control (DTSC)

Private Clients- (Shell, Chevron, BNSF, the Boeing Company, First Solar, British Petroleum, Duke Energy, Freeport-McMoran, First-Solar, Anheuser-Busch and Panoche Energy)

City, County and Water Districts in California - LA Department of Water and Power, Butte County, Glenn County, South Tahoe PUD, Fresno County, City of Fresno, City of Manteca, City of Sacramento, City of Modesto, City of Winters, Yolo County Flood Control, City of Newman, Three Valley's Water District, Mojave Water Agency, City of Vacaville, Twenty-Nine Palms, City of Knight's Landing, Yolo County, City of Santa Cruz, San Francisco PUC, Monterey Regional Water Pollution Agency, Eastern Municipal Water District, Antelope Valley East Kern, Arizona American Water Company, Turner Island Water District and Westlands Water District.

- Other Consultant Companies (expert witness) – AECOM, Kennedy/Jenks, SPF, North Star Engineering



EDUCATION

M.S., Hydrogeology,
University of Idaho,
Moscow, ID 2002

B.S., Geology,
University of Texas,
Arlington, TX 1996

PROFESSIONAL EXPERIENCE

Luhdorff and Scalmanini,
Consulting Engineers Inc.,
Woodland, CA 2018 - Present
Supervising Hydrogeologist

Kennedy/Jenks
Senior Hydrogeologist 2016 - 2018

URS/AECOM
Senior Hydrogeologist 2004 - 2016

PROFESSIONAL CERTIFICATION

CA Certified Hydrogeologist No. 926

PROFESSIONAL REGISTRATION

CA Professional Geologist No. 7791

ID Professional Geologist No. 1561

Representative Professional Assignments (cont.)

Dewatering and Mining Experience

Project Hydrogeologist, Groundwater/Surface Water interaction, Private Client, North Tahoe, CA.-

Mr. Teasdale was selected as subject matter expert to evaluate if upstream flood mitigation measures impacted downstream structures (electrical vaults and basement flooding). Mr. Teasdale conducted a baseline review, implemented a monitoring program and provided SME services to legal council

Project Hydrogeologist, Groundwater Evaluation and Hydrology Study, Fresno County Public Works, Fresno County, CA.-

Conducted hydrology studies as technical support of an EIR for permitting the construction and operation of a proposed gravel mine operation. The project consisted of a geologic/hydrologic study subject to review by the Fresno County Planning Department. Mr. Teasdale conducted groundwater modeling to assess the impacts of mine operations on nearby groundwater and surface water resources, prepared technical reports and coordinated with regulatory agencies.

Hydrogeologist, Confidential Client, Albany, NY- Designed and planned a test well and pumping test to evaluate groundwater control needed (pressure relief) for the excavation of a 110-ft diameter by 175-ft deep shaft and a shallower adjacent shaft through fill and alluvium. Mr. Teasdale provided consultation on pressure relief wells, filter design, test pump capacity, screened intervals for test well and piezometers, test durations, modification of test well to evaluate characteristics of two distinct pervious zones, tidal effects, analysis of test results, and pump test report. Mr. Teasdale also reviewed and commented on contractor's dewatering plan, specification, aquifer test analysis and system design report and other submittals following award of tunnel construction contract.

Project Hydrogeologist, Tidal Study, Pearl, HI, Waipahu Ash Landfill, Oahu, CA.- Lead hydrogeologist on a tidal study related to the Waipahu Ash Landfill (WALF) located on the Waipio Peninsula I Waipau, Hawaii, near Pearl Harbor. The tidal study was performed at five monitoring wells. Data from these wells were used to evaluate whether the groundwater flow direction changes significantly during tidal events.

Hydrogeologist, Groundwater Resource Investigation, Bristol, England- Investigated the subsurface geology, hydrogeology and hydrology of a former transportation depot. Geological investigations included producing a conceptual model of extend of contamination, installing 5 monitoring and 6 vapor wells and performing limited risk-based modeling. Hydrogeological investigation included monitoring tidal influences on site hydrology, general hydraulic testing. Other duties included overall site project management, contractor oversight and completing final report.

Project Hydrogeologist, Leachate Evaluation, California Department of Toxics Substances Control Argonaut Mine, Jackson, CA-

Providing hydrogeologic and geologic expertise for this effort to remove abandoned mine tailings and waste materials from one of the largest underground gold mines in California. This site is adjacent to a local high school and county administration complex. The study involved constructing a one-dimensional unsaturated zone leaching modeling process to support site closeout. The process involves modeling residual unsaturated zone contamination leaching to groundwater. Predicted groundwater impact is compared to groundwater threshold concentrations and the results were used to obtain regulatory closure.

Hydrogeologist, Aquifer Protection Permit, Private Mining Firm, Eastern AZ- Assisted the project manager in completing an Aquifer Protection Permit (APP) applicability assessment for two limestone mining and calcining operations in Arizona. Assisted with conducted site inspections of the operations, collected

Representative Professional Assignments (cont.)

material and solution samples, and arranged for laboratory analysis of the samples. Prepared APP applicability assessment reports for both sites and submitted the reports to the Arizona Department of Environmental Quality (ADEQ) along with requests for determination of applicability.

Geotechnical Investigations Experience

Project Hydrogeologist, Groundwater Dewatering Shell Carson Terminal, Orange County, CA-

Developed a dewatering model to assess the total and recoverable volumes of water at the site, to simulate LNAPL recovery rates, and time to reach recovery goal of current system, and to optimize the current system by changing pumping schedules and/or relocating/adding pumping wells.

Project Hydrogeologist, Groundwater Dewatering, Orange County, CA- Dewatering during expansion of the Trampas reservoir construction is a critical issue due to the presence of shallow groundwater. Mr. Teasdale conducted, as part of the Groundwater Pumping Pilot Study (GPPS) task, a preliminary dewatering analysis to estimate the volume of groundwater water that could be generated during construction activities associated with expanding the reservoir. Slug tests were performed at a site monitoring well to estimate permeability values of the saturated zone, and then a groundwater model was built, developed and utilized to estimate water volume removal rates and time to dewater.

Project Hydrogeologist, Groundwater Dewatering, Owens Valley, CA- The Los Angeles Department of Water and Power (LADWP) requested that Mr. Teasdale provide a third party oversight of their contractor for completion of the dewatering system evaluation associated with the North Haiwee Dam Seismic Improvement Project. As part of the North Haiwee Dam Seismic Improvement Project, a new embankment dam will be designed and constructed approximately 800 feet north of the existing North Haiwee Dam. The materials underlying the proposed dam have the potential to liquefy under seismic loading conditions. As a result, these foundation materials need to be removed and replaced or improved in-situ. The ability to provide groundwater control and dewater the dam foundation is critical for assessing the ground improvement approach.

Hydrogeologist, Confidential Client, Canon City, CO- Developed a conceptual-level alternatives study for dewatering existing tailings within the primary tailings impoundment with the existing dewatering drain system and liner. Four conceptual alternatives were evaluated for lowering the phreatic surface within the tailing prior to cover placement in order to minimize differential settlement.

Hydrogeologist, SCRSD, Sacramento Force Main, Lower Northwest Interceptor, Sacramento, CA- Assisted in the preliminary evaluation of dewatering requirements, preliminary cost estimates, and appropriate types of groundwater control systems for the 2.7-mile-long project, comprised of twin parallel 66-in. ID force mains constructed in open cut with three micro tunnel segments. Assisted in the preparation of Geotechnical Baseline Report (groundwater conditions, stratification, and hydraulic properties of water-bearing strata); and review of contractor's dewatering submittals.

Project Hydrogeologist, Seepage Evaluation, Urban Levee Evaluation Program, Department of Water Resources, Sacramento, CA- Was Project Hydrogeologist for the seepage evaluation task on this program to determine the hydraulic conductivity of the major strata. He completed an in-situ hydrogeologic analysis of several areas in the Sacramento/San Joaquin Delta.

Representative Professional Assignments (cont.)

Lead Hydrogeologist ,USACE Ft. Worth - Lamar Street Levee Site investigation and Design (Section F Project #3), Ft. Worth, TX- Lead hydrogeologist for the preparation of the geomorphology study for the project and rapid drawdown tests. The proposed 3-mile long levee crosses a State and City Highway, two heavy rail lines and a light rail line. The project included the design of earth embankments, flood walls, flood gates, utility crossing, drainage culverts and other features.

Lead Hydrogeologist, United State International Boundary and Water Commission (USIBWC) American Canal Re-lining, El Paso, TX- Lead Hydrogeologist for subsurface investigation including conducting large pump tests, groundwater modeling and preliminary dewatering analysis for the final design of the relining and rehabilitation of the American Canal in El Paso, Texas. The project will increase the canal capacity from 1,200 cfs to 1,535 cfs. The urban setting of the project presents major engineering and construction challenges as the project is adjacent to a state highway, a BNSF railroad line, water and sewer pressure lines, fiber optics telecommunications and power lines, and the Department of Homeland Security border fence. The presence of a contamination plume from an adjacent property also requires canal construction dewatering water to be treated to remove contaminants.

Project Hydrogeologist, United State International Boundary and Water Commission (USIBWC) Final Design of the Courchesne/Nemexas Levee Reaches, El Paso, TX- Lead Hydrogeologist for the rehabilitation of the 3-mile levee reaches. The project includes an extensive field investigation and design to construct earth embankments, flood walls (“T” walls and “I” walls), large drainage structures, cutoff walls and other features.

Project Hydrogeologist, Dewatering Evaluation, American Canal Expansion Project, El Paso, TX- Developed a Groundwater Flow Control Plan and dewatering design for the expansion of the American Canal in El Paso Texas. The project consisted of a mass excavation and extending 15 feet below grade and 10 feet below groundwater table. Groundwater levels had to be dewatered by a combination of deep pumping wells and temporary shoring systems.

Project Hydrogeologist, Groundwater Evaluation, Delta Habitat, Conservation, and Conveyance Program, CA Department of Water Resources, Sacramento, CA- Was the Project Hydrogeologist for the dewatering evaluation task on this program to improve delta conservation and conveyance. He provided independent technical review on initial geologic and hydrogeologic analysis of several areas in the Sacramento/San Joaquin Delta. He is also lead the development of a screening-level analysis of potential construction dewatering protocol for a future feasibility study on the program. MODFLOW is being used to evaluate the general size of the construction dewatering activities and the predicted changes in groundwater levels during construction.

Lead Hydrogeologist, Former Adak Naval Complex, U.S. Navy Adak, AK- Developed a groundwater flow, particle tracking and transport model and the data analysis and interpretation for site. He performed the groundwater modeling using MODFLOW, MODPATH and MT3D computer programs. He is also lead the development of a screening-level analysis of potential construction dewatering protocol for a future feasibility study on the program.

Project Hydrogeologist, Surface Water Modeling, Emergency Levee Repair Program, CA Department of Water Resource, Sacramento, CA- During this emergency levee repair effort, Mr. Teasdale assisted in the application hydrodynamic modeling effort in support of emergency levee repairs in the Sacramento River System from Walnut Creek, CA to Oroville, CA. Mr. Teasdale performed hydrologic and hydraulic analysis for the

Representative Professional Assignments (cont.)

levee erosion sites; developed hydraulic models for the levee erosion sites by utilizing 2-dimensional models CCHE2D and SMS. This modeling effort compares the hydrodynamic flows for existing and project design riverbed bathymetric conditions. This effort is used to evaluate emergency levee repair designs so that they meet strict criteria and minimize negative secondary effects in river flow from the levee repairs.

Groundwater Supply Experience

SGMA Support, Indian Wells Valley, CA- Eddy has been appointed to the Technical Advisory Committee (TAC) to the Indian Wells Valley (IWV) Cooperative Groundwater Management Group (CGMG). Kennedy/Jenks is currently representing a large alfalfa grower on the TAC. In 2014, municipal, agricultural, domestic, China Lake (US Navy), and mineral exploration groundwater use exceeded 25,000 acre-feet per year (AFY). Estimates for safe yield in this basin range from approximately 7,500 to 10,000 AFY and groundwater levels have been declining on average between 1 to 3 feet/year. In August 2015, the DWR designated IWV a critically over-drafted basin. Eddy has been serving as a trusted advisor in planning for implementation of the GSP through regional coordination.

Phase 1 Facilities Plan to Address PCE Contamination in Source Groundwater, Tahoe Keys Property Owners Association, South Lake Tahoe, CA – Provided evaluation of Desert Research Institute groundwater fate and transport model for boundary conditions such as head, water quality as well as source PCE and will evaluate model results under a range of production, treatment and clean up alternatives; participated in meetings and calls to discuss results.

Kern Water Bank, Monterey Plus EIR Revisions, Fresno, CA- As a team member, assisted in the preparation of the Geology and Hydrogeology sections of the Monterey Plus Environmental Impact Report Revisions, in accordance with the requirements of the California Environmental Quality Act (CEQA) and the State CEQA Guidelines.

Numerical Model Evaluation, Carmichael Water District, Carmichael, CA- Evaluated the capability of the MODFLOW numerical model developed for Aerojet Superfund in assessing the existing and future perchlorate and NDMA contamination plumes. The model had not been able to predict ongoing impacts to municipal wells. Provided recommendations on how to improve model performance.

Nance Canyon Partners, L.P., Hydrogeological Input, Nance Canyon, Butte County, CA- Consulting services in support of Well Siting Project on 5,000 acres located near the City of Chico, California to site well(s) capable of providing water of sufficient quality and production to support grape vineyards, olive groves, and hops farming. Reviewed available historical project reports, public records, proposed project design to focus the site visit, determine possible data gaps, and aid in the planning level analysis. Conducted a site visit to stake three well locations.

Hydrogeologist, Water Quality Evaluation, Antelope Valley-East Kern Water Agency (AVEK), Palmdale, CA- Working with AVEK to support the groundwater banks to provide water supply stability and water quality control. AVEK plans to recharge surplus SWP water during average-to-wet periods and withdraw groundwater during dry-to-drought periods. Mr. Teasdale is providing hydrogeology and engineering services to evaluate water-bank performance using groundwater flow modeling, providing locations and designs for extraction wells and recharge basins, construction stormwater compliance, designing delivery systems and connections to water-supply lines, and estimating the TOC concentration of discharge water from the new extraction wells.

Groundwater Supply Experience (cont.)

Groundwater Modeling, SFPUC, San Francisco, CA- Reviewed a complex 3-D finite element groundwater flow model (FEFLOW) to simulate groundwater conditions during the construction, maintenance, and operation of the new Irvington Tunnel: Modeling objectives are: (1) Evaluate the influence of tunnel construction on groundwater system (groundwater drops); (2) Simulate groundwater inflows to tunnel during tunnel construction and maintenance; (3) Simulate groundwater recovery after tunnel construction, and (4) Evaluate the effectiveness of grouting along the length of the tunnel to promote increases in groundwater levels near the tunnel.

Project Hydrogeologist, Groundwater Assessment and Modeling, Gulf Coast, TX Lower Colorado River Authority- Provided peer review support for the groundwater study and modeling of flow system in the lower portion of the Colorado River Watershed. The purpose of the study was to evaluate well field alternatives to develop approximately 62,000 acres/year of additional groundwater supply for irrigation districts in the lower portion of the Colorado Watershed. The numerical model covered approximately 10,000 square miles and consisted of six model layers.

Hydrogeologist, Production Well Assessment, City of Palo Alto, Palo Alto, CA- Provided hydrologic and engineering services to the City of Palo Alto to assist in establishing a municipal emergency backup water supply system. The City is required to demonstrate the capability of providing adequate backup water supply for fire suppression and emergency public use in the event that the primary water supply is disrupted by a seismic event or other catastrophe. Since 1962, the City has received most of its municipal water supply from the Hetch Hetchy system. Prior to 1962, the City operated five groundwater wells for its entire drinking water supply to the public. Evaluated the feasibility of using these five inactive wells to meet water supply requirements and function as a backup system.

Hydrogeologist, Beneficial Use Analysis, Santa Clara Valley Water District, Santa Clara, CA- This project consisted of a study to evaluate the feasibility of extracting shallow groundwater in the Santa Clara Valley Groundwater Basin. The project focused on the Santa Clara and Coyote sub-basins. Based on the feasibility of groundwater extraction for selected areas, potential beneficial uses of extracted groundwater were evaluated. Rating criteria were developed that included sustainable pumping rates, quality of extracted groundwater and the necessity of treatment, program implementability, permitting issues, proximity to existing pipeline conveyance and infrastructure, and cost. Beneficial uses that were considered included industrial, commercial, landscaping, irrigation, residential, stream augmentation and others. The study allowed the SCVWD to decide whether to proceed with a detailed planning study for specific beneficial use projects and to identify the most likely partners for such each project. The first phase of the project has been completed and the second phase will be implemented later in 2010.

Hydrogeologist, Pure Water Monterey Project, Monterey Regional Water Pollution Control Agency, Monterey, CA- The Kennedy/Jenks team has been involved in the Pure Water Monterey Project, working closely with MRWPCA, regulators, funding agencies, and stakeholders for several years. For the AWP and pump station, Kennedy/Jenks led the 30% and is currently completing the final design for the injection field system, Kennedy/Jenks conducted injection well monitoring and performed the 30% and final design.

Hydrogeologist, Groundwater Resource Modeling, Chandler, AZ- Assisted in constructed a numerical groundwater flow model to evaluate additional recharge capacity for the proposed expansion of an existing direct injection recharge facility. The analysis of potential groundwater mounding included a review of existing hydrogeologic data and development of a three-dimensional groundwater flow model. The client was considering expanding its operations by construction of another facility and needed to know whether

Groundwater Supply Experience (cont.)

the existing injection system was capable of receiving additional flow. A 3-dimensional groundwater model (MODFLOW) was constructed covering approximately 60 square miles, and with 10 vertical model layers to simulate the Upper, Middle, and Lower Alluvial Units. The model successfully demonstrated that additional injection is possible at the site. The project was completed on schedule and under budget.

Hydrogeologist, Groundwater Resource Assessment and Water Supply Study, Riverside County, CA- Prepared a desktop water supply analysis for the Desert Quartzite Solar Project (Project) to assess the feasibility of obtaining the water supplies needed to support construction and operation of the Project. The water supply sources considered are: groundwater wells developed on the Project site; existing groundwater wells in the immediate vicinity of the Project site; and/or other off-site sources that would need to be conveyed (i.e., trucked) to the Project site. Mr. Teasdale is also developing a regional (basin) scale groundwater flow model which included portion of the Colorado River, mountain front recharge, hundreds of miles drain and canal system, valley inflow and outflow gaps; calibrated the model with multiple hydraulic targets; evaluated groundwater pumping influence to the USGS accounting surface of the Colorado River basin.

Hydrogeologist, Groundwater Resource Assessment, City of Modesto, CA- Completed a drawdown analysis for two proposed production wells in the Del Rio Area. The purpose of the analysis was to evaluate the potential impacts on local groundwater levels in the area from pumping the Del Rio New Well and the Del Rio Replacement Well. Because both of these wells will be located within the active pumping area, the City of Modesto has chosen to conduct the analysis to determine impacts to groundwater that may result from pumping the proposed wells. Mr. Teasdale utilized the USGS Northeastern San Joaquin Valley Groundwater Numerical Flow Model and converted it to a local-scale model.

Hydrogeologist, Groundwater Resource Assessment, CSU-Chico, CA- Conducted construction and testing of the CSU-Chico Irrigation Well Relining project. As part of this project, he prepared contractor bid documentation, prepared an engineer cost estimate and also supervised all field related field activities including: geophysical investigation consisting of downhole video camera, caliper log and gyroscopic surveys, temporary removal of existing irrigation infrastructure, installation of well casing and screen relining, installation of temporary test pump, aquifer testing tasks and installation of permanent pump. Prior to relining activities, the irrigation well produced 500 gpm (with 150 feet of drawdown) and post relining the wells produced 1,200 gpm (with only 25 feet of drawdown).

Hydrogeologist, Groundwater Resource Assessment, City of Tehachapi, CA- Concept Study evaluates the City's setting for potential to implement an indirect potable reuse (IPR) disinfected tertiary effluent groundwater replenishment reuse project (GRRP). Scope included a review of the regulatory regulations and review of the proposed concepts with DDW and the RWQCB with specific metrics and criteria presented to meet the criteria above as well as control of pathogenic organisms. Need for the project and reliability of quantified supply sources (local, imported and recycled water) was identified. Project developed to meet needs for BOR funding. Plans developed to secure additional funding sources like Prop1 and SRLF. Engineering Report to begin Spring 2016.

Hydrogeologist, Groundwater Resource Assessment, Fresno County Department of Public Works and Planning, Fresno County, CA- Constructed a numerical groundwater flow model to evaluate additional recharge capacity for the proposed recharge facility. The analysis of potential groundwater mounding included a review of existing hydrogeologic data and development of a three-dimensional groundwater flow model. The applicant was considering using extracted groundwater (related to dewatering activities) to recharge

Groundwater Supply Experience (cont.)

the aquifer and needed to know whether the proposed recharge system was capable of receiving additional flow and what the impacts of the additional recharge would be on the local hydrogeology. A 3-dimensional groundwater model (MODFLOW) was constructed covering approximately 60 square miles; the model successfully demonstrated that additional recharge is possible at the site. The project was completed on schedule and under budget.

Project Hydrogeologist, Hydrogeological Analysis, Los Angeles County, Los Angeles Department of Water and Power EIR Revisions, Hansen Spreading Grounds, Sun Valley, CA- To maintain the reliability of the City of Los Angeles' potable water supply and reduce dependence on imported sources of water, the City, as represented by the Los Angeles Department of Water and Power (LADWP) and the Los Angeles Department of Public Works Bureau of Sanitation (LASAN) and Bureau of Engineering (BOE), proposes to implement the Los Angeles Groundwater Replenishment (LAGWR) Project (the Proposed Project or Project) to replenish the San Fernando Groundwater Basin (SFB) with up to 30,000 acre-feet per year (AFY) of purified recycled water (purified water) from the Donald C. Tillman Water Reclamation Plant (DCTWRP). As a team member, assisted in the preparation of the Geology and Hydrogeology sections of the Environmental Impact Report, in accordance with the requirements of the California Environmental Quality Act (CEQA) and the State CEQA Guidelines.

Project Hydrogeologist, Hydrogeological Analysis SUNPOWER Corporation, Plant Water Supply Hydrogeologic Evaluation, Richmond, CA- Reviewed a 3-D groundwater flow model to evaluate the net impact of groundwater pumping for a proposed solar power plant on the local aquifer. The model was utilized to evaluate the current and future groundwater flow conditions and the water budget of the aquifer system, and to predict the potential maximum drawdown in the vicinity of extraction wells and the impacted area of the project-specific pumping for various scenarios of plant operation conditions.

Project Hydrogeologist, Hydrogeological Analysis, Initial Study/Mitigated Negative Declaration, Anheuser Busch, Groundwater Replenishment and Reuse Project, Van Nuys, CA- Prepared the Water Quality Section of the Initial Study/proposed Mitigated Negative Declaration (IS/MND) evaluating the potential environmental effects of the proposed Recycled Water System Expansion Project, in accordance with the requirements of the California Environmental Quality Act (CEQA) and the State CEQA Guidelines. AECOM is also designing and testing the injection well, bench testing the treatment train, and will be involved with further pilot testing

Project Hydrogeologist, Hydrogeological Analysis, Newmark Groundwater Facility, San Bernardino, CA- Performed numerous groundwater resources investigations in this area for the USEPA, including designing, installing, and aquifer testing 13 production wells; performing groundwater flow and capture zone modeling; and evaluating the effects of potential groundwater level declines. Accomplished planning, design, and construction of 52,000 feet of 12-, 16-, 20-, 24-, and 30-inch ductile iron pipe; 4,000 feet of 12-inch PVC pipe; three new treatment plants with over 30 MGD capacity; and a 7,500-gpm pump station and hydrotank. Mr. Teasdale also evaluated hydrogeology and surface and subsurface geophysical studies as part of this project.

Project Hydrogeologist, Regional Groundwater Flow Modeling of Folsom JFP Auxiliary Spillway Area, U.S. Army Corps of Engineers (USACE), Folsom, CA- Reviewed a 3-D finite-element groundwater flow model using FEFLOW to simulate groundwater flow in the Folsom JFP Auxiliary Spillway Area. Model was used to estimate uplift pressures acting on the base and walls of the spillway, and to estimate the seepage rate into the spillway excavation. Analyzed results, prepared reports, and met with the U.S. Army Corps of Engineers.

Project Hydrogeologist, Public Supply Well Siting, Groundwater Modeling, Design, and Installation, City of Modesto, Modesto, CA- Responsible for a project involving the siting, design, installation, and testing of one 600-foot deep public supply wells. Well siting tasks included developing A 3-dimensional groundwater

Groundwater Supply Experience (cont.)

model (MODFLOW) was constructed covering approximately 10 square miles, and with 3 vertical model layers to simulate the Upper, Middle, and Lower Alluvial Units. The model will be utilized simulate the impacts that additional extraction could have in surrounding wells.

Well design tasks include preparation of a site-specific design for the well based on an exploratory boring analysis, and coordination of contractor activities. Project management/oversight responsibilities include the supervision of lithologic log preparation, analysis of geophysical logs, evaluation of the results of sieve analyses of drilled cuttings, oversight of depth-specific groundwater sample collection and analysis, and supervision of post-construction aquifer testing and analysis. The final site-specific well design for the public supply well will be determined on the basis of this information.

Project Hydrogeologist, New Irvington Tunnel Project, San Francisco Public Utilities Commission (SFPUC), San Francisco, CA- Reviewed a complex 3-D finite element groundwater flow model (FEFLOW) to simulate groundwater conditions during the construction, maintenance, and operation of the new Irvington Tunnel. Modeling objectives are: (1) Evaluate the influence of tunnel construction on groundwater system (groundwater drops); (2) Simulate groundwater inflows to tunnel during tunnel construction and maintenance; (3) Simulate groundwater recovery after tunnel construction, and (4) Evaluate the effectiveness of grouting along the length of the tunnel to promote increases in groundwater levels near the tunnel.

Project Hydrogeologist, Groundwater Evaluation and Hydrology Study, Fresno County Department of Public Works and Planning, Fresno County, CA- Conducted hydrology studies as technical support of an EIR for permitting the construction and operation of a proposed gravel mine operation. The project consisted of a geologic/hydrologic study subject to review by the Fresno County Planning Department. Mr. Teasdale conducted groundwater modeling to assess the impacts of mine operations on nearby groundwater and surface water resources, prepared technical reports and coordinated with regulatory agencies.

Project Hydrogeologist, Groundwater Evaluation, Sites Reservoir, Colusa County, CA- Assisted in preparing the Initial Alternatives Information Report, Plan Formulation Report, and worked on the Feasibility Study for the North of the Delta Offstream Storage (NODOS) investigation. The Initial Alternatives Information Report identified the project study area; problems and needs; and developed a formal mission statement for the investigation. This report also studied the feasibility of four offstream storage sites that would be suitable for the offstream storage of water from the Sacramento River (Sites Reservoir, Colusa Reservoir, Thomes-Newville Reservoir, and Red Bank Reservoir). The primary objectives for the study are increased water supply and improving the survivability of anadromous fish and other aquatic species. Secondary objectives include recreation, hydropower, and flood control benefits. The Plan Formulation Report refined the objectives for the study, developed and evaluated alternatives, and provided a preliminary assessment of the environmental consequences associated with the alternatives. The alternatives included modifications to existing fish screens and changes in the operation of Red Bluff Diversion Dam to benefit anadromous fish. New and expanded pumping facilities and a terminal regulating reservoir were proposed for the existing Glenn-Colusa and Tehama-Colusa canals to convey water to and from the new reservoir. Expanding the existing canals to increase their capacity, installing a pipeline to further increase conveyance capacity, and using a diversion from Stony Creek Canal to divert water from Black Butte Reservoir into Sites Reservoir were also considered.

Project Hydrogeologist, Initial Feasibility Study of Industrial Water Resources for Peak Power Generation, Rough and Ready Island Center, Stockton, CA- Provided hydrogeologic review for this study. The purpose of the study was to identify and screen the potential water supply sources available to meet future industrial water demand requirements. The study required estimating future potable water demands and critically reviewing previous geologic and hydrogeologic work for the area.

Groundwater Supply Experience (cont.)

Project Hydrogeologist, Groundwater Assessment, Northfield, Kentucky, Louisville- Conducted a groundwater resource study to assess if two new water wells could produce the projected water yields needed for operations. Compiled results and prepared an implementation plan for the contractor.

Hydrogeologist, Groundwater Assessment, US Naval Facilities Engineering Command Pacific, Guam and CNMI Military Relocation Supplemental Enviro, Guam, Guam- Senior peer-review hydrogeologist for 11.3-million gallons per day (MGd) expansion of the groundwater production network in northern Guam to support the US Marine Relocation from Okinawa, Japan to Guam. The final report estimated the total number of wells required to support the additional groundwater production requirements, provided a range of expected pumping rates, provided well design specifications, and recommended well field locations. The report provided a ranking of well locations based on costs per installed well capacity and various constraints such as impacts to military mission, quality of life, biological resources, cultural resources, and existing wells; and proximity to sinkholes and other karst features, faults, fuel lines, wastewater utilities, and explosive ordnance.

Project Hydrogeologist, Public Outreach, Groundwater Water Usage Compliance, California High-Speed Rail Authority High-Speed Train (HST), Palmdale to Burbank Section, CA, High Speed Rail Authority- Responsible for budget, scope, and schedule oversight of the groundwater task under the Palmdale to Burbank segment of the HST project, alternatives design development with the CEQA/NEPA environmental planning process and the public outreach efforts for this highly complex, high-profile transportation project to link the Bay Area with Los Angeles. Developed strong working relationships with the all the JV task leads and JV management team, the California High-Speed Rail Authority, the Program Management Team, the Engineering Management Team, the Federal Railroad Administration, and the environmental and engineering task leads for the adjoining Burbank to Los Angeles section of the project.

Project Hydrogeologist, Water Supply Investigation, Confidential Client, Pismo Beach, CA- Provided technical assistance and aquifer test analysis to evaluate the potential development of a groundwater resource. The purpose of the testing was to support a water supply analysis for the client's proposed Phase V development. In summary, the assessment indicates that the predicted groundwater level drawdown impacts for the proposed project requirements (approximately 13.28 acre feet per year [AFY] or 8.23 gpm on a constant average pumping rate basis) would result in negligible drawdowns and less than significant effects on nearby wells/users.

Project Hydrogeologist, Water Supply Investigation, City of Marysville, OH- Provided technical assistance to investigate the feasibility of construction and operating an ASR facility for the City of Marysville using portable water (consisting of a combination of treated surface water and treated groundwater). The study considered the ability of the aquifer to store and release treated water as needed. Specific tasks included a hydrogeologic assessment, mounding analysis, water quality analysis and geochemical model screening, conceptual design and economic considerations, regulatory and water right issues.

Project Hydrogeologist, Groundwater Well Installation, Confidential Client, Morenci, AZ- Provided technical oversight for the drilling, testing and design construction of two, 1,600 foot groundwater supply wells for a private mining facility. Provided review of the open hole geophysical logs to confirm producing zones, evaluated the borehole conditions for well completion, and evaluated and approved the final design of the well screen and casing.

Groundwater Supply Experience (cont.)

Project Hydrogeologist, Groundwater Well Installation, and Aquifer Testing, Confidential Client, Inyo County, CA- Supervised aquifer pumping tests that were performed as part of a geotechnical investigation used to assess the constructability of the new dam site. As part of the aquifer testing scope two pumping wells were installed, the development of 11 existing monitoring wells were evaluated and three additional monitoring wells were installed at the Site. The purpose of the tests will be to establish aquifer properties in the area of the proposed dam, which can then be applied to designing a dewatering system that will maintain sufficient drawdown of groundwater (up to 20 to 30 feet) during the course of subsurface construction activities.

Project Hydrogeologist, Groundwater Well Evaluation, and Aquifer Testing, Confidential Client, Richmond, VA- Supervised the evaluation of the well conditions of seven production wells, provided recommendations to help reduce future operation and maintenance costs and provided future well design guidance alternatives to reduce O&M costs. Specific tasks included an historical data evaluation of extraction wells, well evaluation video surveys, pre-rehabilitation well and aquifer samples (geochemical and biological), sample result interpretations, well rehabilitation alternatives and recommendations (including procedure) and post-well testing.

Hydrogeologist, Water Supply Wells, Lake Los Angeles, Los Angeles County Department of Public Works, CA- Provided hydrogeology for a team of geologists/engineers installing three water supply wells for LACDPW. The well installation oversight activity included installing a sanitary seal conductor casing, logging cuttings during the pilot boring, geophysical logging, isolation testing at discrete depths, well design, installation of well casing/screen, well development, aquifer testing/analysis, and pump design. A DWSAP was provided in the final documentation report. One well was completed as an Aquifer Storage & Recovery (ASR). Another well required depth specific sampling of arsenic using a sampling technology developed by the USGS. The projects are typically fast-tracked and conducted in residential neighborhoods.

Hydrogeologist, Water Supply Wells, Torrance, CA- Hydrogeologic support for a team of geologists/engineers drilling two pilot borings to assess groundwater quality in the North Torrance Well Field. The city is currently evaluating their options for well screen placement in consideration of a nearby chlorinated solvent plume that also contains the emergent chemical 1, 4-Dioxane.

Hydrogeologist, Groundwater Well Installation, Confidential Client, Firebaugh, CA- Provided technical oversight for the drilling, testing and design construction of two, 1,300 foot groundwater supply wells for a private power energy facility. Provided review of the open hole geophysical logs to confirm producing zones, evaluated the borehole conditions for well completion, and evaluated and approved the final design of the well screen and casing. The identification of saline zones for potential isolation was also an issue at this site. Also oversaw the technical review of the well development and testing program, which included the successful development and aquifer testing of both wells. Each well produced more than 2,500 gpm sustained yield.

Hydrogeologist, Water Supply Investigation, Coalinga, CA- Provided technical assistance and aquifer test analysis to evaluate the potential development of a groundwater resource for a potential solar hybrid power plant. The objective of the test was to evaluate the aquifer characteristics in order to estimate well yield and the affects long-term pumping may have on other wells in the vicinity of the proposed site. The proposed project was planning to use recycled water for fifty percent of the water demand and the remaining fifty percent would be from groundwater.

Groundwater Supply Experience (cont.)

Hydrogeologist, Production Well Assessment, Arizona, American Water Company, Phoenix, AZ-

Worked on the Arizona-American Water Company Well Evaluation Project, a wellfield analysis that incorporated 25 wells in Sun City and 11 wells in Sun City West (36 wells), of which most were over 40 years old. Over 60% of the wells had problems associated with sand production, structural stability, low production, high pump costs, or water quality. The evaluation successfully characterized the primary cause of the well performance problems and provided recommendations for each well (clean, replace, rehabilitate, etc.).

Environmental Project Experience

Project Hydrogeologist for the Neal Road Recycling and Waste Facility, Butte County, CA-

Was responsible for the coordination of staff and subcontractors in the implementation of quarterly, monthly, and on-call field sampling events for landfill gas, groundwater, surface water, soil pore water, leachate, septage pond supernatant as well as the preparation of periodic reports for media sample results. In addition to the environmental monitoring he was the responsible in charge for the design and installation of four groundwater monitoring wells at the site and he supervised the installation of seven soil gas monitoring probes under the responsible charge of a professional engineer. He evaluates geochemical data and prepares Stiff and Piper diagrams. He coordinates with the analytical laboratory for electronic data deliverables and uploads the quarterly monitoring data and reports to GeoTracker, the State Water Resource Control Board database.

Project Hydrogeologist for the CalRecycle - Johnson Road Illegal Dump Site Remediation Oversight, Del Norte County, CA-

Provided senior oversight and waste removal oversight and sampling and analysis for the Johnson Road Illegal Dump Site on Yurok Tribal and privately owned lands in remote northern California. Ms. Teasdale was responsible for preparation of the scope of work, coordinating staff and subcontractors, documentation of the waste removal, and providing CalRecycle with subcontractor options for high angle training. Staff working under Mr. Teasdale's leadership were trained for work on high angle slopes and staff was made available to the CalRecycle 24/7 and over weekends to document waste removal over a six week period.

Project Manager for the CalRecycle - Tulley Creek Illegal Dump Site Remediation Oversight, Humboldt County, CA-

Supervised staffs that were providing sampling and analysis for the Tulley Creek Illegal Dump Site. Mr. Teasdale's responsibilities were to conduct the sampling and provide waste characterization for soil and ash to be disposed. This project had a very tight schedule and Mr. Teasdale successfully coordinated with multiple laboratories to perform analyses over a weekend to meet the needs of CalRecycle.

Hydrogeologist, Nitrate Well Assessment, Town of Paradise, Paradise, CA- The project involved assessing the impacts to groundwater from septic systems. Assisted the Town in identifying potential contaminant sources. Preliminary data led identified key data gaps, and additional monitoring wells will be installed. Designed and supervised the installation of the proposed monitoring wells.

Hydrogeologist, Groundwater Resource Development, Dublin, Ireland- Investigated the impacts of illegal disposal activities on a nearby village's water supply. The disposal activities occurred within a sand and gravel quarry. Activities included overseeing the site work of the quarry's sub-consultant and guiding the local council authorities throughout the site investigation.

Program Hydrogeologist, Mather Air Force Base Environmental Restoration Program, Sacramento, CA- Performed senior technical oversight for \$10M environmental restoration program including CERCLA remedial investigations, risk assessments, feasibility studies, pilot tests, engineering evaluations and cost analyses, and the basewide groundwater monitoring program. Compiled and successfully presented closure

Environmental Project Experience (cont.)

strategy for 69 IRP sites at Headquarters Air Training Command. This included the development of the Operable Unit Strategy that was implemented for the restoration program. Provided technical review of the basewide groundwater monitoring program reports. Aided in developing the Groundwater Monitoring Program Evaluation document that specified the strategy for optimizing and reducing the sampling frequency and analytical suites for wells in the monitoring program. The strategy was presented to the regulatory community and successfully implemented.

Supervising Rig Geologist Former McClellan AFB Groundwater Monitoring Well and SVE Well Network Optimization and Task Leader for Development of the Field Summary Report, Sacramento, CA- Successfully supervised the drilling and installation of groundwater monitoring wells and soil vapor extractions wells. Documented the lithology in accordance with the Unified Soil Classification System, determined depth to groundwater, developed well construction specifications, and monitored site health and safety in the work areas. Upon completion of the well installations she was the primary author and team coordinator for developing the Field Summary Report (FSR). Wherein, the field activities were documented. The FSR included, site maps for each well location, lithologic logs, well construction diagrams, and waste manifests showing that investigation derived waste was properly disposed.

Project Hydrogeologist for Development of the Site 3 (Former Burn Pit) Remedial Investigation Report, Beale, CA- Was the project team coordinator and primary author for the Site 3 RI report including a risk based water quality site assessment. Site media were contaminated with dioxins and furans, metals, PAHs, chlorinated solvents, and petroleum hydrocarbons. Investigations and remedial actions at the site had been ongoing for approximately 21 years and site hydrogeologic conditions showed significant changes over that same time period. Mr. Teasdale's involvement in the Site 3 RI included the development of a data gap work plan that included sampling strategies for delineation of dioxin and furans in soil and site drainages, confirmation soil gas sampling, data gap groundwater sampling, and design of five aquifer pumping tests. Mr. Teasdale was also responsible for communicating data needs to other contractors performing concurrent remedial actions to support the human health and ecological risk assessments and coordinating project staff involved in the development of the HHRA and ERA, the groundwater model and model documentation, and report graphics.

Project Hydrogeologist, DTSC Skyway Subdivision Remedial Investigation, Chico, CA- Was the field coordinator and primary author for the Work Plan and Field Summary Report. The Skyway Subdivision project effort was to investigate a chlorinated solvent plume discovered to be present in groundwater beneath the southwest portion of Chico, CA. The investigation included the development of a drilling and sampling strategy, preparation of a work plan including preparation of a health and safety plan, implementation of the work plan, groundwater monitoring well design, data compilation and interpretation, and preparation of the Field Summary Report. One source area for the groundwater contaminant plume was identified during the investigation, which assisted DTSC in identifying a responsible party.

Senior Geologist for a Major Petroleum Company's Retail Service Station Project, Redding, CA- Conducted aquifer testing to determine aquifer hydraulic conductivity for use in a site-specific groundwater/contaminant transport model. Three slug tests were implemented and falling head data were analyzed using Aquifer Test® software. Developed a site structure contour map of the bedrock and isopach map of the shallow aquifer using boring logs and outcrop survey data. Performed surface water monitoring to determine connectivity to groundwater. Prepared a Corrective Action Plan for remediation of the contaminated aquifer.

Project Hydrogeologist, Nitrogen Isotope Study, Chico, CA- Designed an investigation program for Butte County to assess the source of elevated nitrate in local groundwater. The City was seeking data that would

Environmental Project Experience (cont.)

indicate whether elevated nitrate concentrations were attributable to leaky water conveyance piping or to agricultural practices. The study relied on collecting groundwater samples from strategic-located regional water wells and analyzing them for stable nitrogen isotopes and indicator parameters that are associated with municipal wastewater, agricultural fertilizers, and other livestock wastes.

Project Hydrogeologist, Groundwater Evaluation and Modeling, Victor Industries Site, and Central Plume Site, State of California, Chico, CA- Study included the evaluation of the aquifer system beneath the City of Chico and Butte County, a regional water balance, and detailed spatial and temporal correlation of groundwater pumping and influences in site monitoring wells. The project also involves development of a two 3-D numerical groundwater flow and transport models. The models are being used to aid in implementing an interim remedial design that will clean-up dissolved concentrations of TCE and PCE. The preliminary design includes two extraction wells, a treatment plan and injection of treated water.

Lead Hydrogeologist, Old Seaman's Club and Lower Tower, Cabras Island, Guam, Private Client- As the Lead Hydrogeologist and technical advisor, Mr. Teasdale was responsible for evaluating the performance of natural attenuation of fuel hydrocarbons at both sites.

Lead Hydrogeologist, Former Adak Naval Complex, Adak, AK- As the Lead Hydrogeologist and technical advisor, Mr. Teasdale developed a groundwater flow, particle tracking and transport model and the data analysis and interpretation for site. He performed the groundwater modeling using MODFLOW, MODPATH and MT3D computer programs. A Municipal water supply source was threatened with diesel range organic compounds from the Site. The contaminant plumes have impacted down-gradient properties and threaten other nearby domestic and agricultural water supply sources.

Project Hydrogeologist, Landfill Project, Various sites in CA- Developed a one-dimensional unsaturated zone leaching modeling process to support site closeout. The process involves modeling residual unsaturated zone contamination leaching to groundwater. Predicted groundwater impact is compared to groundwater threshold concentrations and the results are used to obtain regulatory closure. Several sites in Northern California have been closed and others are pending using this process.

Hydrogeologist, Sharpe Army Depot (formerly DLA Defense Distribution Depot, San Joaquin – Sharpe Site), Lathrop, CA- Performed ITRs on all environmental program reports, work plans, and analytical and numerical modeling. He led the performance evaluation of the groundwater remedy and performed technical review the Sharpe Site Third Five-Year Review. He supported the preparation of the ESD for OU 1, which modified the groundwater remedy to include in situ treatment and LUCs. Mr. Teasdale was involved with designing the investigation to determine whether natural attenuation of VOCs is occurring in the distal portions of groundwater plumes. Results from the investigation will determine whether MNA is a viable component to add to the groundwater remedy.

Hydrogeologist, DLA Defense Distribution Depot, San Joaquin – Sharpe Site, Sharpe, CA, AFCEE- Led technical reviews of all environmental annual monitoring, work plans, and interpretative reports. He guided the development of the CSMs for the site. He prepared the technical arguments that successfully achieved shutdown of 21 EWs on the Sharpe Site. Mr. Teasdale presented the arguments in a focused feasibility study for adding MNA as a part of the groundwater remedy. He demonstrated that natural attenuation was occurring across the site, while EWs were hydraulically stabilizing VOC plumes. Mr. Teasdale wrote the summary evaluation of historical water quality and potential threats to 30 privately owned potable water wells from contaminant plumes.

Environmental Project Experience (cont.)

Hydrogeologist, DLA Defense Distribution Depot, San Joaquin – Tracy Site, Tracy, CA, AFCEE- Led technical reviews of environmental annual monitoring, work plans, and interpretative reports. He guided the development of the CSMs for the Tracy Site. He led technical team that created the proposed plan and ROD for the extraction and treatment remedy for dieldrin contamination beneath a portion of the Tracy Site. Mr. Teasdale also participated in meetings with AFCEE and DLA managers and regulatory agency personnel to select a remedy for this controversial project.

Hydrogeologist, Emergency Response, Nubieber, CA- Initiated an emergency response team to assess, characterize and clean-up a 4,000 gallon diesel spill that involved the derailment of seven locomotives. The assessment consisted of removing liquid diesel; drilling and sampling several boreholes in the area of the former spill at the site. It was determined that the spill had impacted the soil and groundwater at the site. The site was characterized, remediated and closed within 10 months after the spill occurred.

Hydrogeologist, Groundwater Resource Investigation, Chico, CA- Acted as the supervising hydrogeologist for the installation, site characterization and general testing of 6, 200 foot exploratory test borings. Testing involved general lithological characterization using sample cuttings and geophysical logs. Utilized downhole video, optical televiewer and flowmeter equipment to further characterize an existing agricultural well.

Environmental Groundwater Modeling Project Experience

Project Hydrogeologist, Naval Facilities Engineering Command Southwest, Marine Corps Air Station, Yuma, AZ- Developed a 3-D groundwater flow and transport model for the characterization and simulation of volatile organic compounds (VOCs) and 1, 4-Dioxane in groundwater at OU 1 Area. The modeling objectives are to 1) evaluate the potential for off-site migration of contamination; and 2) assess the fate and transport of chemicals of concern (COCs) under various scenarios.

Project Hydrogeologist, BAE System Test Facility, Hollister, CA- Developed a 3-D groundwater model to simulate ground water flow and contaminant transport at the site. The model is used to evaluate the effectiveness of MNA and other remedial alternatives and estimate the respective cleanup times under natural condition and various remedial alternatives.

Project Hydrogeologist, Wood River Refinery, Roxana, IL- Developed a 3-D groundwater flow model to simulate the current ground water flow conditions. The model was used to simulate the groundwater pathlines and delineate the capture zone under the current onsite pumping. The model was also served as a tool for optimizing the existing groundwater pumping system.

Project Hydrogeologist, Numerical Model Evaluation, Carmichael Water District, Carmichael, CA- Evaluated the capability of the MODFLOW numerical model developed for Aerojet Superfund in assessing the existing and future perchlorate and NDMA contamination plumes. The model had not been able to predict ongoing impacts to municipal wells. Provided recommendations on how to improve model performance.

Project Hydrogeologist, Confidential Client, Shell Carson Terminal, Carson, CA- Developed a LNAPL distribution and recovery model to assess the total and recoverable volumes of LNAPL at the site, to simulate LNAPL distributions, the recovery rates, and time to reach recovery goal of current system, and to optimize the current system by changing pumping schedules and/or relocating/adding pumping wells.

Environmental Groundwater Modeling Project Experience (cont.)

Project Hydrogeologist, Hydrogeological Analysis SUNPOWER Corporation, Plant Water Supply Hydrogeologic Evaluation, Richmond, CA- Reviewed a 3-D groundwater flow model to evaluate the net impact of groundwater pumping for a proposed solar power plant on the local aquifer. The model was utilized to evaluate the current and future groundwater flow conditions and the water budget of the aquifer system, and to predict the potential maximum drawdown in the vicinity of extraction wells and the impacted area of the project-specific pumping for various scenarios of plant operation conditions.

Project Hydrogeologist, Regional Groundwater Flow Modeling of Folsom JFP Auxiliary Spillway Area, Folsom, CA, U.S. Army Corps of Engineers (USACE)- Reviewed a 3-D finite-element groundwater flow model using FEFLOW to simulate groundwater flow in the Folsom JFP Auxiliary Spillway Area. Model was used to estimate uplift pressures acting on the base and walls of the spillway, and to estimate the seepage rate into the spillway excavation. Analyzed results, prepared reports, and met with the U.S. Army Corps of Engineers.

Project Hydrogeologist, Groundwater Investigation and Groundwater Modeling, Whidbey Island, WA- Providing groundwater modeling support for the on-going remediation of a former municipal landfill and nearby former liquid industrial waste disposal area. The designed model simulated the migration of chlorinated volatile organic compounds (CVOCs) under the influence of the groundwater extraction system at the site and assessed the potential for CVOCs to migrate to downgradient subsurface and surface receptors, including the Pacific Ocean. The model was further utilized to simulate a number of proposed remedial strategies aimed at reducing the necessity for continued operation of the site's pump and treat system. Designed the model through the conceptual model approach using the Groundwater Modeling System software package. The model incorporated climatic data, surface water recharge, and other factors to simulate an accurate groundwater flow regime which served as the basis for CVOC transport.

Project Hydrogeologist, Groundwater Investigation and Groundwater Modeling, BAE System Test Facility, Hollister, CA- Assisted in the Developed a 3-D groundwater model to simulate ground water flow and contaminant transport at the site. The model is used to evaluate the effectiveness of MNA and other remedial alternatives and estimate the respective cleanup times under natural condition and various remedial alternatives.

Project Hydrogeologist, Groundwater Evaluation and Modeling, Victor Industries Site, and Central Plume Site, State of California, Chico, CA- Study included the evaluation of the aquifer system beneath the City of Chico and Butte County, a regional water balance, and detailed spatial and temporal correlation of groundwater pumping and influences in site monitoring wells. The project also involves development of a two 3-D numerical groundwater flow and transport models. The models are being used to aid in implementing an interim remedial design that will clean-up dissolved concentrations of TCE and PCE. The preliminary design includes two extraction wells, a treatment plan and injection of treated water.

Project Hydrogeologist, Groundwater Evaluation and Modeling, Brunswick, NC, Progress Energy Carolinas- Developed the 3-D groundwater flow model for the Brunswick Nuclear Plant. This 3-D groundwater flow model (MODFLOW) was used to assist in the development of a groundwater extraction system and to evaluate additional extraction well arrays while maintaining capture and containment at the site. The groundwater model utilized particle tracking (MODPATH) to evaluate capture and optimize the groundwater extraction system.

Environmental Groundwater Modeling Project Experience (cont.)

Project Hydrogeologist, Groundwater Evaluation and Modeling, South Gate, EPA, Los Angeles, CA- Led the development of a 3-D groundwater flow and fate and transport model for the Cooper-Drum facility. This 3-D groundwater flow model was used to optimize the existing groundwater extraction systems, and to evaluate additional recharge capacity for the proposed expansion of an existing direct injection remediation recharge facility. The analysis of potential groundwater mounding included a review of existing hydrogeologic data and development of a three-dimensional groundwater flow model. Model recharge scenarios to simulate current and potential future recharge at the site indicate that additional recharge capacity is possible at the site.

Modeling Team Leader, Numerical Flow and Transport Modeling, Confidential Client- Evaluate dewatering scenarios and potential effects on an ammonia plume related to installation of a subsurface pipeline in Southern California.

Modeling Team Leader, Numerical Flow and Transport Modeling, Confidential Client- Investigated historical contamination of groundwater for a confidential industrial client on a site in Modesto, California. Developed site and regional conceptual model. Determine potential effects to neighboring residential potable wells. 3 dimensional flow and transport model using USGS MODFLOW, MODPATH and EPA's MT3D.

Modeling Team Leader, Numerical Flow Modeling, Confidential Client, 2009- Evaluated dewatering scenarios and potential flow impacts to surrounding water bodies involving installation of a subsurface pipeline in central California.

Modeling Team Leader, Numerical Flow and Transport Modeling, Confidential Client- Estimated the time to complete attenuation of chlorinated groundwater plumes zone plumes and evaluate potential impacts to surrounding water bodies in California.

Project Hydrogeologist, Groundwater Modeling, Stockton, CA, DOD- Led the development of a transient 3-D groundwater flow model. This 3-D groundwater flow model is be used to optimize the existing groundwater extraction systems, and to evaluate additional recharge capacity. The analysis of potential groundwater mounding included a review of existing hydrogeologic data and development of a three-dimensional groundwater flow model. Model recharge scenarios to simulate current and potential future recharge at the site indicate that additional recharge capacity is possible at the site.

Air Force Center for Environmental Excellence (AFCEE), Beale AFB (Air Force Base), CA- Analyzed and modeled groundwater flow and contaminant transport migrations under natural attenuation condition (RI), and designed, evaluated and optimized various alternative remedial actions (FS) for various sites of Beale AFB. The modeled sites include Sites 18 & 31, Site 23/SMNU 23, and Site 3.

Hydrogeologist, Groundwater Modeling and Well Evaluation, Sacramento, CA- Provided hydrogeological support for complex modeling efforts at McClellan AFB. Current efforts involve 3-D finite difference groundwater flow (MODFLOW-SURFACT), particle tracking (MODPATH), and fate and transport (MODFLOW-SURFACT) modeling to evaluate capture and optimize groundwater extraction systems. Past efforts involved 3D finite element (FEMWATER) and finite difference groundwater flow (MODFLOW) and transport modeling (MT3DMS) coupled with vadose zone transport modeling (VENT2D) to evaluate long-term groundwater remediation cost analysis. Mr. Teasdale also conducted aquifer tests analysis and assessed the structural properties of three, 8-inch diameter extraction wells. The project involved well analysis utilizing a

Environmental Groundwater Modeling Project Experience (cont.)

technique to collect geophysical logging and depth-specific groundwater sampling data under both pumping and non-pumping conditions. In addition, conventional aquifer test data was collected and analyzed from each well, and a well video survey of each well was conducted to assess its structural condition. This information was utilized to prepare an appropriate well modification design for each well. Mr. Teasdale coordinated the field inspection of the well structure modification by a drilling contractor at each well. The project resulted in a reduction of well clogging and increased water production.

Hydrogeologist, Groundwater Resource Development, Dublin, Ireland, Citizens Advisory Council-

Investigated the impacts of illegal disposal activities on a nearby village's water supply. The disposal activities occurred within a sand and gravel quarry. Activities included overseeing the site work of the quarry's sub-consultant and guiding the local council authorities throughout the site investigation.

Lead Hydrogeologist, Former Adak Naval Complex, Adak, Alaska, U.S. Navy-

As the Lead Hydrogeologist and technical advisor: Mr. Teasdale developed a groundwater flow, particle tracking and transport model and the data analysis and interpretation for site. He performed the groundwater modeling using MODFLOW, MODPATH and MT3D computer programs. A Municipal water supply source is threatened with diesel range organic compounds from the Site. The contaminant plumes have impacted down-gradient properties and threaten other nearby domestic and agricultural water supply sources.

Project Hydrogeologist, Groundwater Evaluation, Delta Habitat, Conservation, and Conveyance Program, Sacramento, CA, CA Department of Water Resources-

Was the Project Hydrogeologist for the dewatering evaluation task on this program to improve delta conservation and conveyance. He provided independent technical review on initial geologic and hydrogeologic analysis of several areas in the Sacramento/San Joaquin Delta. He is also lead the development of a screening-level analysis of potential construction dewatering protocol for a future feasibility study on the program. MODFLOW is being used to evaluate the general size of the construction dewatering activities and the predicted changes in groundwater levels during construction.

Selected Publications:

Eddy Teasdale, 2017, "Well Liners, Are they Worth the Fuzz" AWWA Meeting 2017, Anaheim, CA.

Jim Zhang, and Eddy Teasdale, 2015, "An Iterative Method of Modeling Pump and Treat-Injection System with "Partial Treatment" AGU Meeting 2015, San Francisco, CA.

Jim Zhang, and Eddy Teasdale, 2012, "Steady-State Flow Model Calibration Using Multiple Sets of Observed Groundwater Elevation Data" AGU Meeting 2012, San Francisco, CA.

Eddy W. Teasdale, Jim Zhang, and Liz Elliott, 2010, "Using General Head Boundary Conditions in Groundwater Flow Models" AGU Meeting 2010, San Francisco, CA.

Parrish, K.E., R. Nommenson, and E. Teasdale, 2008, Practical Groundwater Cleanup Optimization with a TMR Model, Abstracts for Applications of Optimization Techniques to Groundwater Symposium, Sacramento, California, October.

Eddy W. Teasdale, Jim Zhang, and Kent Parrish, 2007, "An Enhanced Method of MODFLOW Simulation of Groundwater Extraction/Injection through Wells Penetrating Multiple Aquifers" AGU Meeting 2007, San Francisco, CA.

Selected Publications (cont.)

Kent Parrish, Jim Zhang and Eddy Teasdale, 2007. "A Closed-form Equation for Predicting Groundwater Response to Pumping in Homogeneous, Confined Horizontal Aquifer with Unidirectional Flow" AGU Meeting, December 2007, San Francisco, CA.

Eddy Teasdale, Kent Parrish and Ed Titus, Presentation 2007 "Well Field Optimization" 27th Biennial Groundwater Conference and 16th Annual Meeting of the Groundwater Resources Association of California.

Eddy Teasdale, Kent Parrish and Robb Clayton, Presentation 2005 "Groundwater Models;" The Geological Conceptual Approach" 25th Biennial Groundwater Conference and 14th Annual Meeting of the Groundwater Resources Association of California.

"Groundwater Pollution". Presentation: Northern California Natural History Museum without walls lecture series, Chico, CA, October, 2004

"In-Situ Well Rehabilitation Techniques, Case Studies from the Desert", Presented as an in-house training seminar, Leeds U.K, November, 2003

John H. Bush, Dean L. Garwood, and Eddy W. Teasdale, Poster, 2002, Re-Interpretation of the Pullman-Moscow Geology, Idaho-Washington: "An Example of the Importance of Geological Mapping to Groundwater Modeling", Idaho Rural Water Development Project, December, 2002

Xeriscape ("Zeri" scape" your garden, and help in conserving our "groundwater" in the Palouse, Presentation: Latah County, Pullman, and Whitman County, January 2002

Abstract "Evidence for Structural Partitioning of Groundwater Resources in Moscow, Idaho Pullman, Washington and surrounding areas", Geological Sciences, University of Idaho, Moscow, ID, AGU Fall Meeting, San Francisco, CA, December, 2001

Professional Affiliations:

Groundwater Resources Association of California

National Ground Water Association

Geological Society of America

American Geophysical Union



Specialization

She has more than 30 years of experience in regional groundwater resource management and quality assessments, including groundwater supply sufficiency and availability assessments, design of monitoring networks and programs, long-term groundwater quality monitoring and protection programs for twelve agricultural coalitions in the Central Valley, and groundwater technical assistance to the Central Valley Salinity Coalition since 2009. She worked with a County Groundwater Resources Advisory Committee for two and a half years at their regular bimonthly meetings to educate the Committee on the County’s groundwater resources and to aid County staff and the Committee in community outreach and education efforts. She has provided regular technical reports to the Napa County Board of Supervisors since 2011. She is highly familiar with the provisions of SGMA through extensive involvement in SGMA-related work in groundwater basins across California. She was in the principal in charge of an Alternative to a Groundwater Sustainability Plan. Subsequently, in the same basin, a groundwater flow model was developed in 2017 to assess various sustainability interests including surface water groundwater interaction and potential streamflow depletion factors, a SGMA Management Area was designated, a SGMA-related report on the Management Area was prepared and submitted to DWR in March 2018, and the first SGMA Annual Report was filed in March 2018. She is involved in the development of Groundwater Sustainability Plans in many other basins and subbasins. Since 2009, she has been the groundwater program technical manager for work conducted for the Central Valley Salinity Alternatives for Long-Term Sustainability initiative (CV-SALTS), a collaborative effort initiated in 2006 to find solutions to the salt and nitrate problem in the Central Valley. She has provided numerous technical presentations to the Executive/Policy Committee during the development of the Central Valley Region Salt and Nitrate Management Plan (December 2016) and the subsequent development of the Basin Plan Amendment for the Sacramento, San Joaquin, and Tulare Hydrologic Regions (approved by the Regional Board May 31, 2018 and now under consideration by the State Water Board. In 1992, she became the Founding President of the Groundwater Resources Association of California (GRA) and served as a director for 23 years. In 2010, she planned and organized the launch of a new Contemporary Groundwater Issues Council on behalf of GRA. The Council consists of nearly three dozen local, state, and national distinguished executives and leaders who are providing their input on the most pressing information, education, and programming needs to address California’s groundwater challenges. She has co-led the implementation of eight annual Council workshops. She co-led the

EDUCATION

M.S. Water Science, University of California, Davis, CA	1989
B.S. Environmental Toxicology, University of California, Davis, CA	1977

PROFESSIONAL REGISTRATION

Professional Hydrologist - Ground Water 870
(American Institute of Hydrology)

PROFESSIONAL EXPERIENCE

Luhdorff and Scalmanini, Consulting Engineers, Woodland, CA	
<i>Principal Hydrologist</i>	1992 - present
<i>President</i>	2012 - present
<i>Corporation Secretary</i>	2005 - present
<i>Principal Partner</i>	1991 - 2004
Luhdorff and Scalmanini, Consulting Engineers Woodland, CA	
<i>Hydrologist</i>	1983 -1991
University of California, Davis, CA	
<i>Research Assistant - Department of Land, Air, and Water Resources</i>	1981 -1982

Groundwater Caucus for the Department of Water Resources California Water Plan Update 2013. She was involved in Sustainable Groundwater Management Act (SGMA) GSP regulation development and feedback as part of Groundwater Resources Association's Sustainable Groundwater Management Committee. Since 2015, she has served as a member of DWR's Practitioner Advisory Panel that is providing input to DWR on SGMA implementation. In 2017, she contributed input on the Berkeley Law/UC Water paper on Navigating Groundwater and Surface Water Interactions Under the Sustainable Groundwater Management Act. In 2018, she reviewed and contributed input on the Berkeley Law/UC Water paper Recharge Net Metering to Enhance Groundwater Sustainability. She is a Steering Committee Member for the Distinguished Anne J. Schneider Lecture Series. She has provided technical testimony for legal cases, including testifying before a jury in a U.S. District Court case.

Representative Professional Assignments

- Principal-in-Charge of Groundwater Sustainability Plan development in many groundwater basins and subbasins in California.
- Managed LSCE's design and implementation of a countywide project on behalf of Napa County with emphasis on understanding groundwater conditions based on available data, and implementing an expanded groundwater monitoring and data management program as a framework for coordinated, integrated water resources management and dissemination of water resources information. Tasks included gathering available groundwater-related data, cross-correlating ancillary data, and developing a centralized water resources data management system. Oversaw LSCE's review and evaluation of selected available data (particularly groundwater data) to determine adequacy and accuracy of the data for desired assessments of groundwater conditions. Data gaps were identified and recommendations provided for the ongoing countywide monitoring program to facilitate effective interpretation and understanding of groundwater conditions. Recommendations were made for a countywide groundwater level and quality monitoring program. Managed preparation of a technical memorandum on groundwater management considerations and the County's Groundwater Ordinance and Permit Process in the context of General Plan goals and future steps toward integrated regional water management. Numerous outreach presentations provided in coordination with County. In 2011, and prior to the 2014 Sustainable Groundwater Management Act (SGMA), she worked with a County Groundwater Resources Advisory Committee for two and a half years to educate the Committee on the County's groundwater resources and to aid County staff and the Committee in community outreach and education efforts. She was the principal-in-charge of the preparation of the Napa Valley Subbasin Alternative to a Groundwater Sustainability Plan (December 2016). In 2017 to April 2018, she has been the principal-in-charge of the development of a groundwater flow model for the assessment of the potential for streamflow depletion in an area of the Napa Valley Subbasin, preparation of a SGMA-related report on an area of the Subbasin that is now a designated SGMA Management Area, and preparation of the SGMA-required Annual Report.
- Managed preparation of a comprehensive report by LSCE, in conjunction with James W. Borchers and Michael Carpenter, focusing on the escalating occurrence and severity of land subsidence due to groundwater pumping in California. The report, Land Subsidence from Groundwater Use in California, provides key examples of significant and far-reaching impacts of subsidence and includes recommendations to avoid those impacts. This report provides an analysis and examples from throughout California where groundwater pumping and land subsidence have been particularly significant. The report describes the lack of a state and federal agency program in California to monitor subsidence, indicates that without it there will continue to be unforeseen economic and environmental costs and disruptions for the State, and includes recommendations for improving subsidence monitoring and assessment.

Representative Professional Assignments (cont.)

- Managed LSCE's technical work as part of a four-consulting firm team that designed and implemented the Salt and Nitrate Sources Pilot Implementation Study, which was a key initial step in the effort by the Central Valley Salinity Coalition toward the development of a Basin Plan amendment to address the issue of salt and nutrient management in California's Central Valley. The overall objectives of the study were to develop and document procedures and methodologies to quantify the significant salt and nitrate sources in the Central Valley. The procedures were piloted in selected areas to evaluate their appropriateness and region-wide applicability. LSCE's work focused on groundwater aspects of the study. The study employed the use of the Watershed Analysis Risk Management Framework (WARMF) watershed model in coordination with the finite difference groundwater flow model, MODFLOW, to evaluate salt and nitrate mass loading to groundwater in three pilot study areas. Managed the groundwater work in the Yolo County study area. The USGS Central Valley Hydrologic Model (CVHM) was used to provide information about groundwater pumpage and deep percolation to the WARMF domain in the Yolo area. Salt and nitrate mass loads in the Yolo area were simulated with the WARMF model, and the results compared to historical groundwater quality observations.
- Provided technical support to the California dairy industry that ultimately resulted in the CVRWQCB's revision of the General Order Monitoring and Reporting Program, which led to the representative groundwater monitoring as an alternative to the CVRWQCB's site-by-site approach. The Phase 1 Representative Monitoring Program (RMP) Workplan provides a detailed discussion of the scientific basis supporting representative monitoring and the extrapolation of monitoring results, an explanation of the process of dynamic refinement, innovative monitoring well design specific to the needs of and requirements for the RMP, and a design of a comprehensive network of 135 dedicated monitoring sites on 18 dairy farms in Stanislaus and Merced Counties. Phase 2 of the RMP has also been completed; the RMP network now includes 42 dairies and over 400 monitoring wells.
- Managed the groundwater work for the Initial Conceptual Model (ICM, SNMP Phase I) effort for the ongoing CV-SALTS program that includes develop and implementing an approach for estimating the movement of water, salt, and nitrate for groundwater and surface water in the entire Central Valley. The ICM was the first of several phases of work that were needed to develop the first draft of the Central Valley Salt and Nitrate Management Plan (CV-SNMP). Also managed the groundwater work associated with Phase II of the CV-SNMP. The technical analyses and associated documentation that are developed as a part of the CV-SNMP form the basis for amendments to the Water Quality Control Plans for the Sacramento/San Joaquin Basin and Tulare Lake Basin. The work is also foundational for the more detailed, subregional analyses that will be undertaken later by local stakeholder groups when they develop local SNMPs.
- Managed the preparation of high resolution groundwater quality maps for nitrate and TDS for three defined groundwater zones (Upper, Lower, and Production Zones) throughout the Central Valley Floor on behalf of the Central Valley Salinity Coalition to provides a more refined and accurate characterization of the ambient groundwater quality and assimilative capacity than what was provided previously as a part of the aggregated Initial Analysis Zones (IAZ) analysis with the CV-SALTS Phase I Initial Conceptual Model. The high resolution detail will facilitate regional salt and nitrate management for the entirety of Region 5's jurisdiction, including the planning and implementation of long-term strategies and assessment of interim measures. The high resolution groundwater quality maps also provide the background information for identifying monitoring data gaps and for developing future groundwater quality monitoring programs. The updated groundwater quality analyses and mapping provide preliminary local scale information, which can be refined by local and/or regional entities as needed.

Representative Professional Assignments (cont.)

- Managed overall technical work for the development of East San Joaquin Water Quality Coalition’s Groundwater Quality Assessment Report (GAR), as required by the Coalition’s Waste Discharge Requirements for the Irrigated Lands Regulatory Program. LSCE developed a geostatistical method to quantitatively delineate relatively higher and lower vulnerability areas. The vulnerability of groundwater quality to agricultural impacts is being assessed and prioritized based on (1) hydrogeological sensitivity, (2) overlying land uses and practices, and (3) the beneficial uses of the groundwater. Each of these three factors was separately evaluated and rated, and then weighted to calculate a final groundwater vulnerability metric and prioritization for all areas within the Eastern San Joaquin River Watershed. Hydrogeological sensitivity is a factor that is tied to inherent physical characteristics of the geology and soils and underlying hydrogeologic and geologic conditions. Land use (location of cropping and management systems on the landscape, and locations of other non-agricultural land uses) is an indicator of potential groundwater quality stressors. The spatial relationship between the hydrogeological sensitivity of an area, the overlying land use (as rated in terms of its intensity as a water quality stressor), and the proximity or nature of the beneficial use for the groundwater (particularly recharge areas upgradient of communities that rely on groundwater), were quantified using GIS to provide a final map and GIS database of groundwater vulnerability for the Watershed.
- Managed overall technical work for the development of Westside San Joaquin River Groundwater Quality Assessment Report (GAR) and a Groundwater Quality Management Plan, as required by the Coalition’s Waste Discharge Requirements for the Irrigated Lands Regulatory Program. LSCE developed a geostatistical method to quantitatively delineate relatively higher and lower vulnerability areas. The vulnerability of groundwater quality to agricultural impacts was assessed and prioritized based on (1) hydrogeological sensitivity, (2) overlying land uses and practices, and (3) the beneficial uses of the groundwater.
- Managed overall technical work for the development of Grassland Drainage Area Groundwater Quality Assessment Report (GAR) and a Groundwater Quality Management Plan, as required by the Waste Discharge Requirements for the Irrigated Lands Regulatory Program. The vulnerability of groundwater quality to agricultural impacts was assessed and prioritized based on (1) hydrogeological sensitivity, (2) overlying land uses and practices, and (3) the beneficial uses of the groundwater.
- Managed overall technical work for the development of Western Tulare Lake Basin Area Groundwater Quality Assessment Report (GAR), as required by the Coalition’s Waste Discharge Requirements for the Irrigated Lands Regulatory Program. LSCE developed a geostatistical method to quantitatively delineate relatively higher and lower vulnerability areas. The vulnerability of groundwater quality to agricultural impacts was assessed and prioritized based on (1) hydrogeological sensitivity, (2) overlying land uses and practices, and (3) the beneficial uses of the groundwater.
- Managed overall technical work for the development of a groundwater quality trend monitoring program for the Central Valley Groundwater Monitoring Collaborative, 11 Agricultural Coalitions, located in the San Joaquin Valley. This umbrella program encompasses Groundwater Quality Trend Monitoring developed by the 11 Coalitions and establishes the framework for the future Central Valley Groundwater Monitoring Program, as required by the Central Valley Salt and Nitrate Management Plan and the upcoming Basin Plan Amendment for the Sacramento, San Joaquin and Tulare Lake Hydrologic Regions.
- Managed overall technical work for the groundwater quality characterization reports for the Northern and Southern Counties of the Central Coast Region.
- Managed LSCE’s technical work as part of a multi-firm team identifying the background conditions and geographical extent relating to the proposed MUN de-designation Target Area of the Tulare Lakebed. The team

Representative Professional Assignments (cont.)

addressed the purpose and need for the proposed MUN de-designation, a precise geographic description of the Target Area, regulatory requirements and circumstances relevant to the de-designation, a discussion of pertinent state and federal regulations, laws, and policies, and an overview of the proposed amendments to the Basin Plan. As part of this effort, Kretsinger reviewed and provided comprehensive comments on Ken Schmidt Draft Report (April 2013) “Hydrogeologic Evaluation of Delisting Part of the Tulare Lakebed Area”.

- Managed services provided on behalf of the City of Rohnert Park to prepare the groundwater portion of the Water Supply Assessment needed to satisfy the requirements of SB 610 and the City’s Water Policy Resolution. The WSA was required due to six planning applications that meet the definition of a “project” under SB 610 or that require annexation to the City. The WSA includes water demands (surface and groundwater) that will occur as the City reaches build-out under its General Plan. The WSA also considers the demands of other pumpers in the groundwater basin.
- Managed an AB 303 Groundwater Monitoring Program for Yolo County on behalf of the Yolo County Flood Control and Water Conservation District (District). The project contained three phases, including Phase 1 – Data Collection, Evaluation, and Recommended Groundwater Monitoring Program; Phase 2 – Database Management System; and Phase 3 – Report of Baseline Groundwater Quality Conditions and State of Groundwater Conditions. The Project included review of the existing extensive groundwater level monitoring network (approximately 300 wells) and establishment of a groundwater quality monitoring network (approximately 110 wells) to gather and assess the necessary data to ensure the long-term protection of the basin. Managed LSCE’s work to develop and implement a database management system for storage and evaluation of pertinent groundwater data, as well as for exchange of data with area cooperators, state and federal agencies and the public (via web site and other means) to promote coordinated and effective water resources management and dissemination of information on water resource management (especially groundwater conditions).
- Managed a comprehensive evaluation of current and historical hydrogeologic conditions in the vicinity of the City of Vacaville; prepared an SB 221/610 report as a supporting document to the City’s WSA that was required for three new development projects proposed within the City’s UWMP area. Developed an initial estimate of sustainable pumpage for the principal aquifer in the Vacaville study area and also the reasonably foreseeable impacts of projected municipal demands on the availability of water for agricultural and industrial users within the City water service area that are not currently receiving water from the City but are drawing water from the same aquifer. Recommended expansion of the City’s groundwater monitoring program, one objective of which is to collect data that would be used to evaluate future pumpage sustainability.
- Managed the support provided to CDM to prepare the Integrated Regional Water Management Plan developed for Solano County Water Agency and its member agencies. LSCE’s support focused on hydrogeologic conditions in the plan area and groundwater-related planning efforts.
- Managed LSCE’s work on behalf of the Solano County Water Agency for the design and construction of multiple completion groundwater monitoring facilities at four locations within the Northern Solano County area. These facilities (which include three nested wells at each location) are being used to expand the subsurface characterization of the regional aquifer system and provide dedicated monitoring facilities for ongoing groundwater level and quality monitoring of different zones of the aquifer system. The data collected from the deep monitoring wells will aid in the ongoing assessment of basin conditions and groundwater management activities. Additional subsidence monitoring stations are also being implemented as an important component of the regional monitoring program. LSCE prepared a report that describes the physical

Representative Professional Assignments (cont.)

conceptualization of the area complemented by groundwater level and quality data; this report includes a preliminary evaluation of depositional processes and an initial assessment of the sources of groundwater recharge for the basal Tehama Formation.

- Managed services to assist the County Sanitation Districts of Los Angeles County (CSDLAC) in preparation for meetings with the RWQCB on the update of the Upper Santa Clara River Chloride Total Maximum Daily Load (TMDL) and alternatives being recommended to reduce salt loads in the Santa Clara River. Historical groundwater quality data were evaluated to assess whether discharges from the CSDLAC's wastewater treatment plants were impacting groundwater downgradient of the plants. Time-series plots prepared of historical water quality data (groundwater and surface water) for four different areas (Los Angeles County/ Upper Santa Clara River, Piru subbasin east of Piru Creek, Piru subbasin west of Piru Creek, and the eastern portion of the Fillmore subbasin). Hydrologic conditions and factors influencing surface water and groundwater quality in each of the four subbasins evaluated were found to be highly complex with trends varying both spatially and vertically and also in response to river conditions (recharge and discharge reaches, flow and quality), land use factors, and other natural recharge (recharge near mountain front).
- Principal Hydrologist for work conducted for the Solano County Water Agency for the design and construction of multiple-completion groundwater monitoring facilities at four locations in the Northern Solano County area. These facilities expand the subsurface characterization of the regional aquifer system and provide dedicated monitoring facilities for ongoing groundwater level and quality monitoring of different zones of the aquifer system. The depth of geologic exploration at the four monitoring sites ranges from about 2,100 to 2,700 feet. The work included expansion of subsidence monitoring at two locations in Northern Solano County.
- Managed services provided on behalf of developers for preparation of a SB 610 Water Supply Assessment for a project located in Yuba County. The work included the analyses necessary to meet California Water Code requirements to evaluate the sufficiency of the water supply to meet future demands of the project. Work included description of the current and future water service area (including the project as well as other planned growth), and a summary of projected population growth, climate, and existing and planned sources of water supply. The WSA described the hydrogeology of the groundwater basin, including geology, well yields, aquifer characteristics, and regional and local groundwater conditions. Historical and current pumpage and groundwater level data in the current service area and the South Yuba Subbasin were analyzed. Groundwater recharge to the subbasin was estimated, including an estimate of the potential leakage from the upper to the lower zone of the aquifer system. Current and future water demands for the water service area were provided and also current and projected demands in the South Yuba Subbasin.
- Principal Hydrologist for work conducted to evaluate the feasibility of groundwater development on a property in Eastern Sacramento County where groundwater was planned to provide an interim or longer-term water supply to a planned community development project. The work involved consideration of potential risk to the water supply from contamination of a California Superfund site and also other local sources of contamination. Development of groundwater beneath the subject property led to communications with the Department of Public Health. A numerical groundwater flow model (MODFLOW) and particle tracking model (PATH3D) were developed to preliminarily assess potential pumping effects of the potential well field on contaminant migration, including pumping requirements, conceptual model of groundwater conditions and, groundwater flow and contaminant transport assumptions.
- Managed services for work to prepare a Groundwater Supply Assessment (GSA) for a proposed project in Sutter County to address the groundwater-related issues as required for a SB 610 Water Supply Assessment

Representative Professional Assignments (cont.)

(the latter was prepared by another member of the consultant team working on behalf of the project applicant). The GSA provided an analysis of current and future groundwater demands for the project for various water year types, supplies, and predicted impacts for the groundwater portion of the WSA and to provide input to the analysis of groundwater conditions for the Environmental Impact Report. The GSA contained a detailed analysis of land use, water demands, and water supplies for the Natomas Basin for current and projected (2030) conditions with and without the proposed project. These estimates were used to develop the baseline scenarios simulated with the groundwater flow model. A simplified current water budget was also prepared to estimate groundwater recharge due to deep percolation of precipitation and applied water. The water budget results were compared against the deep percolation simulated by the model. Potential pumping impacts and groundwater sufficiency were analyzed using a pair of existing numerical groundwater flow models (North American River Integrated Groundwater and Surface Water Model and Sacramento County Integrated Groundwater and Surface Water Model) to evaluate the impacts of the project on current and future groundwater conditions in the North American Subbasin.

- Managed services for the preparation of a Groundwater Investigation Work Plan for a Wastewater Reclamation Authority to outline an approach to determine the vertical and lateral extent of elevated nitrate-nitrogen concentrations in the vicinity of a wastewater reclamation authority as a result of effluent discharge to the Mojave River and the authority's percolation ponds, along with possible contributions from other sources. The Work Plan included evaluation of hydrogeologic conditions and historical groundwater level and quality data. The Work Plan also included preparation of a well inventory and map, including well locations, construction, aquifer designation, and the availability of groundwater level and quality data for each well. The Work Plan is the first phase of a three-phase effort to evaluate nitrate occurrence and predicted movement in the groundwater in the vicinity of the authority's treatment and disposal areas and to develop remediation measures as appropriate.
- A water district situated along the coast of Santa Cruz County authorized LSCE to conduct a focused study to assess the occurrence of arsenic in groundwater in the local aquifer system. Managed the design and implementation of a sampling program that included analyses of pertinent arsenic species and the governing oxidizing and reducing conditions at selected district water supply well locations. In addition, multiple-completion monitoring wells were sampled to evaluate the occurrence of arsenic within the different subunits of the Purisima Formation, the most widespread water-bearing unit in the Monterey Bay area. The levels of arsenic in groundwater evaluated during this study were found to be associated with the natural occurrence of arsenic resulting from the depositional and geochemical conditions in the local coastal environment. The enhanced understanding of the occurrence of dissolved arsenic in the local aquifer system provided important information to the local water purveyor.
- Prior to being operational, a new water supply well for the city of Vacaville was idle for approximately two years. Testing during this period found that when the well was idle for long periods, cross flow from the lower of two zones from which the well produced, which contained higher arsenic concentrations, caused the well water to temporarily exceed the MCL for arsenic. Oversaw the design and implementation of a 17-day initial test followed by other shorter tests to assess operational scenarios, including different seasonal operations. Test results showed arsenic concentrations fell below the MCL after the well was pumped sufficiently to mitigate cross flow effects, and arsenic concentrations remained below the MCL with regular use along with some overboard pumping at well start-up. With this information, the city programmed the well for automatic overboard flushing to ensure the well water meets the arsenic drinking water standard.
- Managed preparation of work plans, reports of results, corrective action plans, and closure plans as required by the RWQCB for groundwater contamination investigations (including sites affected by petroleum

Representative Professional Assignments (cont.)

hydrocarbons, wastewater, pesticides, nitrate, salts, and other land use activities). Activities have included technical discussions and negotiation with the RWQCB regarding monitoring program design, monitoring frequency, and site-specific remedial approach. Activities have also included coordination between client, legal counsel, and prior landowners.

- Managed the detection, verification and corrective action programs at Sacramento County's largest landfill. Work at the landfill included saturated and unsaturated zone hydrogeologic and hydrochemical characterization, soil gas investigation, a seismic reflection and refraction program to identify offsite leachate migration, and capture-zone analyses to recommend a groundwater extraction and treatment program. Managed work related to the design and implementation of full scale groundwater extraction and treatment facility (1,500 gpm capacity). Other work at the landfill included development of a numerical groundwater flow and contaminant transport model to evaluate hydraulic control of groundwater contamination; NPDES permitting; Army Corps of Engineers permit for streambed alteration; master plan for water supply; modification and abandonment of existing water supply well; design and construction of onsite water supply well; litigation support; and evaluation of beneficial uses of treated water.
- Managed work at Sacramento County's largest landfill as a subconsultant on a project to identify source control methods or combinations of source control methods for possible implementation to prevent groundwater contamination. Field investigation conducted to verify estimates developed of the contamination in the unsaturated and saturated zones, including phase distribution of contaminants and contaminant migration mechanisms, and to finalize the design basis for a staged remediation. Provided hydrogeochemical interpretation of the complex subsurface unsaturated and saturated units to assist with the preliminary design of effective contaminant control measures.
- Managed project to review documents concerning an out-of-California RCRA site on behalf of legal counsel for Sacramento County's Waste Water Treatment Plant. The site working group proposed
- allocating cleanup fund requirements to dischargers (Sacramento County and several hundred other potentially liable parties) based on the quantity of carbon disposed at the facility for regeneration. The proposed allocation method could have resulted in a required cleanup contribution from the County of several million dollars. Following site document review, review of other records and procedures, and assessment of the allocation rationale, County facilities were waived from this requirement.
- Managed detection, verification and corrective action programs for a brining operation having two evaporation ponds over a seven-acre area regulated by Chapter 15. Work at the site has included hydrogeologic and hydrochemical characterization, aquifer testing, monitoring facility installation, implementation of a groundwater monitoring program and preparation of a corrective action program. A Class I injection well was constructed under an EPA permit to a depth of 5,500 feet to allow brine disposal. Work was conducted to manage site stormwater containing elevated salt concentrations and to achieve closure on the two ponds. Post-closure monitoring is ongoing.
- Principal Hydrologist for third party review conducted on behalf of Sacramento County's Department of Environmental Review and Assessment for diversion and treatment of surface water and subsurface storage of that water in the main Sacramento County aquifer system for subsequent pumping to meet seasonal and dry period demands of a planned community.
- Project manager for assessing the impact of effluent disposal/reclamation operations on groundwater quality and quantity at the City of Fresno Regional Wastewater Reclamation Facilities. Prepared workplan

Representative Professional Assignments (cont.)

and reviewed applicable water quality protection standards, and establish groundwater monitoring objectives, including recommended sampling, analysis, and on-going monitoring requirements. Project included estimating the optimum capacity of the on-site effluent disposal using numerical groundwater modeling techniques.

- Managed project to investigate localized soil and groundwater contamination near a dry cleaning facility. Work expanded to include consideration of soil gas and groundwater contaminant plume interaction with about two dozen other potentially contaminated sites. Project included design of vapor extraction program for remediation, design of soil vapor pilot study for use in design of full scale soil vapor extraction facility for PCE removal from vadose zone, design of groundwater extraction system for groundwater remediation, designed monitoring program to assess decreasing soil vapor concentrations, and designed program for assessing vapor extraction system and cleanup.
- Investigated the correlation between delta channel conditions in the vicinity of Jersey Island and groundwater salinity beneath the island for historical and future scenarios (simulated conditions based on release flows in the delta area) by developing a numerical groundwater flow and quality model.
- Performed water well evaluations, aquifer testing, and water quality time-series sampling in the Soquel-Aptos area of Santa Cruz County, California. The testing and research enhanced the historical data base (water level, water quality and hydrogeologic) and furthered ongoing development of the regional groundwater monitoring program. Collaborating parties included the University, Luhdorff and Scalmanini, Consulting Engineers, and the Soquel Creek Water District. The project was funded through the University Public Service Research and Dissemination Program and the Kellogg Foundation, and supplemental funding by the University's Agricultural Experiment Station.

Professional Affiliations

American Institute of Hydrology, Professional Member (1989 to present)

American Institute of Hydrology, Board of Registration (1994 to 1996)

American Geophysical Union, Member (2009 to present)

Association of California Water Agencies, Member

Groundwater Committee, Member (2002 to 2005)

Guidelines for Local Groundwater Management Plans, Task Force Member (2002, 2003)

Association of Ground Water Scientists and Engineers (Division of the National Ground Water Association),

Member 1984 - Present,

AGWSE, Director (1998 to 2007)

AGWSE, Secretary - Treasurer (2002, 2003)

AGWSE, Chair (2004, 2005)

AGWSE, Strategic Planning Committee, Chair (2004, 2005)

AGWSE, Past Chair (2006, 2007)

AGWSE, Newsletter, Member (2004, 2005; monthly columns)

AGWSE, Awards Committee, Member (2008-2011)

Professional Affiliations (cont.)

AGWSE, National Program Committee, Member (2004-2006)
AGWSE, Nominating Committee, Chair (2006-2007) and Member (2006-2010)
NGWA, Board Observer (2002, 2003)
NGWA, Vice President (2004, 2005)
NGWA, Executive Committee (2004, 2005)
NGWA, Finance Committee (2004, 2005, 2006, 2007)
NGWA, Affiliate State Subcommittee (1998-2006)
NGWA, Audit Committee (2005, 2006)
NGWA, Operational Oversight Council Member and Chair (2006, 2007)
Ground Water News & Views (Technical Editor, 2007)
Ground Water News & Views Column in Ground Water Journal, Column Co-Editor
(2008 and continuing)
AGWSE Ground Water Summit Planning Committee, 2005
AGWSE Ground Water Summit Planning Committee, 2006
Interdivisional Cooperation Committee (2005, 2006)
NGWA Liaison to GSA (2004-2007)
Certification Committee -- Certified Ground Water Professional Program, Member (1998 to 2007);
Chair (2004, 2005)

California Groundwater Association

Technical Division, State Association, Vice President (1991)
Technical Division, Northern Branch, President (1991)

California Department of Water Resources. Member Sustainable Groundwater Management Practitioner
Advisory Panel (since 2015).

Environmental Law Section, State Bar of California, Associate Member (1992 to 2005)

Friends of Placer Hall, Committee Member

(Supports partnership between Geology Dept. at California State University at Sacramento and
the USGS)

Geological Society of America, Hydrogeology Division, Member (2002 to present)

Henry Darcy's 200th Birthday: Fundamental Advancements through Observation and Analysis
(Session Co-convener, 2003 Annual Conference)

Ground-Water Quality and Quantity Interconnections - The Effects of Natural and Anthropogenic
Contamination on Ground-Water Availability (Session Co-convener, 2005 Annual Conference)

Models and Other Tools for Managing Surface and Groundwater Resources and Informing
Policy Makers (Session Co-convener, 2007 Annual Conference)

Terroir -- The Relationship of Geology, Soils, Hydrology and Climate to Wine: a Special Tribute to
George Moore (Session Co-convener, 2009 Annual Conference)

Integrating Geoscience with Sustainable Land-Use Management, Critical Issues Position Paper
(Committee Member 2008-2014)

Hydrogeology Division Cordilleran Section Representative (2009 - 2010)

Groundwater Education Consortium of California, Steering Committee (1994 to 2000)

Groundwater Resources Association of California

State Association Founding President (1992, 1993)

Professional Affiliations (cont.)

Director (1992 to 2014)
Director Emeritus (2015 and ongoing)
Executive Committee (1992-2011)
Affiliate Committee, Chair (1992 to present)
Annual Meeting Committee Chair (1992-2004)
Bylaws Committee, Member (2006-2015)
Communications Committee, Member (2006-present)
Contemporary Groundwater Issues Council (organizer and co-leader, 2011 to present)
Editorial Board (2012-present)
Education Committee, Member (~1995-present)
Events Committee, Member (2005-present)
Nominating Committee, Member (2010-2015)
David Keith Todd Lecture Series, Coordinator for Northern California Lecturer (2011, 2013)
Sustainable Groundwater Management Act Committee, Co-Chair (2015)

International Association of Hydrogeologists, Member (1991 to present)
U.S. National Chapter Director, Executive Committee (2009-present)
U.S. National Chapter Membership Coordinator (2009-2012)
U.S. National Chapter Secretary (2016-present)
U.S. National Chapter Treasurer (2012-2016)
U.S. National Chapter GSA Liaison (2009 to 2013)
North American Scientific Advisory Committee Member, IAH 39th Congress, 2012; Confronting Global Change; session co-convener, Groundwater and Nutrients

National Ground Water Research and Educational Foundation, Board Member (2004, 2005)

Society of Environmental Toxicology and Chemistry, Member (1989 to 2004)

Water Reuse Association, Member (2000 to 2004)

Lecturer, University Extension Course, University of California, Davis:
Solid Waste Landfills: Leachate Production and Management, 1994
Wells and Pumping Plants for Water Supply Monitoring, 1988
Ground Water, Wells and Pumps, 1986

Seminar Coordinator and/or Session Chair, Groundwater Resources Association:
Testing and Modeling of Low Yield Aquifers, 1992
Vadose Zone Monitoring and Remediation, 1993
Applied Environmental Statistics, 1994
Overview of California Hydrogeology, 1995
Applied Groundwater Hydrology, 1998
Vadose Zone Modeling, 1998
Hexavalent Chromium in Groundwater, Co-Moderator 2001
Characterization/Remediation of Recalcitrant and Emerging Contaminants, Moderator 2001
Geostatistics for Hydrogeological and Environmental Applications, 2001
Perchlorate and NDMA Symposium, Planning Committee, 2002
Statistics for Groundwater Investigations, 2002
Artificial Recharge in California: Technical and Policy Issues, 2003

Professional Affiliations (cont.)

Groundwater Monitoring: Design, Analysis, Communication & Integration with Decision Making;
Planning Committee Member and Moderator, 2009

Groundwater Salinity: A Ground Water Dilemma; Planning Committee Member and Moderator 2009
International Agricultural Groundwater Conference, 2010; Planning Council Member

Salt and Nitrate in Groundwater: Finding Solutions for a Widespread Problem, 2012

Groundwater Issues and Water Management - Strategies Addressing the Challenges of Sustainability in
California, 2014 (Joint Meeting GRA and US Committee on Irrigation and Drainage)

Land Subsidence: Déjà vu All Over Again, Technical Challenges and Financial Impacts, Planning
Committee and Moderator, 2014

Workshop Coordinator, University Extension Course, University of California, Davis

Groundwater Workshop: Strategies for Cooperative Planning and Management, 1994

Annual Meeting Committee member or Chair, Groundwater Resources Association

Visions into California's Vital Resource, 1992

Applied Hydrogeology: Innovative Techniques and Approaches, 1993

Groundwater: The Crucial Component to California's Future, 1994

Diversity in Engineering Geology and Groundwater Resources, 1995

(joint meeting with National Association of Engineering Geologists)

Ground Water and Future Supply, 1997

(joint Biennial Groundwater conference with the University of California Water Resources Center)

Interconnected Water Supply in California, 1999

(joint Biennial Groundwater conference with the University of California Water Resources Center
and GRA Annual Meeting)

Managing California's Groundwater: The Challenges of Quality and Quantity, 2001

(joint Biennial Groundwater Conference with the University California Water Resources Center and
GRA Annual Meeting)

Sustaining Groundwater Resources: The Critical Vision, Conference Chair, 2002

The Role of Groundwater in Integrated Water Management, 2003

(joint Biennial Groundwater Conference with the University of California Water Resources Center
and GRA Annual Meeting)

Aquifer Protection, Restoration, Replenishment and Treated Water Reuse, 2004

Past Lessons and Future Prospects, 2005

(joint Biennial Groundwater Conference with the University of California Water Resources Center
and GRA Annual Meeting)

GRA 15th Annual Meeting: Assessment, Use & Management of Groundwater in Areas of Limited
Supply, 2006

California's Water Future: Expanding the Role of Groundwater, 2007

(joint Biennial Groundwater Conference with the University of California Water Resources Center
and GRA Annual Meeting)

GRA 17th Annual Meeting: Groundwater: Challenges to Meeting Our Future Needs, Conference
Co-chair, 2008

27th Biennial Groundwater Conference and 18th GRA Annual Meeting, 2009

(joint conference with the University of California Water Resources Center)

GRA 19th Annual Meeting, Think Outside the Pipe: Exploring and Protecting Local Water Supplies, 2010

Professional Affiliations (cont.)

28th Biennial Groundwater Conference and 20th GRA Annual Meeting, 2011; California's Water Future Goes Underground

GRA 21st Annual Meeting, California: Data, Planning and Opportunities, 2012

29th Biennial Groundwater Conference and 22nd GRA Annual Meeting, 2013

GRA 23rd Annual Meeting, 2014 -- The Year of Groundwater, 2014

30th Biennial Groundwater Conference and 24th GRA Annual Meeting, 2015

Review Journal Articles, Invited Reviewer for manuscripts submitted to the Journal Ground Water and the *Hydrogeology Journal*

University of California Water Resources Center

Advisory Council Member (1994 to 2009)

Steering Committee Member and Session or conference Co-Chair, Biennial Groundwater Conference: 1997, 1999, 2001, 2003, 2005, 2007, 2009

Water Education Foundation

2014 Mentor Water Education Foundation Water Leaders Class

Topic: Groundwater Management in California

Planning Council member for International Conference Linking Science and Policy; Toward Sustainable Groundwater in Agriculture. June 2016.

Water Resources Archives, Honorary Committee Member, public television documentary preview

"The Battle for Mono Lake"

Water Resources Archives Board Member (2009-2011)

Water Resources Archives and Collections Board Member (2012 to 2014)

Yolo County Solid Waste Hearing Panel (1995 to 2000)

Other Volunteer Activities

California Department of Water Resources, California Water Plan Update 2013. Co-Leader of the Groundwater Caucus (2011 to 2014)

California Department of Water Resources, member of Practitioner Advisory Panel to provide input on the implementation of the Sustainable Groundwater Management Act (2015 and ongoing)

Professional Recognition

Keith E. Anderson Award, 2008

Robert Storm Award, 2010

Groundwater Resources Association of California President's Award, 2014, "The Foundation, The Rock of GRA"

Groundwater Resources Association of California, "GRA's Founding Mother 1992-2014"

Example Groundwater Publications and Presentations

Kretsinger Grabert, V. 2018. Technical Approaches for Salt and Nitrate Management to Achieve Groundwater Quality Sustainability. September 25, 2018. Presentation at Groundwater Resources Association of California, Western Groundwater Congress.

Kretsinger Grabert, V. 2018. Northeast Napa Area: Special Groundwater Study. August 14, 2018. Presentation to Napa Engineers Society.

Kretsinger Grabert, V. 2018. Napa County Groundwater Sustainability Annual Report and Other Updates. July 26, 2018. Presentation to Watershed Information & Conservation Council.

Kretsinger Grabert, V. 2018. Groundwater Quality and SGMA: Recharge, Nitrate, and Other Considerations. June 11, 2018. Presentation at Stanford University Water in the West Uncommon Dialogues.

Kretsinger Grabert, V. 2018. Napa Valley Subbasin Groundwater Sustainability Groundwater-Surface Water Interaction. June 7, 2018. LSCE presentation at Groundwater Resources Association of California Groundwater Sustainability Agency Summit.

Kretsinger Grabert, V. 2018. Napa County Groundwater Sustainability Annual Report – Water Year 2017. March 20, 2018. Presentation to Napa County Board of Supervisors.

Kretsinger Grabert, V. 2018. Northeast Napa Area: Special Groundwater Study. January 25, 2018. Presentation to Watershed Information & Conservation Council.

Kretsinger Grabert, V. and T.Grovhoug. 2018. Salt and Nitrate Management Planning for the Sacramento Valley. February 6, 2018. Presentation at the Colusa Farm Show for the Northern California Water Association and Sacramento Valley Water Quality Coalition.

Kretsinger Grabert, V. and T. Grovhoug. 2017. Salt and Nitrate Management Planning for the Sacramento Valley. December 19, 2017. Presentation to the Northern California Water Association.

Kretsinger Grabert, V. 2017. Northeast Napa Area: Special Groundwater Study. October 24, 2017. Presentation to Napa County Board of Supervisors.

Kretsinger Grabert, V. 2017. Napa County Comprehensive Groundwater Monitoring Program 2016 Annual Report and CASGEM Update. July 27, 2017. Presentation to Watershed Information & Conservation Council.

Kretsinger Grabert, V. 2017. Presentation to Napa County Board of Supervisors. Napa County Comprehensive Groundwater Monitoring Program 2016 Annual Report and CASGEM Update. April 17, 2017.

Kretsinger Grabert, V. 2017. Napa Valley Groundwater Sustainability: Overview of Basin Analysis Report for the Napa Valley Subbasin. February 8, 2017. Presentation to Sonoma County Farm Bureau.

Kretsinger Grabert, V. 2016. Groundwater Quantity and Quality: Recent Regulations Affecting Growers. University of California Cooperative Extension. January 7, 2016.

Example Groundwater Publications and Presentations (cont.)

Kretsinger, V. and R. Bryson. 2016. Napa County Workshop: Basic Groundwater Concepts and Water Availability Analysis Guidelines. February 4, 2016.

Kretsinger Grabert, V. 2016. Napa County Comprehensive Groundwater Monitoring Program 2015 Annual Report and CASGEM Update. Watershed Information & Conservation Council. April 21, 2016.

Kretsinger Grabert, V. 2016. Napa County Groundwater Resources: A Comprehensive Program to Ensure Sustainability. Conference: Towards Sustainable Groundwater in Agriculture. June 28, 2016.

Dalgish, B. V. Kretsinger Grabert (presenting), and others. 2016. A Flow and Transport Model Developed as a Salt and Nitrate Management Analysis Tool for a Management Zone in California's Eastern Kings Subbasin. Conference: Towards Sustainable Groundwater in Agriculture. June 29, 2016.

Kretsinger, V., R. Bryson, and B. Brezing. 2016. Napa Valley Groundwater Sustainability: A Basin Analysis Report for the Napa Valley Subbasin (Draft Chapters 6 and 7). Watershed Information & Conservation Council September 22, 2016.

Kretsinger Grabert, V. 2016. Napa County Groundwater Resources: Groundwater Recharge on Regional and Local Scales, Napa County's Winery Definition Ordinance. November 2, 2016.

Kretsinger Grabert, V., and R. Bryson. 2016. Napa Valley Groundwater Sustainability: A Basin Analysis Report for the Napa Valley Subbasin (Draft). Watershed Information & Conservation Council. November 3, 2016.

Kretsinger Grabert, V. 2015. Sustainable Groundwater Management: Improving Basic Data. Invited Speaker. Presentation at meeting of Association of Women in Water, Energy and the Environment. June 30, 2015.

Kretsinger Grabert, V. 2015. Understanding Groundwater in Napa County and Ongoing Monitoring to Support Sustainability. Invited Speaker. Presentation at Napa Watershed Symposium. May 15, 2015.

Kretsinger Grabert, V. 2014. Understanding Groundwater in Napa County: Steps Towards Sustainability. Presentation to St. Helena Kiwanis. October 8, 2014.

Boyle, D., V. Kretsinger Grabert, B. Dalgish. 2014 Initial Conceptual Model of Water, Salt and Nitrate for Groundwater and Surface Water in California's Central Valley: Technical Challenges, Solutions, Results. Boyle presenting at International Salinity Forum June 17.

Kretsinger Grabert, V. and J. Borchers. 2014. Land Subsidence from Groundwater Use in California. June 16 on behalf of the Yolo County Water Resources Association. Kretsinger Grabert and Borchers presenting.

Kretsinger Grabert, V. 2014. California's Groundwater: That Sinking Feeling. Invited Panelist. California Water Policy Conference: Tangled Up in Blue. April 4.

Kretsinger Grabert, V. 2014. Napa County Groundwater. Open town meeting for public at Tucker Farm Center, Calistoga. March 10, evening.

Example Groundwater Publications and Presentations (cont.)

Kretsinger Grabert, V. 2014. Understanding Groundwater in Napa County. Presentation to Napa Valley Vintners, Yountville Community Center. March 10, morning.

Kretsinger Grabert, V. 2014 East San Joaquin Water Quality Coalition, Irrigated Lands Regulatory Program, Groundwater Assessment Report (GAR). Presentation by Klassen and Kretsinger Grabert at SWRCB Meeting March 3.

Kretsinger Grabert, V. 2014. East San Joaquin Water Quality Coalition Groundwater Quality Assessment Report. Presentation at RWQCB Stakeholder Meeting. February 26.

Dalgish B., D. Boyle, and V. Kretsinger Grabert. 2013. Large-scale water, salt, and nitrate balance calculations for groundwater and surface water for salt and nitrate management planning in California's Central Valley Floor. Geological Society of America Annual Conference, October 2013. Kretsinger Grabert presenting.

Angermann, T., V. Kretsinger Grabert, and B. Dalgish. 2012. Implementing a non traditional approach: California Central Valley Dairy Representative Monitoring Program. IAH Canada 2012 Congress; Kretsinger presenting (invited speaker).

Kretsinger, V. and B. Dalgish. 2011. Characterization of natural chromium in deep groundwater in central California. 2011 GSA Annual Meeting, Kretsinger presenting.

Kretsinger, V., B. Dalgish, and others. 2010. Pilot approach for assessing salt and nitrate loading to groundwater in California's Central Valley. NGWA Groundwater Summit 2010.

Kretsinger, V. L. Foglia, J. Herr, J. Dickey, R. Smith. 2009. Assessment of salt and nitrate sources and loading implications using a coupled surface water/groundwater model: a Central Valley example. Poster at American Geophysical Union Annual Meeting and Conference, San Francisco, CA, December 14, 2009.

Kretsinger Grabert, V. 2009. The word style "groundwater" reflects increased public awareness of the resource. Ground Water Vol. 47 (accepted February 2009, published March 31, 2009 on Ground Water Early View; Technical Commentary invited by Mary Anderson, Editor-in-Chief of Ground Water).

Foglia, L., V. Kretsinger, J. Herr, J. Dickey, R. Smith. 2009. Assessment of salt and nitrate sources and loading implications using a coupled surface water/groundwater model: a Central Valley example. Poster at 27th Biennial Groundwater Conference and 16th Annual GRA Meeting, Sacramento, CA, October 6-7, 2009.

Kretsinger, V. and T. Johnson. 2008. Summary of the 17th Annual GRA conference and meeting "Groundwater Challenges to Meeting our Future Needs". HydroVisions. Vol. 17 No.4.

Kretsinger, V. 2008. 2008 Darcy Forum – carbon sequestration: opportunities and challenges. Ground Water News & Views Column, Ground Water Vol. 46, No.6.

Kretsinger, V. 2007. Briefing Paper: Understanding state and national ground water availability requires improved monitoring networks and regional ground water assessments. Requested in person by John Watts, Legislative Director to Senator Dianne Feinstein, at the National Ground Water Association Fly- In, Washington DC. Briefing paper provided April 23, 2007. 5 pages.

Example Groundwater Publications and Presentations (cont.)

Kretsinger, V. 2007. 26th Biennial groundwater conference and 16th annual GRA meeting, "California's water future: expanding the role of groundwater". HydroVisions. Vol. 16, No.4.

Kretsinger, V., T. Elson. 2006. Regional groundwater resources assessment in Yolo County. University of California, Hydrologic Science Lecture Series. Oral presentation; Kretsinger and Elson presenting, March 30, 2006.

Kretsinger, V., T.N. Narasimhan. 2006. California's evolution toward integrated regional water management: A long-term view. Hydrogeology Journal 14:407-423.

Narasimhan, T.N., V. Kretsinger. 2006. Broader context of groundwater monitoring. 2006 GSA Annual Meeting. Oral presentation, Kretsinger presenting.

Custodio, E., V. Kretsinger, M.R. Llamas. 2005. Intensive development of groundwater: concept, facts and suggestions. Water Policy 7:151-162

Kretsinger, V., D. Cannon. 2005. Regional groundwater quality monitoring: coordinating science with policy and management, 2005 GSA Annual Meeting (Poster Presentation, Kretsinger presenting).

Kretsinger, V., T.N. Narasimhan. 2005. Sustaining groundwater resources: California's shift toward more effective groundwater management. Southwest Hydrology 4:18-19.

Kretsinger, V. 2004. Characterization of natural arsenic in a sedimentary coastal aquifer system. International Association of Hydrogeologists. 23rd IAH and 7th ALHSUD Congress, Zacatecas City, Mexico, Extended Abstract in Congress Proceedings.

Kretsinger, V. D. Cannon, K. Utley, K. Brower. 2004. Regional monitoring and data management: An essential foundation for integrated regional water management. Geological Society of America, Geoscience in a changing world: Annual meeting & exposition, Abstracts and Program, 2004 GSA Annual Meeting, 36: Paper 73-7.

Narasimhan, T.N., V. Kretsinger. 2003. Developing, managing and sustaining California's groundwater resources. A White Paper for the Groundwater Resources Association of California http://www.grac.org/CA_GW_Resources.pdf Cited 2 Aug 2005.

Narasimhan, T. N., V. Kretsinger. 2003. Developing, managing and sustaining California's groundwater resources. Newsletter of the Groundwater Resources Association of California, HydroVisions, Spring 2003.

Narasimhan, T.N., V. Kretsinger. 2003. Developing, managing and sustaining California's groundwater resources. Newsletter of the University of California Water Resources Center Archives (Vol. 10, No.2).

Kretsinger, V. 2000. Integrating hydrologic science with legal precedent. Newsletter of the Association of Ground Water Scientists & Engineers. Vol. 16, No. 6.

Example Groundwater Publications and Presentations (cont.)

Ground Water News & Views Column in Ground Water Journal, Column Co-Editors Vicki Kretsinger Grabert and Dawn Kaback (2008 - present). Column Themes:

- Carbon Sequestration (November – December 2008)
- Groundwater Replenishment with Recycled Water (July – August 2009)
- Groundwater and Energy (November – December 2009)
- Groundwater: Conflict and Crisis (May – June 2010)
- Advances and Strategies in Groundwater Remediation (November – December 2010)
- Water Issues Related to Mining (May – June 2011)
- Groundwater Research and Training (November – December 2011)
- 50th Year Tribute to Modeling: Past, Current, and Future (May – June 2012)
- Groundwater Remediation: Today and Future (March – April 2013)
- Unconventional Shale Gas Development and Potential Impacts to Groundwater (January – February 2015)
- Groundwater Management Directions: Stewardship to Sustain our Water Resources (November – December 2016)



Specialization

Mohamed's areas of specialization include modeling of groundwater flow, saltwater intrusion, fate and transport of solute, groundwater age, and multicomponent reactive transport in natural media and parameter estimation of mathematical models given different kind of observation data (head, age, and solute concentration), groundwater sustainability through quantification and simulation of groundwater age at regional scales. Mohamed worked on the transport simulations for the AID MZ Model for the CV-SALTS SNMP Archetype Management Zone project. Also, he developed the regional scale solute transport model for Westland water district to quantify unreasonable water quality key related to SGMA. Mohamed devolved a mathematical modeling of the dynamics of bio-chemical reaction on porous media properties (porosity and intrinsic permeability) during microbially-induced biocementation. These efforts have involved intensive use of a wide range of computer modeling tools including MODPATH, MODFLOW, MT3DMS, MT3D-USGS, SEAWAT, PHT3D, PHREEQC and UCODE. Mohamed is also experienced in using geostatistical tools to estimate required variables at unsampled locations.

Representative Professional Assignments

- Surface water-Groundwater interaction study at Sunol Valley Groundwater Basin
- Modeling of transport at Westland Basin, CA, USA for SGMA
- Modeling of groundwater flow at Tulare Lake Groundwater Basin, CA, USA for SGMA
- Groundwater-Surface water interaction of Feather River and Groundwater Basin, CA, USA.
- Modeling of flow and transport of Alta Irrigation District (AID) as management zone archetype, CA, USA.
- Modeling of regional saltwater intrusion of the Gulf of Taranto, Italy.
- Modeling of multicomponent reactive transport and biogeochemical process in natural media, CA, USA.
- Modeling of groundwater flow and age in the northern part of San Joaquin Valley, CA, USA.
- Modeling of salinity mixing to control salinity the Mendota Wildlife Area (MWA), CA, USA.
- Modeling of ground water flow at Teichert Woodland (Shifler Parcel), CA, USA.

EDUCATION

PhD, Civil and Environmental Engineering, University of California, Davis CA	2015
M.S., Groundwater Hydraulics, Cairo University	2004
B.S., Civil Engineering, Cairo University	1999

PROFESSIONAL EXPERIENCE

Luhdorff & Scalmanini Consulting Engineers Project Engineer	2015 - Present
University of California-Davis Post-Doctoral Fellow	2016 - 2017

Teaching:

University of California, Davis, 2015 - 2016
ECI141 (Hydraulics Lab), HYD146 (Hydrogeology and Contaminant Transport), HYD144 (Hydrogeology), ECI144 (Groundwater Systems Design), ECI114 (Probabilistic Systems Analysis for Civil Engineers), ECI271 (Inverse Problem), ECI272A, B, C (Advanced Hydrogeology-Flow, Transport, Reactive Transport).

Theoretical:

Teaching different UC-Davis courses at Civil and Environmental Engineering (CEE) and Land, Air, Water Resources (LAWR) departments at with focus in analytical and numerical groundwater flow and transport modeling.

COMPUTER SKILLS

- Hydrogeology forward modeling (flow, transport, reactive transport): MODFLOW, MT3DMS, MT3D-USGS, SEAWAT, PHREEQC, PHT3D, SHEMAT and HYDRUS
- Inverse modeling: UCODE
- Programming: FORTRAN, MATLAB, MathCAD.
- Geostatistics: GS+, SURFER.

Referenced Publications

Nassar, M.K., Deviyani Gurung, Mehrdad Bastani, Timothy R. Ginn, Babak Shafei, Michael G. Gomez, Charles M. R. Graddy, Doug C. Nelson, Jason T. DeJong (2018), **Large-Scale Experiments in Microbially Induced Calcite Precipitation (MICP): Reactive Transport Model Development and Prediction**, Water Resources Research, DOI: 10.1002/2017wr021488

Ginn, T. R., L.G. Schreyer, X. Sanchez-Vila, M.K. Nassar, A.A. Ali, S. Kräutle (2017), **Revisiting the Analytical Solution Approach to Mixing-Limited Equilibrium Multicomponent Reactive Transport Using Mixing Ratios: Identification of Basis, Fixing an Error, and Dealing with Multiple Minerals**, Water Resources Research, DOI: 10.1002/2017wr020759

Kamai, T., M. K. Nassar, K. E. Nelson and T. R. Ginn (2015), **Colloid Filtration Prediction by Mapping the Correlation-Equation Parameters from Transport Experiments in Porous Media**, Water Resour. Res., doi: 10.1002/2015WR017403

Nassar, M. K. and T. R. Ginn (2014a), **Impact of numerical artifact of the forward model in the inverse solution of density-dependent flow problem**, Water Resour. Res., 50, doi: 10.1002/2013WR014672

Nassar, M. K., and T. R. Ginn (2014b), **Cauchy data requirement of the inverse problem of the mean age equation**, Water Resour. Res., 50, doi:10.1002/2013WR014674

Presentations/Workshops & Training Courses

Nassar, M.K., D. Gurung, M. Bastani, T.R. Ginn, M. Gomez, C. Graddy, D. Nelson, J. DeJong (2019), **“Modeling a large scale experiment in MICP using independently determined parameters”**, 11th International Conference on Porous Media & Annual Meeting (InterPore2019), May 6 - 10, 2019, Valencia, Spain.

Nassar, M. K., D. Gurung, M. Bastani, M. Gomez, C. Graddy, J. DeJong, D. Nelson, T.R. Ginn (2018), **“Large-Scale Experiments in Microbially-Induced Calcite Precipitation (MICP): Reactive Transport Model Development and Prediction”**, “, EGU General Assembly, April 8-13, Vienna, Austria

Nassar, M. K., V. K. Grabert, Dalgish, B. J. Dickey, D. Moss, (2018) **“A Flow and Transport Model Developed as a Salt and Nitrate Management Analysis Tool for a Management Zone in California’s Eastern Kings Subbasin”**, 24th CWEMF ANNUAL MEETING “California Sustainability of Resources, the Environment & Lifestyle through Modeling” April 2-4 2018, Folsom-CA, USA.

Kamai, T., M. K. Nassar, K. E. Nelson, and T. R. Ginn (2017) **“Using data from colloid transport experiments to parameterize filtration model parameter”**, EGU General Assembly 2017, April 23-28, Vienna, Austria.

August 08-09, 2016: Workshop in title of **“PHT3D Short Course –MICP Focused”** organized and presented by M. K. Nassar, D. Gurung, and T. R. Ginn, for participants in the NSF ERC Center for Biomediated and Bioinspired Geotechnics, Civil and Environmental Engineering Department, at UC Davis. This two-day workshop detailed the theory and mathematical modeling of the dynamics of bio-chemical reaction on porous media properties (porosity and intrinsic permeability) during microbially-induced biocementation. This process involves in-situ stimulation of native ureolytic bacteria which then serve as distributed catalyst for ureolysis of injected urea, leading to distributed calcite precipitation. We examined the mathematical modeling of experiments in the context of geotechnical manipulation of subsurface soil strength. The workshop involved description and teaching of the use of MODFLOW-PHT3D as well as presentation of the challenges of modeling the biotic phase. The workshop closed with focus on frontier engineering science questions involved in extending the model to application to real field problem.



Specialization

Ms. Dhaliwal has eight years of professional experience in data analysis, data collection, and solute transport modelling. Ms. Dhaliwal is well versed in statistical plume analysis, GIS mapping, geochemical modelling and data analysis, groundwater flow modelling, and database development. Ms. Dhaliwal engages in groundwater level and quality data processing to identify flow patterns, geochemical trends, and potential relationships to management practices.

Representative Professional Assignments

Contributing to Westlands Water District’s GSP development. Evaluated current monitoring program and made recommendations for SGMA compliance. Reviewed current data management system and currently involved in developing a management system to meet GSP reporting requirements. Assisting in creating data input files for MODFLOW platform based groundwater model.

Conducted a pilot study in Kern County to assess the suitability for a potential recharge project. Examined soils data and hydraulic conductivity and participated in double ring infiltration tests to calculate infiltration rates and made recommendations for further investigations.

Engaged in a data collection campaign at dairy farms through the use of meteorological equipment and pressure transducers. Conducted analysis for pond seepage experiment to quantify pond seepage and subsurface loading and examine relationships between water quality data and loading rates. Performed uncertainty analysis on subsurface loading data.

Performed analysis on groundwater level data including contouring and mapping to observe varying flow patterns on a monthly basis for 42 dairies in the Central Valley.

Tracked plume movement through scale invariant, heterogeneous media via random walk particle tracking model. Concluded that scale-dependent dispersivity could be explained through mass transfer between aquitard and aquifer and flow through interconnected fluvial channels.

Developed a SGMA compliant monitoring program for sustainability indicators for Westlands Water District. Created an internal database to compile and analyze water level, water quality, and subsidence data. Using spatial analysis in conjunction with temporal trend analysis, devised a well distributed monitoring program to meet GSP needs.

Assisted with TDS impact analysis on groundwater for irrigation districts evaluating a pumpback water exchange program. Utilized an LSCE developed mixing model to determine TDS changes in the Upper Aquifer in each district over time. Conducted an optimization analysis to determine additional surface water delivery volumes required to ensure a net zero impact from increased TDS concentrations in applied water.



EDUCATION

M.S., Hydrologic Sciences,
University of California Davis
Davis, CA 2014

B.Sc., Cognitive Systems minor in Biology,
University of British Columbia Vancouver,
Vancouver, BC 2008

PROFESSIONAL EXPERIENCE

Luhdorff and Scalmanini,
Consulting Engineers Inc.,
Woodland, CA
Project Hydrologist 2013 to Present

University of California Davis,
Davis, CA
Graduate Student Researcher 2010 - 2013

PROFESSIONAL AFFILIATIONS

California Groundwater Resources Association



Specialization

Nick has NINE years of professional experience in hydrogeology and numerical modeling. He has a background in hydrogeologic conceptualization, regional and local scale groundwater flow and solute transport modeling, and monitoring program design and implementation. He has diverse modeling experience that has included studies analyzing pumping induced impact on groundwater-surface water interaction and montane meadows, local and regional scale solute transport, groundwater overdraft, and subsidence. Recently, Nick has been involved in the development of numerical models used to provide technical support for GSP preparation in the Westside and Delta-Mendota Subbasins.

Representative Professional Assignments

Groundwater Modeling

- Developed and calibrated basin-wide transient groundwater flow and solute transport model of the Westside Subbasin using MODFLOW-OWHM for GSP technical support.
- Developed and calibrated regional groundwater flow and solute transport model to evaluate drawdown, subsidence rates and water quality impacts from proposed 400,000 acre-foot groundwater exchange program.
- Developed and calibrated a numerical model of stream depletion on the Feather River to establish exchange rates for a groundwater transfer program administered by the State Water Contractors.
- Developed transient groundwater model of the Yosemite Valley to evaluate impacts of groundwater pumping on meadow hydrology and streamflow in the Merced River using MODFLOW-USG.
- Developed groundwater flow and contaminant transport model of the Barnes Aquifer using MODFLOW-2000. Coupled EPA HELP and MT3D/RT3D to evaluate effects of a proposed landfill expansion on regional groundwater chemistry in Easthampton, MA.
- Compiled and processed hydrologic data and led preliminary development of a watershed response model of the Delaware River to evaluate dwarfwedge mussel habitat management scenarios.
- Critical reviews of USGS CVHM, DWR C2VSIM, Sac IGSM, Modesto Regional Groundwater Model and Paso Robles Groundwater Basin Model.

Field Monitoring

- Led field operations including monitoring well design and installation, contracting, environmental compliance and long-term water level monitoring as part of an interdisciplinary floodplain restoration study on the lower Cosumnes River.



EDUCATION

M.S., Hydrologic Sciences,
University of California Davis
Davis, CA 2014

B.A., Natural Sciences,
Hampshire College,
Amherst, MA 2008

PROFESSIONAL EXPERIENCE

Luhdorff and Scalmanini,
Consulting Engineers Inc.,
Woodland, CA
Project Hydrogeologist 2017 to present
Staff Hydrogeologist 2014 - 2016

University of California at Davis, CA
Research Assistant 2010 - 2014

Northeast Instream Habitat Program
Research Internship 2007 - 2008

University of Idaho
Research Internship 2007

COMPUTER PROGRAMMING SKILLS

Numerical Modeling: MODFLOW-2005, MODFLOW-USG, MODFLOW-OWHM, MT3D-USGS and RT3D

Inverse Modeling: UCODE 2014

Programing: MatLab, FORTRAN, Visual Basic and Python

Geostatistics: GS+, SURFER, ESRI Spatial Analyst/Geostatistical Analyst, TProGS

PROFESSIONAL AFFILIATIONS

California Groundwater Resources Association

Representative Professional Assignments (cont.)

- Designed and implemented long-term groundwater and surface water monitoring program in the Yosemite Valley including installation of shallow piezometers, instrumentation of artesian production wells and installation of stream gages.
- Designed and executed field study examining the spatial variability of wind speed in undulating terrain. Used results to validate GIS-based wind speed model used to estimate potential evapotranspiration.

Publications and Presentations

Newcomb, N.J. 2014. Evaluating the impact of groundwater pumping on meadow hydrology and streamflow in the Yosemite Valley. *Hydrovisions* 23 No. 3: 17-20.

Liu, Y., **N.J. Newcomb** and G.E. Fogg. 2013. Spatial pattern and temporal dynamics of groundwater surface water interaction in heterogeneous alluvial fan system. American Geophysical Union Fall Meeting, San Francisco, CA.

Liles, G.C., **N.J. Newcomb**, Y. Liu, J.H. Viers and G.E. Fogg. 2013. Using high resolution subsurface modeling in managed aquifer recharge. American Geophysical Union Fall Meeting, San Francisco, CA.

Newcomb, N.J. and G.E. Fogg. 2011. Hydrogeology of a portion of the Yosemite Valley: Groundwater and surface water interaction and conceptual groundwater model. Final Project Report Prepared for U.S. National Park Service, 53 pp.

<http://www.nps.gov/yose/parkmgmt/upload/groundwater-Yosemite-Valley-final.pdf>

Newcomb, N.J. and G.E. Fogg. 2011. Hydrogeology of a portion of the Yosemite Valley: Groundwater and surface water interaction and conceptual groundwater model. American Geophysical Union Fall Meeting, San Francisco, CA.

Newcomb, N.J. and R.M. Newton. 2008. Modeling the effect of leachate transport on regional groundwater chemistry. Massachusetts Water Resources Research Conference, Amherst, MA. (Awarded Best Student Poster)

**PROPOSAL
OF
STETSON ENGINEERS INC.
FOR
AS-NEEDED HYDROGEOLOGICAL CONSULTING SERVICES
PREPARED FOR:
THE SAN LORENZO VALLEY WATER DISTRICT**

JUNE 24, 2019



W A T E R R E S O U R C E P R O F E S S I O N A L S
S E R V I N G C L I E N T S S I N C E 1 9 5 7



June 24, 2019

Reply to: San Rafael

Holly Hossack, District Secretary
San Lorenzo Valley Water District
13060 Highway 9
Boulder Creek, CA 95006

Subject: Proposal for As-Needed Hydrogeological Consulting Services

Dear Ms. Hossack:

Stetson Engineers is excited about this opportunity to provide hydrogeology consulting services to meet the San Lorenzo Valley Water District's (SLVWD) needs during development of the Santa Margarita Groundwater Basin (SMGB) Groundwater Sustainability Plan (GSP). We have been serving clients' civil, water resources, and environmental engineering needs throughout California for over 62 years and look forward to demonstrating our commitment, expertise, and project team benefits in the attached statement of qualifications (SOQ).

Stetson is a leader in groundwater resource planning and basin sustainability throughout California and the southwest as evident by our work in groundwater sustainability planning and planning for integrated surface-groundwater systems. Our team of groundwater modeling and hydrogeologic experts are leaders in their field who specialize in simulating the impacts of basin-wide projects on streamflow and environmental habitat resources. Their experience has addressed issues in coastal basins that are similar to those that exist in the San Lorenzo River Watershed.

The character of the San Lorenzo River Watershed is renown. You seek a consultant that is not only well versed in groundwater modeling, management, and the Sustainable Groundwater Management Act, but also one that is committed to working closely with you in an advisory relationship on jointly developed solutions for long term sustainability. Stetson is committed to helping the SLVWD develop and attain its key goals collaboratively.

I will serve as Principal in Charge and oversee this project and can be reached at: 2171 East Francisco Blvd., Suite K, San Rafael, CA 94901; (760) 730-0701; (415) 457-1638 (fax); stever@stetsonengineers.com.

We believe the Stetson Team is the best qualified firm to provide hydrogeological support and appreciate the opportunity to submit our qualifications. Please contact me at any time if you have questions or need additional information during your review of our SOQ.

Sincerely,

A handwritten signature in black ink, appearing to read "S. Reich", is written over a light blue horizontal line.

Stephen Reich, P.E., P.G.
Principal

2. BACKGROUND

Meeting the mission of ensuring sustainable groundwater resources for the benefit of SLVWD requires a coordinated effort between the District, the public, and technical professionals who are industry leaders in their field. While expertise may be reflected by years of experience or the number of successful projects, it is also defined by vision and understanding of integrated surface-groundwater systems, future groundwater management methods, and statutory requirements that will affect both supply and demand.

This is especially true in the San Lorenzo River watershed, where the protection of precious terrestrial, riparian, and aquatic resources and habitat for steelhead, salmon, and other sensitive, threatened, and endangered species must be balanced with protection and maintenance of local water supplies. Understanding the integrated nature of the system and limitations upon groundwater development in order to achieve sustainability is the cornerstone in developing a successful groundwater sustainability plan (GSP) that meets the needs of the SLVWD stakeholders while satisfying regulatory requirements.

Stetson Engineers has assembled a team of innovative experts to provide in-depth experience in hydrogeology to support the District and represent its interests at the Santa Margarita Groundwater Agency (SMGWA) as it develops a GSP to comply with the Sustainable Groundwater Management Act (SGMA). Stetson Engineers Inc. is a California small business (#26650) which has been providing water resources expertise in California for 62 years. As requested in the RFQ, Stetson has no past bankruptcy filings, nor has it had any contract or subcontract which has been terminated, placed in default, or had claims made against it that resulted in litigation or arbitration during the last five years.

Stetson has supported development and administration of Groundwater Sustainability Agencies (GSAs) under the SGMA and has developed many GSPs, GMPs, and Salt and Nutrient Management Plans (SNMPs) for many of California's groundwater basins. We have also authored many special studies for conjunctive use, recycled water recharge, stormwater management for recharge, and adaptive management plans for managing sensitive riparian and aquatic habitats in conjunction with groundwater production. Together, these programs, projects, and studies form the basis for not only understanding statutory requirements related to integrated sustainable surface water resources and groundwater supplies, but also environmental and legal requirements that must be addressed in such projects and programs.

The Stetson Team sets itself apart from others due to our expertise in understanding coastal hydrogeology and the regulatory framework, and experience working to build consensus around meeting the needs of all stakeholders. Our recent work with regulatory resource agencies resulted in two successful Biological Opinions that protect a distinct population of southern steelhead (*Oncorhynchus mykiss*) and endangered avian and terrestrial species under a groundwater project operations plan. Stetson developed a unique algorithm using MODFLOW and analytical methods to estimate project impacts to riverine habitat that was relied upon by National Marines Fisheries Service and Fish and Wildlife Service to quantify impacts.

Our unique abilities in developing innovative and creative solutions based on fundamental principles of science and engineering have resulted in successful projects throughout California. Stetson Engineers has worked closely with the United States Geological Survey (USGS) for more than 25 years. Our collaborative

effort with the USGS has resulted in a professional relationship in developing groundwater management plans that rely on groundwater and surface water modeling, multi-level monitoring well installations, and water quality analyses to provide aquifer delineation and storage analysis.

Based on our level of experience and expertise, we believe the Stetson team will exceed the SLVWD's expectations for hydrogeological support during development of the GSP.

Project Understanding

The Stetson Team understands that the SLVWD is committed to managing its water resources sustainably. The population within the SLVWD service area and the Santa Margarita Groundwater Basin is expected to increase over the next 20 years, and there are concerns that there is potential for higher frequency and more extreme drought conditions in the future. Clearly, sustainable management of local groundwater resources is of paramount concern.

The SLVWD owns, operates, and maintains four permitted water systems in three service areas, each of which provides supplies from separate water sources: North Service Area (20.9 square miles) and Lompico (2.5 square miles); South Service Area (0.8 square mile); and Felton Service Area (2.2 square miles). Land uses within the District's service areas include timber, State and regional parks, water supply watersheds, rural residential, low-density urban residential and commercial, quarries, agriculture, and other open space. The District relies on both surface water and groundwater resources, including nine currently active stream diversions, one groundwater spring, eight active groundwater wells, and operates two surface water treatment plants. These sources are derived solely from rainfall within the San Lorenzo River watershed. The District's water distribution system is complex, matching the dispersed pattern of development and widely distributed raw water sources. The District's three systems have very limited above-ground storage capacity and rely on groundwater for seasonal and year-to-year storage. The District produces and treats water based on relatively immediate water demand.

The Basin covers about 33 square miles on the southwestern slope of the central Santa Cruz Mountains, forming a roughly triangular area that extends from Felton in the southwest, to Boulder Creek in the northwest, to Scotts Valley in the east. The San Lorenzo River is the most significant surface water feature in the Basin. Important tributaries to the river include Lompico Creek, Zayante Creek, Bean Creek, and Carbonera Creek. The San Lorenzo watershed is home to sensitive and threatened species including Coho salmon, steelhead, and lamprey.

The basin hydrogeology is complex, with four stacked aquifers and surface-groundwater interaction. The main aquifers are the Santa Margarita Formation, Lompico Formation, and the Butano Formation. The Monterey Formation, which separates the Santa Margarita Formation from the Lompico Formation, acts as an aquitard. Unconfined conditions exist in the Santa Margarita Formation and semi-confined or confined conditions occur in the Lompico Formation.

The Santa Margarita aquifer is the shallowest aquifer in the Basin. It is usually the first aquifer to be impacted by changing hydrologic conditions. Along the southeastern margin of the Basin underneath Scotts Valley, the Santa Margarita Aquifer is in direct contact with the underlying Lompico aquifer. In these

areas, the Santa Margarita aquifer remains unsaturated, as it has since the 1980s when groundwater levels in the Lompico aquifer declined. Elsewhere, the Santa Margarita aquifer overlies the Monterey Formation that hydraulically separates it from the deeper Lompico Aquifer. Groundwater levels in these areas have remained relatively stable over time, demonstrating that groundwater levels in the Santa Margarita aquifer respond independently from changes in the Lompico aquifer in locations where the Monterey Formation is present. The Lompico aquifer is the primary producing aquifer in the Basin and provides a large percentage of the municipal water supply, especially in the Scotts Valley area. Pumping from this aquifer to produce approximately 75% of the groundwater used by Scotts Valley Water District (SVWD) has contributed to groundwater level declines in the Lompico aquifer underlying the central portion of SVWD. In this area, groundwater levels have decreased up to 5 feet. Away from the pumping center, groundwater levels have increased by up to 2 feet in recent years. The geologic interpretation is that the Lompico aquifer is in direct contact with the overlying Santa Margarita aquifer in the southern portion of the Basin. This direct contact between the two aquifers allows recharge to more rapidly increase groundwater levels in the southern portion of the Lompico aquifer. The Butano aquifer is a significant water-producing aquifer in the Basin for SVWD, accounting for 24% of groundwater production during WY 2017.

From 1996 to 2006, static groundwater levels at some wells fluctuated seasonally within an elevation range of 200 to 300 feet above mean sea level (amsl). With decreased pumping since then, groundwater levels have increased slightly, and the seasonal range in groundwater elevations is typically between 250 and 300 feet amsl. Groundwater levels in the Butano aquifer declined between 4 and 8 feet in the vicinity of the SVWD production wells. With increasing distance from the pumping center, groundwater levels are less affected by pumping. A granitic basement rock constitutes the definable bottom of the Basin.

In summary, during the last four decades of the twentieth Century, groundwater levels in many parts of the basin were drawn down. Portions of the Lompico aquifer experienced significant groundwater level declines of up to 200 feet in some areas. It is estimated that the Basin lost an estimated 28,000 acre-feet in storage, resulting in diminished local water supply and reduced sustaining base flows to local streams that support fisheries and habitats for other sensitive species. Since that time, and due to concerted efforts at conservation and demand management by local water agencies, groundwater production has decreased by 45% (since 1997). Over the last ten years groundwater supplies and demand have been in balance, albeit at a drawn down level.

In 1994 a GMP was developed as an initial framework for coordinating the management activities. The GMP provided background information on the agencies and other stakeholders involved in the Basin, described the hydrogeological and land use setting, established a water budget and set Basin Management Objectives, which include:

- Encouraging public participation through an annual report of groundwater management activities and its presentation at one or more public meetings.
- Coordinating with other local agencies.

- Continued monitoring and evaluation of groundwater conditions.
- Implementing groundwater augmentation projects.
- Investigating groundwater quality and preventing groundwater contamination.

This plan was an important step in coordinating stakeholder involvement, monitoring, and management and protection of the Basin. Work has been done in the intervening years to collect additional data to fill data gaps and develop a better understanding of groundwater and water use dynamics in order to sustainably manage the Basin.

The Basin Model was developed in 2006 and updated in 2015 with new data, MODFLOW code advancements, and improved methods for estimating streamflow inputs, thereby improving the model's calibration. Sustainable yield for the combined aquifers was calculated as 3410 AFY. A series of model scenarios were developed accounting for continuation of past practices and implementation for conjunctive use, active recharge, low impact development, and climate variations. During 2018 an independent review of the 2015 Basin Model produced a number of recommendations for enhancing the model, including expanding the model grid and model period; reducing the model timestep; updating methods of calculating recharge and evapotranspiration; updating model calibration; as well as other improvements.

The SLVWD, SVWD, City of Santa Cruz, and County of Santa Cruz have entered into a Memorandum of Agreement to explore and evaluate potential projects for the conjunctive use of surface and groundwater resources in the SMGB and San Lorenzo River watershed. In the future, the Emergency Intertie between SLVWD and SVWD could be converted to a permanent Regional Intertie to support conjunctive use in the basin. Low Impact Development projects constructed in the Basin will induce greater recharge of stormwater runoff and increase water quality into the future. Increasing the conjunctive use of groundwater and surface water supplies within the San Lorenzo River watershed has the potential to improve water rights compliance, instream flows, and groundwater storage. The potential for increased conjunctive use is supported by the occurrence of divertible streamflow exceeding local demand, the recent construction of system interties, and SLVWD's mostly unused annual allotment of Loch Lomond Reservoir storage. There is also potential for conveying available surface water to the Scotts Valley area for use as in-lieu recharge (i.e., used as a substitute for groundwater pumping, contributes to groundwater storage recovery).

Groundwater quality is generally good. Elevated concentrations of iron and manganese are addressed through treatment, and total dissolved solids (TDS) is measured above secondary maximum contaminant levels (SMCL) in some production wells.

The Basin was designated as a medium-priority basin by DWR, and as the GSA for the Basin, the SMGWA is now responsible for developing a GSP that will guide future water resource management in the Basin. The GSP will encompass the entire Basin and be completed and submitted to DWR by January 31, 2022.

Approach

Stetson's proposed method to accomplish the work is based on consistent communication and transparency between the Stetson Team, the SLVWD Board of Directors and staff, and the Santa Margarita Groundwater Agency. Stetson's Principal in Charge will be responsible for every aspect of the work and will provide direction, solutions, and quality control throughout each project. Stetson will provide the highest quality work product by first developing an in-depth understanding of the project, followed by a stepwise approach, and assignment of responsibility to appropriate experts. Our role as Water Resources Manager in other areas of California provides us with the insight and experience for maintaining clear and open communication with SLVWD and stakeholders, as well as with DWR.

Our project management approach is to plan, organize, lead, and monitor resources in a proactive and clear manner. A kick-off meeting will open lines of communication and promote understanding of project objectives, any constraints upon the project, and the District's needs and expectations. Stetson will communicate the initial approach for the work and gather preliminary data and information. Early in the project, Stetson will develop the project timeline, identify milestones, and establish deadlines for deliverables in coordination with the District.

Clear and open lines of communication are essential to successful projects and have an outsized impact on project efficiency, cost control, and timeliness. The Principal in Charge will manage the project, leading regular project meetings with the Project Team to oversee progress, track performance against project objectives, ensure resources are allocated and kept available, costs are on budget and on schedule, and challenges are anticipated and overcome. Documents will be maintained and shared via a *SharePoint* system to disseminate key project information and to facilitate the team's shared work and version control. The Principal in Charge will communicate on a regular basis at a frequency amenable with the District via conference calls, scheduled project meetings, and monthly progress reports. Stetson will use MS Project software to coordinate resources, establish and track timelines, and manage the critical path for each task with the overall GSP development. Stetson uses a variety of software platforms for technical analyses, design, communications, reporting, presentation to meet the project requirements.

Proposed Tasks

We propose the following tasks to provide hydrogeological support to the SLVWD:

- Representation of SLVWD's interests at the SMGA during development of the GSP.
- Identification of potential management areas for the GSP.
- Development of specific projects necessary to maintain or achieve water supply sustainability.
 - The Stetson Team will work closely with the District and SMGWA to develop and evaluate projects and management actions that may be required to reach interim milestones and long-term sustainability goals for the Basin. This work will build upon planning and studies already completed within the Basin, including: conjunctive use, Low impact Development, water efficiency programs, and other such actions.

- Identify new sources of supply, including well locations.
- Review and develop recommendations regarding Conjunctive Use and other options to sustainably manage the water supply.
 - Stetson will work closely with the District in developing prioritization criteria to evaluate each potential project or management action. Key criteria may include capital and O&M costs, permitting, public acceptance, ease of construction, and effectiveness for improving groundwater quantity and quality. The numerical models can also help to guide prioritization of proposed actions.
- Preparation and attendance of meetings with the District Board of Directors.
- Development of hydrologic assessments and project related impacts to water availability, and recommendations to the District to sustainably manage the District’s water resources.
 - Stetson will evaluate sustainability indicators and work with the District to set minimum thresholds and measurable objectives. Stetson will also perform hydrologic assessment and evaluate project related impacts to water availability and sustainability. Methodologies and approaches will be developed based on a combination of hydrologic model simulations, empirical analyses of field data, and other robust hydrogeologic tools.
 - Projects and management actions will be evaluated for each sustainability indicator, with the minimum threshold indicated that will trigger implementation, implementation timetable, expected benefits, required legal authority, regulatory permitting, and implementation costs.
- Third-party review of water resources-related documents and data.
- Evaluation and reporting related to specific issues that may be encountered.
- Client communication.

3. EXPERIENCE

Stetson Engineers is at the forefront of hydrogeological investigation and modeling of complex, integrated surface-groundwater systems. We have highlighted projects below that reflect specialized groundwater hydrogeology, planning, and management tasks including SGMA programs similar to those identified in the RFQ.

Water Resources Manager for Groundwater Sustainability Agency

Indian Wells Valley Groundwater Authority, Ridgecrest, CA

Mr. Ron Strand, Acting General Manager, (760) 499-5002
 Contract Value ~ \$3,000,000

Indian Wells Valley is a 600-square mile critical priority SGMA groundwater basin located at the intersection of Kern, Inyo, and San Bernardino counties overseen by the Indian Wells Valley Groundwater Authority (GA). The GA unanimously approved



an agreement for Stetson Engineers to serve as the **Water Resources Manager for addressing the SGMA**. This work includes working in consultation with the GA to develop the GSP, interface with local, state, and federal agencies, and implement the plan. The GA Board tasked Stetson to apply for a Prop 1 Grant that secured over \$2,000,000 for developing the GSP; and to develop and administer pumping assessment fees for ongoing funding of the GA.

GSP Development

As the Water Resource Manager, Stetson Engineers is currently working with the Indian Wells Valley GA Board, Technical Advisory Committee (TAC), and Policy Advisory Committee (PAC) to **develop the GSP by January 2020**. The Technical aspects include **development of the hydrogeologic conceptual model**, numerical modeling for historical, baseline, and management alternatives through 2070; **development of a monitoring network** to establish sustainable criteria and measurable management objectives; identification of data gaps with accompanying monitoring well drilling, groundwater and surface water quality baseline sampling, and **aquifer performance testing**. Stetson has been developing the GSP under the DWR regulations for the last 1-1/2 years using the guidelines and best management practices developed for SGMA.

As part of the development of the GSP, Stetson implemented an initial **Data Management System (DMS)** (www.iwvgsp.com) for the basin. This web-based tool includes data storage, analysis, visualization and reporting information for the basin. **Integrated visualization tools** include interactive web-based mapping and interactive web-charting which pull and update from web-standard open source MySQL relational database. Web charts include options to directly export data into common tabular Excel formats with included associated metadata, as well as image export options. Access controls are implemented for granular access of specific data to specific users. Supplemental reference GIS feature layers are included as well as hosting a rendered tile layer which live streams directly to standard GIS programs. Other features include a searchable document library of water supply, geological, and planning documents for the development of the GSP. Software is built in a fully open source environment, meaning that features are fully customizable for future expansion and evolution, and annual software license maintenance fees are limited.

Comprehensive Groundwater Modeling, Basin Management, and Planning

Marine Corps Base Camp Pendleton, CA

Ms. Jessica Spurlock, Contracting Officer's Technical Representative

Water Resource Division, (760) 725-1466

5-year, \$7.5 million Firm Fixed Price Contract; ongoing

Stetson Engineers has been providing technical water resources management and water right support to Marine Corps Base Camp Pendleton in northern San Diego County since 1989. Technical support has included surface water hydrology on four coastal rivers and streams, groundwater modeling and management, reservoir maintenance and management, water quality (both surface and groundwater), watershed management, salinity management, and water rights. Legal support has included settlement negotiations with two public agencies party to on-going litigation that began in 1951, negotiations with resource agencies, permit acquisition, and SWRCB water rights support.



Stetson supports the implementation of Camp Pendleton's groundwater monitoring program, which consists of 85 groundwater monitoring wells with level loggers and telemetry equipment. Stetson employees process the raw 60-minute datalogger pressure data collected by Camp Pendleton, to groundwater elevations and depth to water, and provide the base with the data through several channels. Stetson provides Camp Pendleton with a GIS-enabled website with a database backend, that allows the base to browse and compare water level readings at both high detail (hourly) and long term (daily averages and monthly averages). Stetson has incorporated additional data sources including water quality data, real time surface flows, and USGS data for comparison. The website allows for Camp Pendleton to download the raw numbers in excel format. In addition, Stetson provides the monthly average data with graphs showing the period of record at each well. Camp Pendleton spans several basins, one of which is under a court appointed Watermaster. Stetson assists in the reporting to the Watermaster.

- **Developed MODFLOW flow and MT3D Transport models** for four coastal groundwater basins along 17 miles of coastline
- Completed Feasibility Studies for **Recharge Enhancement, Aquifer Injection, Constructed Treatment Wetland Development, Stormwater Capture**, and other water management techniques
- Authored **Conjunctive Use Project** to Enhance Local Water Supply
- Installed Multi-Level Groundwater Monitoring Wells
- Installation and Maintenance of Dataloggers, Telemetry and Data Management System
- Performed Surface and Groundwater Quality Monitoring and Sampling
- Water Quality Sampling and Investigation to **Characterize Emerging Contaminants of Concern for Recycled Water Indirect Potable Reuse**
- **Groundwater Modeling** for Salt and Nutrient Management Plans

Regulatory Support for Potential Impacts to Aquatic/Riparian Protected Species Marine Corps Base Camp Pendleton, CA

Ms. Jessica Spurlock, Contacting Officer's Technical Representative, Water Resource Div (760) 725-1466
5-year, \$7.5 million Firm Fixed Price Contract; ongoing


As a sub-task under the Comprehensive Groundwater Management, Basin Management, and Planning Program, Stetson served as a key member of the negotiating team for several regulatory consultations under Section 7 of the Endangered Species Act. **Stetson negotiated with NMFS regarding instream flow requirements for steelhead** and seasonality of conjunctive use and groundwater recharge practices on Camp Pendleton. 

Stetson also negotiated with the USFWS regarding potential impacts to arroyo toad, southwest willow flycatcher, least Bell's vireo, and other protected species. These consultations led to development of Biological Assessments (BA) and Biological Opinions (BO) for management of the Base's water resource management on the Santa Margarita River. An important aspect of the negotiations involved developing an Adaptive Management Plan (AMP) for **managing sustainable yield from Camp Pendleton's aquifers while supporting sensitive species habitat**. The AMP is a decision-making tool based on real-time monitoring of streamflow, groundwater levels, and riparian ecology. Developed in coordination with NMFS and USFWS, the AMP provides triggers, thresholds, and management actions to control sustainable use of the Base's water resources.

San Luis Rey Indian Water Authority SGMA Services

San Luis Rey Indian Water Authority, CA

Mr. David Garcia, General Manager, (760) 742-1903
Contract value is \$146,000

Stetson is providing **technical support services** to the San Luis Rey Indian Water Authority (SLRIWA) regarding the provisions of SGMA in the San Luis Rey Groundwater Basin in San Diego County. 

Stetson has **conducted workshops** for the SLRIWA on the requirements and schedule for SGMA and advised the SLRIWA on the alternatives available to the SLRIWA to interact with local agencies and DWR regarding SGMA. Stetson is one of the SLRIWA's

four **representatives on the Executive Team for governance of the SGMA process for the Basin** and is the SLRIWA's sole representative on the stakeholders' **Technical Team** providing technical oversight of the development of the GSP.

Groundwater Management Support

Santa Ynez River Water Conservation District, CA

Dr. Bruce A. Wales, General Manager, (805) 693-1156

Contract Value: \$5,000,000+

Stetson has provided engineering services and support to the Santa Ynez River Water Conservation District (SYRWCD) since 1968. Stetson's services include preparation of water resources management studies; preparation of studies of **conjunctive use** of groundwater and surface supplies from various sources; hydrological studies of the river system and operations of river control facilities; design and construction of groundwater recharge basins; studies of historical water rights; serving on the technical committee for AB3030 **groundwater basin planning; perennial groundwater yield determinations; water quality evaluations; and determination of supplemental water requirements and alternative water supply sources**. Stetson developed or modified computer models of groundwater flow and transport to evaluate basin management alternatives and environmental impacts. Stetson also **developed river flow and reservoir operation models**. The models have been used extensively in simulating alternative system operations in order to determine the most economical method of managing supplies, protecting groundwater quality, and meeting instream flow needs for fish and aquatic habitat.

During 2019 Stetson was selected by the SYRWCD to develop two GSPs: West Management Area of the Santa Ynez Basin and Central Management Area of the Santa Ynez Basin. Work is currently underway developing the Database Management System and the Stakeholder Engagement Plan.

Sustainable Groundwater Management Act Services

City of La Habra, CA

Mr. Elias Saykali, Director of Public Works, (562) 383-4170

Contract Value: \$46,000

Stetson is providing technical support to the City of La Habra for compliance with the provisions of SGMA. Stetson prepared and submitted all required documents to complete the GSA formation notification process for the City, and Stetson prepared and submitted all the required technical support information for a basin boundary modification to establish the La Habra Groundwater Basin. Stetson has participated in **stakeholder outreach for the City's SGMA activities**, coordinated with DWR regarding SGMA submittals, and **represented the City at DWR hearings**. Stetson's scope of work included **preparing a Sustainable Groundwater Management Plan**, deemed an Alternative GSP under SGMA for La Habra Basin.

Indirect Reuse Replenishment Program & California Statewide Groundwater Elevation Monitoring Program (CASGEM)

Upper San Gabriel Valley Municipal Water District, CA

Mr. Shane Chapman, Manager, (626) 443-2297

Contract value: \$180,000 - \$470,000/year over last 4 years

As District Engineer for over 30 years, Stetson performs essentially all District engineering tasks including supporting the District's Indirect Reuse Replenishment Program (IRRP). The IRRP addresses the increasing unreliability and cost of imported water by replacing approximately 10,000 acre-feet per year of imported water currently used for basin replenishment with recycled water produced by the Sanitation Districts of Los Angeles County's (SDLAC) San Jose Creek Water Reclamation Plant (SJCWRP).

Stetson performed a Feasibility Study for USBR Title XVI **Recycled Water Program** and assisted the District in developing and implementing a **Basin-wide Groundwater Elevation Monitoring Program** that meets the DWR CASGEM program requirements. Since 1997, Stetson has assisted the Watermaster in monitoring seasonal and long-term trends of groundwater levels in the Main San Gabriel Basin by developing a **Groundwater Monitoring Program** and selecting wells for the monitoring network, developing the monitoring schedule, and preparing semi-annual groundwater contour maps. Stetson collects and analyzes water level and water quality data and completed a **MODFLOW Groundwater Model Report** to meet groundwater replenishment rule in the Recycled Water Policy.

4. STAFF EXPERIENCE

Stetson has assembled a team of highly qualified professionals who present the range and depth of experience that will be necessary to address the SLVWD's Hydrogeology support and GSP development needs. The team has current experience in developing GSPs and administering GSAs, establishing basin boundaries, and coordinating with regulatory authorities and stakeholders to comply with DWR mandates. We have over 50 water resource professionals and staff with a depth of knowledge and experience focused on the coastal watersheds of California.

Experience of Key Managers

This section highlights experience of Key Personnel working on projects of similar size, capacity, and dollar value. Stetson Engineers is committed to maintaining Key Personnel throughout GSP development. The Team is proposing a staffing level of 8-10 professionals and supporting staff for this project. All proposed key personnel have sufficient capacity over the next three years to complete the proposed tasks.

Stephen Reich, P.E., P.G. – Principal in Charge

Mr. Reich, a Principal of Stetson Engineers, will serve as Principal in Charge for this project, directing the team in providing hydrogeology support. Mr. Reich has over 25 years of experience in water resources management. Mr. Reich is a California registered Professional Engineer and Professional Geologist with broad experience managing multi-faceted water resource projects that require in-depth knowledge of

groundwater management, water rights, regulatory issues, and civil engineering solutions. Of the projects described in the Experience Section, Mr. Reich was Principal in Charge or Key Personnel for the following:

- Water Resources Manager for Groundwater Sustainability Agency, Indian Wells Valley
- Comprehensive Groundwater Modeling, Basin Management, and Planning for Camp Pendleton
- Regulatory Consultation for Potential Impacts to Aquatic and Riparian Protected Species
- Groundwater Management Support, Santa Ynez River Water Conservation District

Other recent projects that Mr. Reich has overseen are included in his resume below.

Jean Moran, P.G. C.H.G. – Technical Lead for Hydrogeology

Ms. Moran will serve as the Technical Lead for Hydrogeology. Her area of expertise is the investigation of groundwater basin sustainable yield, geologic structure of aquifers, surface and groundwater interaction and the occurrence and movement of groundwater. She is currently performing work in support of GSAs and GSP development, and she has installed wells, performed aquifer field tests, and characterized groundwater aquifers for complex hydrogeological sites. Her experience includes hydrogeologic modeling, assessment for reclaimed water reuse projects, evaluation of water quality impacts from stream discharges, studies of groundwater subflow to rivers and streams, and quantifying the impact of evapotranspiration of riparian vegetation to the groundwater basin budgets. Of the projects described in the Experience Section, Ms. Moran was Lead Scientist for the following:

- Water Resources Manager for Groundwater Sustainability Agency, Indian Wells Valley
- Comprehensive Groundwater Modeling, Basin Management, and Planning for Camp Pendleton
- Regulatory Consultation for Potential Impacts to Aquatic and Riparian Protected Species
- Watershed Planning on the Santa Margarita River, U.S. Bureau of Reclamation
- Groundwater Management Support, Santa Ynez River Water Conservation District
- San Luis Rey Indian Water Authority SGMA Services

Other recent projects in which Ms. Moran participated are included in her resume below.

Molly Palmer, P.E. – Technical Lead for Surface Water Hydrology

Ms. Palmer will serve as Technical Lead for Surface Water Hydrology. Her area of expertise includes hydrologic modeling and water supply studies. She has experience performing instream flow assessments and endangered species consultations, with an emphasis on balancing instream flow needs with domestic and municipal water supply needs. Of the projects described in the Experience Section, Ms. Palmer was Key Personnel for the following:

- Comprehensive Groundwater Modeling, Basin Management, and Planning, Camp Pendleton
- Regulatory Consultation for Potential Impacts to Aquatic and Riparian Protected Species
- Watershed Planning on the Santa Margarita River, U.S. Bureau of Reclamation
- Groundwater Management Support, Santa Ynez River Water Conservation District

Other recent projects in which Ms. Palmer participated are include in her resume below.

Jeff Helsley – Technical Lead for Projects and Management Actions

Mr. Helsley will serve as Technical Lead for the Projects and Management Actions Team. He is a Supervising Engineer for Stetson and has over 36 years of experience in California. Mr. Helsley brings a wealth of groundwater management and project development experience. He has worked on over a dozen GSA/GSPs and other groundwater management plans and studies and many water infrastructure projects. Of the projects described in the Experience Section, Mr. Helsley was a Lead Engineer or Key Personnel for the following:

- Water Resources Manager for Groundwater Sustainability Agency, Indian Wells Valley
- San Luis Rey Indian Water Authority SGMA Services
- Sustainable Groundwater Management Act Services for City of La Habra
- Indirect Reuse Replenishment Program & CASGEM for Upper San Gabriel Valley Municipal Water District

Other recent projects that Mr. Helsley has overseen are included in his resume below.

5. SUB-CONSULTANT’S EXPERIENCE

There are no subconsultants in this proposal.

6. CLIENT REFERENCES

Mr. Ron Strand, Acting General Manager
Indian Wells Valley Groundwater Authority, Ridgecrest, CA
(760) 499-5002

Ms. Jessica Spurlock, Contacting Officer’s Technical Representative
Water Resource Division, Marine Corps Base Camp Pendleton, CA
(760) 725-1466

Dr. Bruce A. Wales, General Manager
Santa Ynez River Water Conservation District, CA
(805) 693-1156

Mr. Shane Chapman, Manager
Upper San Gabriel Valley Municipal Water District, CA
(626) 443-2297

Mr. Elias Saykali, Director of Public Works
City of La Habra, CA
(562) 383-4170

7. FEE SCHEDULE

The Stetson Engineers fee schedule is enclosed as a separate file per the RFQ.



Standard Billing Rate Schedule Professional Fees

Principal	\$237.00	Per Hour
Special Project Director	\$237.00	Per Hour
Project Manager, Senior	\$206.00	Per Hour
Supervisor I	\$206.00	Per Hour
Supervising Soil Scientist	\$191.00	Per Hour
Supervisor II	\$191.00	Per Hour
Supervisor III	\$185.00	Per Hour
Senior I	\$165.00	Per Hour
Senior II	\$149.00	Per Hour
Senior III	\$134.00	Per Hour
Construction Manager	\$134.00	Per Hour
Construction Manager / Oversight	\$118.00	Per Hour
Senior Construction Inspector	\$118.00	Per Hour
Senior Field Geologist	\$134.00	Per Hour
Senior Associate	\$128.00	Per Hour
Associate I	\$122.00	Per Hour
Associate II	\$116.00	Per Hour
Associate III	\$111.00	Per Hour
Associate Soil Scientist	\$111.00	Per Hour
Senior Assistant	\$103.00	Per Hour
Assistant I	\$98.00	Per Hour
Assistant II	\$93.00	Per Hour
Assistant Soil Scientist	\$93.00	Per Hour
Assistant III	\$88.00	Per Hour
GIS Manager	\$122.00	Per Hour
GIS Specialist I	\$101.00	Per Hour
GIS Specialist II	\$91.00	Per Hour
Technical Illustrator	\$88.00	Per Hour
AutoCAD Technician	\$88.00	Per Hour
Soil Technician	\$77.00	Per Hour
Aide I	\$72.00	Per Hour
Aide II	\$62.00	Per Hour
Aide III	\$57.00	Per Hour
Project Coordinator I	\$134.00	Per Hour
Project Coordinator II	\$98.00	Per Hour
Project Coordinator III	\$88.00	Per Hour
Contract Management	\$103.00	Per Hour
Administrative I	\$72.00	Per Hour
Administrative II	\$67.00	Per Hour
Administrative III	\$62.00	Per Hour

Effective January 1, 2019

Direct Expense Rates

Expense Description	Billing Rate
Fax	\$0.30 / Page
Mileage	\$* / Mile
Reproduction: Black & White (In-House)	\$0.15 / Page
Reproduction: Color - 8.5" x 11" (In-House)	\$0.89 / Page
Reproduction: Color - 11" x 17" (In-House)	\$1.89 / Page
Plotter Reproduction (In-House)	\$1.50 / Sq. Ft.
Specialty Computer Expense (In-House)	\$15.00 / Hour
4x4 Truck with Drill Rig	\$150.00 / Day
Survey Equipment	\$120.00 / Day

Notes:

- 1) * Mileage is billed at the current IRS approved mileage rate and may be subject to change.
- 2) Subcontractor services will be charged at cost plus 10% administration fee.
- 3) All other project reimbursable expenses (i.e., telephone, commercial transportation, meals, lodging, postage, outside reproduction, etc.) will be billed at cost.
- 4) Testimony fees are 150% of standard rates and apply to depositions, court time and time spent on stand-by at attorney's request. Travel time and preparation time is charged at standard rates. Stetson Engineers Inc. authorizes only staff at associate classification or higher to testify as expert witnesses.

Stephen Reich, P.E., P.G. Principal in Charge

Years of Experience with Firm: 28

Years of Experience with Other Firms: 2

Education: Degree(s) / Year / Specialization:

M.S. / 1989 / Geophysical Engineering, Colorado School of Mines, Golden, Colorado

B.S. / 1985 / Geophysical Engineering, Colorado School of Mines, Golden, Colorado

Registrations / Certifications:

Civil Engineer, No. 58713 CA

Professional Geologist, No. 9713 CA

Experience Record: Mr. Reich provides technical and administrative expertise required to manage multi-faceted water resource projects that require in-depth knowledge of water rights, environmental requirements, regulatory issues, and civil engineering solutions. Mr. Reich has led technical teams for both litigation and settlement purposes for issues related to water supply, water quality, wastewater, and water rights disputes.

He has overseen and had key roles a number of groundwater investigations and management plans including the Indian Wells Valley GSP and over a dozen Basins within San Diego, Orange, Riverside, and San Bernardino Counties. As sole arbitrator between LADWP and Inyo County, regarding groundwater pumping in Owens Valley, Mr. Reich balanced legal, physical, and environmental requirements to settle a pumping dispute between Inyo County and Los Angeles Department of Water and Power. His expertise in hydrology and hydrogeology, water quality, geomorphology, civil engineering, geophysics, economics, state and federal water supply issues, and environmental concerns provides a wide range of experience for the successful completion of both small- and large-scale water development projects.

- As lead engineer and project manager, Mr. Reich developed a conjunctive use project that utilizes surface flow during wintertime rainfall events to recharge a groundwater aquifer for subsequent extraction during peak summer demand months. Mr. Reich was responsible for the design of the diversion facility, conveyance systems, and recharge facilities to divert water from the Santa Margarita River. Mr. Reich oversaw the development of field investigations, including the construction of monitoring and production wells, to support the creation of a numerical groundwater model. Working with the Bureau of Reclamation and the United States Navy, Mr. Reich played a key role in the development of legislative approval of the project passed by the United States congress in public law PL 111-11.
- As author and project manager, directed all engineering, hydrologic, hydrogeologic, environmental tasks involved in the completion of the Santa Margarita River Recharge and Recovery Enhancement Program. This project combined the complex engineering and environmental studies required to maximize the ground-water production from a ground-water basin without harming the 16 endangered species that live within the riparian corridor and associated estuary of the Santa Margarita River.



Jean Moran, PG, CHG, Supervising Hydrogeologist

Years of Experience with Firm: 19

Years of Experience with Other Firms: 5



Education: Degree(s) / Year / Specialization:

M.S. / 1997 / Hydrogeology, University of California, Berkeley, California

B.S. / 1994 / Geology, University of Wisconsin, Madison, Wisconsin

Registrations / Certifications:

Professional Geologist No. 7162, California

Certified Hydrogeologist No. 755, California

Experience Record: Ms. Moran's area of expertise is the investigation of groundwater basin sustainable yield, geologic structure of aquifers, surface and groundwater interaction and the occurrence and movement of groundwater. She has worked directly on SGMA projects for 2 years, interacting with Technical Advisory Committees, performing model evaluation, monitoring networks, developing sustainability criteria and measurable objectives, and performing data gap analysis.

She is experienced in the development and use of numerical models for hydraulic characterization of aquifers, development of balanced hydrologic budgets, flow patterns and plume migration, and feasibility analysis for future management alternatives. Throughout her career, she has overseen monitoring and pumping well drilling programs for aquifer characterization, developed monitoring networks to provide scientific data for basin management decisions, and worked with clients to explain complex ideas to the public. Ms. Moran has developed work plans, permitted, and worked with drillers to perform geophysical logging and installation of multi-level monitoring wells in San Diego County. She has performed and analyzed multiple aquifer performance tests to measure aquifer hydraulic and storage properties. Ms. Moran continues to serve as an expert witness for the Department of Justice on groundwater-stream interaction, cone of influence of pumping wells, and the application of groundwater models to basin management in basins under court review.

- Santa Margarita River Basin Study and Groundwater Monitoring Program. Designed and performed aquifer pumping and injection tests; analyzed test data to determine transmissivity and storage capacity; created aquifer flow nets to analyze recharge and discharge areas; delineated depth to bedrock and thickness of aquifer sediments; analyzed sustainable yield under varying pumping conditions and basin-wide hydrologic budgets.
- Analyzed historical watershed inventory for a 19,400-acre Southern California river basin, including streamflow; recharge basins, water production wells, wastewater releases, evapotranspiration, and mountain front recharge. Established a numerical groundwater model (MODFLOW) for a 50-year balanced hydrologic period that is used as an investigative, predictive, and design tool to study potential hydrogeologic and environmental impacts from which to make drought, normal, and wet year water basin management decisions for analysis.

Molly Palmer, P.E., Senior Engineer (Hydrologist)

Years of Experience with Firm: 15

Years of Experience with Other Firms: 0



Education: Degree(s) / Year / Specialization:

M.S. / 2003 / Civil & Environmental Engineering, Massachusetts Institute of Technology, Cambridge, MA

B.S. / 2001 / Civil & Environmental Engineering, Georgia Institute of Technology, Atlanta, GA

Registrations / Certifications:

Civil Engineer No. 71788, California

Experience Record: Ms. Palmer's area of expertise is in hydrologic and water system modeling, determining surface-groundwater interactions, investigating water rights claims, and water supply planning. She has experience performing instream flow assessments and endangered species consultations, with an emphasis on balancing instream flow needs with domestic and municipal water supply needs. She is experienced in the development and use of numerical models for hydrologic and hydraulic studies as well as developing balanced hydrologic budgets and feasibility analysis for future management alternatives. She has served as Project manager for 2-year study looking at how diversions in headwaters streams impact anadromous fisheries habitat wherein she managed the field study, hydrologic modeling and fisheries protectiveness analysis as well as coordinated work by two subconsultants.

- Lead engineer for Stetson working with team of engineers, planners and biologists to complete the steelhead passage study on the Santa Margarita River. She worked with a multi-disciplinary team to conduct field work, modeling and analysis to determine timing and frequency of steelhead passage opportunities, and design alternatives for fish passage structures.
- Key contributor to the North Coast Instream Flow Policy commissioned by the State Water Resources Control Board. She developed hydrologic records to assess instream flow policy for anadromous salmonids, reviewed CEQA impacts of the policy on regional water supplies.
- Provided analysis of surface water resources for proposed recharge and recovery program at Camp Pendleton. She prepared gaged and reconstructed streamflow records and maintained the daily, 50-year reservoir operations model. She provided input for the groundwater model, using streamflow and reservoir operations models to assess future water supply and demand scenarios.
- Project manager, 20-year Water System Master Plan. Supervised hydraulic modeling. Directed modeling scenarios and selection of criteria for identifying existing and future deficiencies. Worked with District to conduct hydrant flow tests for model calibration. Evaluated metered usage to estimate spatial and temporal demands within the District. Developed pipeline condition assessment and risk and consequence of failure criteria to create pipeline replacement program for District. Developed schedule and costs for 20-year CIP.

Jeff Helsley, P.E., Supervising Engineer

Years of Experience with Firm: 19

Years of Experience with Other Firms: 17

Education: Degree(s) / Year / Specialization:

M.S. / 1982 / Environmental Engineering, USC

B.S. / 1981 / Civil Engineering, California State University, Los Angeles (CSULA)

Registrations / Certifications:

Civil Engineer 039599, California

Experience Record:

Mr. Helsley is a Supervising Engineer and project manager for groundwater management and water supply studies. He has experience on numerous groundwater evaluations and development of management plans including the San Luis Rey GSP, Indian Wells Valley GSP, La Habra Alternative GSP, Rincon groundwater study, and Antelope Valley Groundwater Banking and Recovery.

Mr. Helsley was formerly the District Engineer and Assistant General Manager of the Water Replenishment District of Southern California, where he was responsible for the development and implementation of programs to enhance groundwater recharge and improve groundwater basin management. Having this agency experience, Mr. Helsley possesses the knowledge and perspective to translate client objectives into water sustainability solutions.

- Lead Engineer, Indian Wells Valley Groundwater Sustainability Plan. Leads development of GSP. Coordinates stakeholder interaction with Board of Indian Wells Valley Groundwater Authority as well as stakeholder contributions to GSP development. Coordinates development of sustainability criteria and measurable objectives, as well as project and management actions to achieve groundwater sustainability.
- Water Supply Feasibility Studies
 - Sierra Bella Development, Lucerne Valley, California
 - Sierra Lakes Development, Santa Clarita Valley, California
 - Rolling Meadows Development, Tejon Ranch, California
 - East Highlands Ranch, Upland, California
 - Larsen Ranch, Antelope Valley, California

