Response to Request for Proposals for Madera County Groundwater Sustainability Agency Measurement Services

June 2025

Prepared By:

DAVIDS ENGINEERING, INC

H2Otech water technology specialists

Section 1 – Cover Letter

June 16, 2025

Aleta Allen
Madera County GSA
200 West Fourth Street
Madera, CA 93637
Email: Aleta.Allen@maderacounty.com

Subject: Response to Request for Proposals for Madera County Groundwater Sustainability Agencies (GSAs) Measurement Services

Dear Ms. Allen,

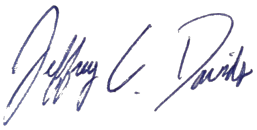
On behalf of Davids Engineering, Inc. (DE) and H2oTech, LLC (collectively the DE-H2oTech Team), we are pleased to submit this proposal in response to Madera County GSAs' Request for Proposals (RFP) for measurement services. **Specifically, we are responding to the expressed desire within the RFP for the implementation of an online platform that would enable growers to view and interact with their groundwater allocation and measurement data** (not the provision of measurement data)**.**

The DE-H2oTech Team brings over 30 years of experience in agricultural water management, water accounting, remote sensing, flow measurement, data management, and groundwater sustainability plan development and implementation across California, with a long-standing commitment to technical excellence and client success. H2oTech complements this expertise with nearly 20 years of flow measurement, data management, and online platform development and implementation experience. Together, the DE-H2oTech Team has successfully implemented water accounting and allocation management systems for over 800,000 acres in California.

We believe that the combined technical capabilities and regional experience of the DE-H2oTech Team uniquely positions us to deliver a high-performing, cost-effective solution aligned with Madera County GSA's goals. Our proposed approach couples a deep understanding of the Madera County GSAs' Allocation Program with the ability to integrate allocation measurement data from any source to implement a user-friendly groundwater accounting platform that supports parcel, farm unit, and account-level insights into allocations, carryover, adjustments, evapotranspiration of applied water (ETAW), remaining, credits, and penalties.

Thank you for your consideration. We look forward to the opportunity to present our approach and work collaboratively to support sustainable groundwater management in Madera County.

Sincerely,



Jeffrey (Jeff) C. Davids, Ph.D., P.E.
Proposed Project Manager
Vice President and CTO, Davids Engineering, Inc. and President, H2oTech, LLC

Section 2 – Table of Contents

Section 3 – Organizational Chart

Under the direction of Stephanie Anagnoson, Director of Water and Natural Resources for the Madera County Groundwater Sustainability Agencies (Madera County GSAs), Jeff Davids will serve as the DE-H2oTech Team project manager (Figure 1). Jeff will seamlessly integrate H2oTech's online platform development and implementation experience with DE's deep knowledge and hands on experience with the Madera County GSAs allocation program. John Davids, who has essential insights into the local context due to his leadership role with Groundwater Sustainability Plan (GSP) revisions and implementation for the Chowchilla and Madera Subbasins, will serve as an on-call strategic advisor. Daniel Smith will serve as the DE Team leader, providing oversight for integration of the online platform with the existing data management system, measurement data from remote sensing and flowmeters, and periodic updates to base data layers including crops, parcels, and fields and the linkages between these and grower accounts. Finally, Jeff will serve as the H2oTech Team leader, organizing efforts for online platform requirements, development, refinement, implementation, and support.

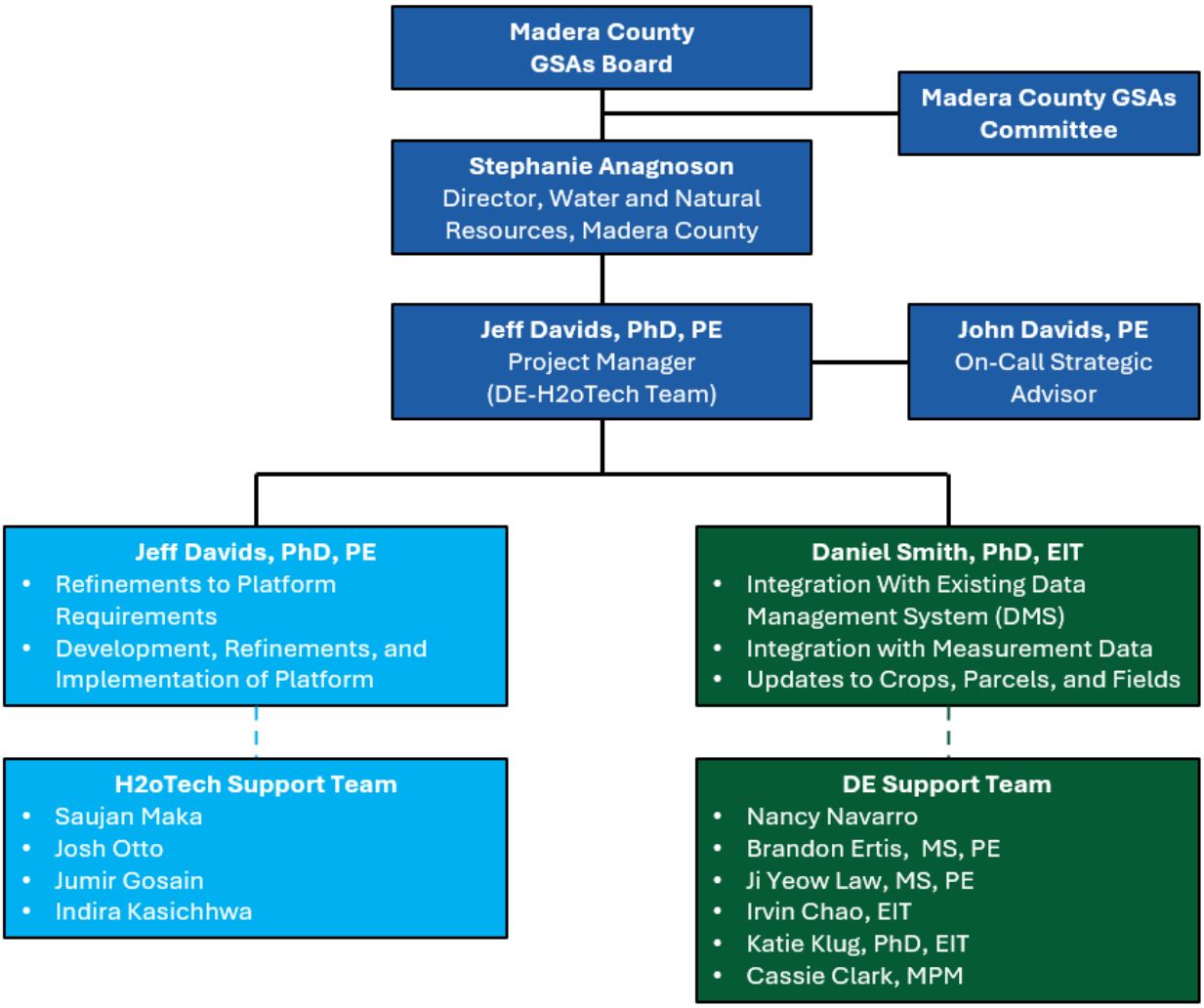


Figure 1. DE-H2oTech Team organizational structure.

Section 4 - Qualifications

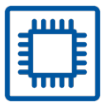
DE Overview – Agricultural Water Management

Since 1993, DE has provided professional engineering and scientific services to public agencies, private entities, and individual landowners responsible for managing water resources in the Western United States. We are founded on a commitment to the highest standards of professional integrity and intellectual honesty, and have successfully completed projects in Arizona, California, Nebraska, Nevada, Oregon, Washington, and in a handful of developing nations. We are proud of the fact that the large majority of our work comes by word-of-mouth or through repeat work for past clients.

DE is organized into three tightly integrated solutions that work together to support our clients' surface water and groundwater management initiatives:

Water: Solutions for agricultural water management, environmental water stewardship, and sustainable groundwater management.

Infrastructure: Solutions for infrastructure modernization planning, assessment, design, and construction.



Technology: Solutions for environmental monitoring, GIS and remote sensing, and data management and modeling.

Some of DE's projects employ professional services from just one solution, while others (typically larger, more complex projects) employ professional services from two or three solutions to creatively and seamlessly tailor our solutions to meet the unique needs of each project and each client. The online platform implementation project would leverage professional services and expertise from both the Water and Technology solutions and would draw on team members from all three of DE's offices in California's Central Valley (Chico, Davis, and Oakdale).

H2oTech Overview – Water Measurement and Accounting

Since 2006, H2oTech has been a leader in flow measurement and water accounting in California. H2oTech's Founder and President, Jeff Davids, has led the development and implementation of flow measurement plans for over 1,000,000 acres of irrigated agriculture within California. From 2017 through 2020, Dr. Davids worked on a series of national-scale remote sensing water accounting efforts with the United Nations Food and Agriculture Organization in Afghanistan and Myanmar. Additionally, for the past decade, Jeff has led SmartPhones4Water (S4W) - an international network of hundreds of young researchers and citizen scientists focused on improving our understanding and management of water resources (www.smartphones4water.org) in places like Nepal, Afghanistan, Vietnam, and the Middle East.

RemoteTracker Water Measurement and Accounting System

For over a decade, the DE-H2oTech Team has developed, implemented, and supported the RemoteTracker Water Accounting System. Initially adopted in 2012 as the preferred water measurement and accounting system by the Richvale Irrigation District and Reclamation District No. 108, RemoteTracker is now being used at over 8,000 delivery points providing irrigation water to over 600,000 acres in California. The RemoteTracker System includes: (1) custom field-data collection software, (2) a wireless acoustic doppler velocimeter flow measurement device, (3) a centralized database for data aggregation, quality control, and reporting, and (4) an online-grower portal.

SGMA Implementation and Experience

Since passage of the Sustainable Groundwater Management Act (SGMA) in 2014, DE has had the privilege of either leading or supporting development and/or implementation of 22 GSPs, including the Chowchilla and Madera Subbasins. Through these efforts, DE has developed extensive knowledge of SGMA and the regional, working landscapes within which sustainable management plays out. Coupled with an understanding of the unique, often complicated, political factors characterizing each groundwater subbasin, we have developed a renewed appreciation for the old adage: *one size doesn't fit all*. As we look to the future of sustainable groundwater management in California, we recognize that in all cases, sustainability will either need to be attained or maintained through the implementation of projects and management actions. Organization of DE's professional services into the three solutions, as described above, was a deliberate action in support of GSP implementation, and ultimately sustainable groundwater management in California.

Groundwater Demand Management

The DE-H2oTech team has been deeply involved in the planning and implementation of Groundwater Demand Management (GDM) efforts in California. Most recently, DE, together with Dr. Robyn Grimm, CEO of the California Water Data Consortium, and Dr. Isaya Kisseka, Director of the UC Davis Agricultural Water Center, formed the Groundwater Demand Management Network (www.gdmnetwork.org). DE has led the implementation and support of the Madera County GSAs' allocation program since 2021. This has included the development of a custom database schema (i.e., architecture) to support the unique aspects of the Madera County GSAs groundwater allocation program, creation of a platform for the collection and quality control of grower-supplied flowmeter data, and the generation of periodic allocation reports at the account, farm unit, parcel, and parcel-field scale. Most recently, DE has led the GDM planning efforts for over 700,000 acres in the Colusa Subbasin in Northern California.

Resumes for the key DE-H2oTech Team members featured in the organizational chart (Figure 1) are presented in Appendix B. Resumes for additional support staff are available upon request.

Madera County GSAs Allocation Program

The objective of SGMA and implementation of GSPs in Madera County is to achieve groundwater sustainability in each of the subbasins underlying the County by 2040. The Madera County GSAs[1] are currently responsible for GSP implementation in the "white areas"[2] of the Chowchilla, Madera, and Delta-Mendota Subbasins. Other GSAs in Madera County are responsible for GSP implementation in the respective areas they manage in the subbasins. In most years, groundwater is the sole source of water for irrigation of agricultural lands in the Madera County GSAs, although surface water is available for some lands in wet years, such as 2023. Where necessary, an important component of GSP implementation and achieving sustainability is reducing consumptive use[3] of groundwater, which may be accomplished through implementation and enforcement of a groundwater allocation.

On December 15, 2020, the Madera County Board of Supervisors adopted Resolution 2020-166 describing the groundwater allocation approach to be used for GSP implementation in the Madera County GSAs. The resolution describes two designations of groundwater: (1) sustainable yield of native groundwater that represents the baseline, stable volume of groundwater in storage that is replenished from natural sources, and (2) transitional water that represents continued overdraft of the Chowchilla, Delta-Mendota, and Madera subbasins that will be incrementally reduced over the GSP implementation period (2020 through 2040), culminating in sustainable groundwater conditions. Importantly, the adopted allocation approach is based on the quantity of groundwater consumed, not pumped. This distinction recognizes that the consumption of groundwater causes subbasin depletion (and therefore affects sustainability), while groundwater that is pumped but not consumed returns to the groundwater system (as deep percolation) and does not cause depletion[4]. Further, recognizing that crops consume precipitation (P) as well as applied water (AW) stored in the root zone, it is important for purposes of groundwater allocation and accounting to distinguish crop evapotranspiration (ET) of applied water (ETAW) – which largely results from groundwater consumption within the Madera County GSAs – from crop ET of precipitation (ETPR). Thus, ETAW was adopted as the quantitative accounting metric at the parcel scale for measuring and monitoring groundwater consumption against groundwater allocations within the Madera County GSAs.

[1] The Madera County GSAs are the three GSAs managed by Madera County in the Chowchilla, Delta-Mendota, and Madera Subbasins, respectively.
[2] "White areas" represent lands outside of the boundaries of cities and surface water district service areas (i.e. areas not governed or managed by another local agency).
[3] Consumptive use refers to "that part of water withdrawn that is evaporated, transpired, incorporated into products or crops, consumed by humans or livestock, or otherwise removed from the immediate water environment" (ASCE, 2016).
[4] Because pressurized drip and micro-sprinkler on-farm irrigation systems are dominant in the three Madera County GSAs, the assumption was made that there is negligible surface runoff from the GSAs that could cause groundwater depletion. The limited nature of runoff from AGW was reviewed during 2022 and 2023 field data collection activities, providing evidence to support this assumption.

Section 5 – Project Understanding and Approach

As of 2023, growers in the Madera County GSAs have three options for tracking ETAW against their allocations: (1) Flowmeters (ground-based measurement method), (2) IrriWatch/Hydrosat (satellite-based ETAW measurement method), and (3) Land IQ (satellite-based ETAW measurement method).

Project Understanding and Approach

As articulated in the RFP, the DE-H2oTech Team understands that there is a desire by some growers to implement an online platform that would enable growers to view and interact with their groundwater allocation and measurement data. In response to this desire, and not the request for measurement data, the DE-H2oTech Team proposes to develop and implement an online platform that integrates all aspects of the allocation program. The platform will be developed to work seamlessly with any measurement method selected by the grower under a simple, secure, and user-friendly portal. Specifically, the following approach is proposed:

- Deploy a customizable web-based platform that includes:
  - Secure unique logins for growers and/or their account managers
  - Each login would be tied to one or more Madera County GSA allocation accounts (MAD_MA_XXXXX) associated with one or more Assessor Parcel Numbers (APNs)
  - Account, farm unit, parcel, and field-level summaries of allocations, adjustments, credits, ETAW, and remaining allocation
  - Access to existing allocation reports regardless of grower selected measurement method
  - Timeseries plots of ETAW for current year and available historical years
  - Automated penalty/credit notifications at predefined ETAW threshold levels
  - GSA administration view of all accounts
  - GSA administration view of all farm unit zones
- Facilitate critical data integrations:
  - Integrate raster data pipelines via automated application programming interface (API) or manual upload
  - Leverage existing partnerships (as required) with Land IQ, IrriWatch/Hydrosat, and OpenET using open and reproducible methods aligned with DWR and GSA best practices
  - Integrate flowmeter data from grower-supplied flowmeter readings and optional integration with telemetered flowmeter data via API
  - Integrate account-parcel, field-crop, field-flowmeter, etc. data managed with existing DMS via API
- Create a pathway for single DMS and grower platform:
  - Incorporate essential create, read, update, and delete (CRUD) operations with existing DMS
  - Incorporate essential GSA administration reporting functions (e.g., summary of penalty and carryover volumes, pending penalty amounts, payments received, etc.)
  - Streamline DMS interactions for complex datasets like field-flowmeter relationships

RemoteTracker Water Measurement and Accounting System

Jeff Davids and Josh Otto led the development, piloting, and implementation of the RemoteTracker water measurement and accounting system now in use on over 600,000 irrigated acres. While initially focused on surface water accounting, the RemoteTracker concepts of managing fields, parcels, measurement points (canal turnouts or wells), places of application (relationship between measurement points and fields), customer/accounts, land ownership and/or management (relationship between customers and parcels), cropping, and financial charge rate structures over time readily extends to groundwater accounting as well. For each district, the DE-H2oTech team has inventoried district distribution systems, established standardized naming conventions, developed custom database applications for quality controlling and managing turnout flow data, and supported implementation for over a decade. The RemoteTracker System was pivotal in equitably and efficiently managing curtailments to water allocations during the most recent 2014-2015 and 2020-2022 droughts.

- Length of contracts:
  - Reclamation District No. 108 (2012 to present)
  - Richvale Irrigation District (2012 to present)
  - Biggs-West Gridley Water District (2012 to present)
  - Western Canal Water District (2015 to present)
  - Princeton-Codora-Glenn and Provident Irrigation Districts (2018 to present)
  - Sutter Mutual Water Company (2021 to present)
  - South Sutter Water District (2022 to present)
  - Glenn-Colusa Irrigation District (2022 to present)
  - Reclamation District No. 1004 (2023 to present)
  - Dunnigan Water District (2025 to present)
  - Orland-Artois Water District (2025 to present)
  - Colusa County Water District (2025 to present)
- Scope of professional services provided:
  - Agency-wide flow measurement and water accounting solution
  - Field data collection training
  - Online grower portal training
  - Preparation and management of geospatial datasets of fields, measurement points, field-customer, field-crop, field-measurement point relationships
  - Development and management of water invoices, payments, and adjustments
- Type of contracts:
  - Annual fees and on-call time and materials support
- Specific accomplishments:
  - Development and implementation of an innovative, cloud-connected flow measurement and water accounting solution designed primarily for agricultural and water management applications on over 600,000 acres for over 8,000 water measurement points

- Senate Bill x7-7 and Senate Bill 88 flow measurement compliance
- Development and implementation of an online portal for viewing and interacting with water measurement and allocation tracking data

Madera County GSA's Groundwater Allocation Program Support

The DE-H2oTech Team developed accounting methodology, implementation logic, and data collection and management protocols and procedures in coordination with Madera County GSA staff to administer the Madera County GSAs groundwater allocation resolutions. This work included conceptual development and Python coding for monthly groundwater allocation reports including tabular summaries, mapping, and data visualizations. The DE-H2oTech Team led the creation of a Django PostGIS web-based database allowing the Madera County GSAs' staff real-time concurrent access to a central repository of data about their grower accounts, parcels, fields, crops, measurement points, adjustments, penalties and payments, and other relevant metadata. The DE-H2oTech Team also led the development of a mobile data collection platform that enables growers to submit flowmeter readings from their smartphones, including GPS coordinates, text and numerical entries, and photographs.

- Length of contracts:
  - Madera County Water and Natural Resource (2021 to present)
- Scope of professional services provided:
  - Translation of Madera County resolutions into a database schema
  - Development of spatial hydrology processes to translate ET and precipitation data to ETAW
  - Development of process for partitioning recharge between in-lieu and direct components
  - Training of Madera County GSA staff on water accounting principles and allocation program management and administration
  - Preparation and management of geospatial datasets of accounts, fields, measurement points, field-account, field-crop, field-measurement point relationships
  - Development and management of water invoices, payments, and adjustments
- Type of contracts:
  - On-call time and materials support
- Specific accomplishments:
  - Custom flowmeter mobile data collection platform development and implementation
  - Concurrent flowmeter data review with traceable editing and quality control status
  - Integration of measurement data from three sources: flowmeters, IrriWatch/Hydrosat, and Land IQ
  - Three years of comparisons between flowmeters and remote sensing methods (i.e., IrriWatch/Hydrosat, Land IQ, and OpenET) via the Verification Project

Additional project descriptions are included in Appendix A.

Section 7 – References

Sutter Mutual Water Company and Reclamation District No. 1500

- Contact Name: Roger Cornwell, General Manager
- Phone Number: 530.681.5227
- Email: rcornwell@sutterbasinwater.com
- Scope of Professional Services:
    - RemoteTracker system implementation (including FLOW grower portal)
    - Water distribution system modernization
    - Pump station modernization
    - Infrastructure mapping and asset management system support
    - Water and salinity budget analyses

Reclamation District No. 108

- Contact Name: Jordon Navarrot, Deputy Manager
- Phone Number: 530.682.4205
- Email: jnavarrot@rd108.org
- Scope of Professional Services:
    - RemoteTracker System implementation (including FLOW grower portal)
    - Water distribution system modernization
    - Water budget analyses
    - Lateral and recycle pump flow measurement and accounting

Colusa Subbasin Glenn Groundwater Authority

- Contact Name: Lisa Hunter, Water Resource Coordinator and Program Manager
- Phone Number: 530.934.6540
- Email: lhunter@countyofglenn.net
- Scope of Professional Services:
    - Groundwater Sustainability Plan (GSP) development, revision, and implementation
    - GSP Annual Report development
    - Domestic Well Mitigation program design
    - Groundwater Demand Management program design
    - Telemetered groundwater extraction monitoring pilot project

Section 7 – References

Richvale Irrigation District

- Contact Name: Sean Earley, General Manager
- Phone Number: 530.882.4243
- Email: searley@richvaleid.com
- Scope of Professional Services:
    - RemoteTracker system implementation (including FLOW grower portal)
    - Water distribution system modernization
    - Infrastructure mapping and asset management system support
    - Agricultural water management planning

Glenn-Colusa Irrigation District

- Contact Name: Ed Henderson, Water Operations Superintendent
- Phone Number: 530.934.8881
- Email: ehenderson@gcid.net
- Scope of Professional Services:
    - RemoteTracker system implementation (including FLOW grower portal)
    - Water distribution system modernization
    - Agricultural water management planning

Butte County Department of Water and Resource Conservation

- Contact Name: Christina R. Buck, Ph.D., Assistant Director
- Phone Number: 530.552.3595
- Email: cbuck@buttecounty.net
- Scope of Professional Services:
    - Groundwater Sustainability Plan (GSP) development and implementation
    - GSP Annual Report development
    - Groundwater Demand Management program design
    - Technical Advisory Committee (TAC) support

Section 8 – Costs

Background

As previously mentioned, the DE-H2oTech Team is specifically responding to the expressed desire within the RFP for the implementation of an online platform that would enable growers to view and interact with their groundwater allocation and measurement data (not the provision of measurement data). Since the RFP is primarily focused on soliciting responses for the provision of measurement data, the details regarding the specific requirements for an online platform are not comprehensively provided. Therefore, the costs provided below should be considered reconnaissance-level and inclusive of the features outlined in Section 5 – Project Understanding and Approach under the heading "Deploy a customizable web-based platform…". Future work to implement the concepts listed under "Facilitate critical data integrations" and "Create a pathway for single DMS and grower platform" can be performed as mutually agreed upon between the Madera County GSAs and the DE-H2oTech Team.

Cost Estimate

As requested in the RFP, costs are summarized for a one-year, two-year, and three-year contract period, along with the resulting costs per year (Table 1).

Table 1. Summary of DE-H2oTech Team costs.

Period	Cost ($)	Cost Per Year ($ / YR)
One Year (2026)	$100,000	$100,000 / YR
Two Years (2026 - 2027)	$170,000	$85,000 / YR
Three Year (2026 - 2028)	$210,000	$70,000 / YR

Rate Sheet

DE's rate sheet is provided below as requested in the RFP. H2oTech charges on a lump sum annual basis. The costs provided above in Table 1 include both the estimated H2oTech lump sum annual charges together with estimated DE time and materials charges at the charge rates then in effect at the time work is performed.

2025 Rate Schedule

Labor Rates (Effective January 1, 2025)

Labor Classification	Hourly Rate [1]
Engineering Team	
Senior Principal Engineer	$272
Principal Engineer	$259
Supervising Engineer	$237
Senior Engineer	$217
Associate Engineer II	$207
Associate Engineer I	$196
Staff Engineer II	$183
Staff Engineer I	$170
Assistant Engineer II	$145
Assistant Engineer I	$126
Specialist Team [2]	
Supervising Specialist	$213
Senior Specialist	$195
Associate Specialist II	$186
Associate Specialist I	$176
Staff Specialist II	$165
Staff Specialist I	$153
Assistant Specialist II	$131
Assistant Specialist I	$113

Labor Classification	Hourly Rate [1]
Technical Team	
Supervising Technician	$181
Senior Technician	$166
Associate Technician II	$158
Associate Technician I	$150
Staff Technician II	$140
Staff Technician I	$130
Assistant Technician II	$111
Assistant Technician I	$96
Intern Team	
Intern II	$82
Intern I	$57
Client Intern [3]	$38
Support Team	
Senior Project Manager	$200
Communications Specialist	$175
Senior Project Assistant	$149
Associate Project Assistant	$135
Staff Project Assistant	$117
Other	
Expert Witness	Market Rate [4]
Strategic Advisor	Market Rate [4]

Vehicle, Equipment, and Material Rates (Effective January 1, 2025)

Item		Rate [1]
Current IRS Mileage ($ / mile)		$0.700
Field Vehicle (4 x 4) ($ / mile)		$1.34
Meals ($ / person / day)	Meals charged at actual cost, not to exceed U.S. GSA M&IE Standard Rate Total	$68
Hotel ($ / person / day)	Daily lodging charged at actual cost, not to exceed U.S. Daily Lodging Rate for Sacramento County	$150
Pressure Transducer ($ / month)		$100
Fuji Portaflow Transit Time ($ / day)		$100
Timeseries Data Management ($ / site / month)		$125
SonTek FlowTracker (ADV) ($ / day)		$125
EMLID Real Time Kinematic (RTK) Survey ($ / day)		$250
SonTek RiverSurveyor with RTK GPS ($ / day)		$325
SonTek RiverSurveyor with Remote Control ($ / day)		$550
Motor Boat 18 ft. with jet engine ($ / day)		$600
Monitoring and control equipment and materials ($ / item)		Unit Costs

Notes:

[1] Labor and equipment rates are subject to revision at the beginning of each calendar year.

[2] Specialist Team includes, but is not limited to Data Scientists, Hydrologists/Hydrogeologists, etc.

[3] DE team member working under direct client supervision.

[4] Market rates subject to negotiation.

Appendix A – Supplemental Project Descriptions

Colusa Subbasin Groundwater Sustainability Plan Revisions

Summary

In fall 2023, Davids Engineering, Inc. (DE) was contracted by the Colusa Groundwater Authority (CGA) and the Glenn Groundwater Authority (GGA) to support their revisions to the Colusa Subbasin Groundwater Sustainability Plan (GSP) in response to comments received from the California Department of Water Resources (DWR). In DWR's October 2023 "incomplete" determination for the Colusa Subbasin GSP, DWR identified three deficiencies pertaining to (1) the overdraft estimate and overdraft mitigation strategy for the Colusa Subbasin, (2) the sustainable management criteria (SMC) and mitigation strategy for chronic lowering of groundwater levels, and (3) the SMC, monitoring approach, and mitigation strategy for subsidence.

Over the remainder of the 180-day period from December 2023 to April 2024, DE supported the GSAs in developing and implementing a strategy for the GSP revisions and consulting with DWR staff to discuss and verify that the revisions were on track toward approval. DE led and supported the GSAs in navigating the revisions process through biweekly coordination meetings, monthly Technical Advisory Committee and Board meetings, five formal consultation meetings with DWR, and other touchpoints to work through the many technical and policy decisions involved in the GSP revisions. DE also teamed with West Yost Associates to complete various technical analyses and revisions to the GSP document related to these discussions and decisions.

During the GSP revisions process, DE supported the GSAs in the initial development of a demand management program and domestic well mitigation program to address and mitigate sustainability concerns in the Colusa Subbasin related to overdraft, groundwater level decline, and subsidence. As an

Project(s)

1173.04

Client

Colusa Groundwater Authority and Glenn Groundwater Authority

Funder

Clients

Location

Colusa Subbasin, Colusa and Glenn Counties, CA

Date

2023-2024

Budget

$233,177 *(including ~$97k for West Yost and Associates)*

Contacts

Lisa Hunter, Program Manager
Glenn Groundwater Authority
lhunter@countyofglenn.net
530.934.6540

Carol Thomas-Keefer, Program Manager
Colusa Groundwater Authority
cthomaskeefer@rgs.ca.gov
650.587.7300 x17

outcome of this work, the GSAs have developed and signed an agreement for each program that outlines the terms and approach for implementing the programs over the next several years. DE's efforts also helped to create a clear timeline and strategy for GSP implementation over the next five years to ensure that the GSAs remain on track to reaching sustainability in the Colusa Subbasin.

Tehama County Groundwater Sustainability Plan Implementation

Summary

As a key partner in the Luhdorff and Scalmanini Consulting Engineers (LSCE) team, Davids Engineering, Inc. (DE) is currently supporting the Tehama County Flood Control and Water Conservation District (TCFCWCD) and the Corning Subbasin Groundwater Sustainability Agency (CSGSA) in their Groundwater Sustainability Plan (GSP) implementation efforts. GSP implementation efforts are supported under Sustainable Groundwater Management Act (SGMA) Implementation Round 2 grants awarded for the Red Bluff, Los Molinos, Antelope and Corning Subbasins.

As part of these efforts from 2023-2026, DE is supporting:

- **Developing and implementing a policy framework** for demand management, and/or water and land use restrictions, and/or well permitting in the Corning Subbasin.
- **Planning and implementing a synoptic stream gage study** to evaluate interconnected surface water, including work plan development, data collection and field work, as well as data analysis, evaluation, and reporting.
- **Planning and implementing various multi-benefit, direct, and in-lieu recharge projects** across the Red Bluff and Corning Subbasins, including:
    - Planning, design, and documentation related to feasibility studies and evaluations.
    - Identifying potential recharge sites, in coordination with growers, landowners, and agencies.
    - Identifying potential water supplies, recharge techniques, and recharge infrastructure, as appropriate.

Project(s)

1139.14

Client

Luhdorff and Scalmanini Consulting Engineers (LSCE) – TCFCWCD is LSCE's client

Funder

DWR (SGMA Round 2 Prop 68Grant)

Location

Corning, Red Bluff, Antelope, and Los Molinos Subbasins (Glenn and Tehama Counties, CA)

Date

2023-2026

Budget

$2,235,700

Contact

Lisa Hunter, Water Resources Coordinator
Glenn Groundwater Authority
lhunter@countyofglenn.net
530.934.6540

    - Creating design materials and documents for recharge infrastructure and site preparation.
    - Supporting project permitting efforts and CEQA documentation, as appropriate.
    - Developing implementation plans, monitoring and efficiency evaluation strategies, and related documentation.
- **Creating and implementing a planning, design, and implementation study** to facilitate regional water transfers to support enhanced use of available surface water for in-lieu recharge in the Corning Subbasin.
- **Supporting SGMA reporting efforts**, including GSP periodic evaluations and annual reports for the Red Bluff, Los Molinos, Antelope, Corning, and Bowman Subbasins (as applicable).
- **Developing and updating a regional integrated surface water-groundwater model**.
- **Revising GSPs for the Red Bluff, Los Molinos, Antelope, and Corning Subbasins** in response to the incomplete determinations by DWR.

Through these many efforts, DE is supporting the TCFCWCD and CSGSA in their endeavor to achieve and maintain sustainable groundwater conditions in the Red Bluff, Los Molinos, Antelope and Corning Subbasins by 2042.

Chowchilla Subbasin Groundwater Sustainability Plan Revisions

Summary

In winter 2021/2022, Davids Engineering, Inc. (DE) was contracted by Chowchilla Water District on behalf of the four Groundwater Sustainability Agencies (GSAs) with the Chowchilla Subbasin to support their revisions to the Chowchilla Subbasin Groundwater Sustainability Plan (GSP) in response to comments received from the California Department of Water Resources (DWR). The Chowchilla Subbasin GSP was developed jointly by four GSAs that cover the entirety of the Chowchilla Subbasin (Subbasin): the Chowchilla Water District (CWD) GSA, the County of Madera GSA – Chowchilla Subbasin, the Triangle T Water District (TTWD) GSA, and the Merced County GSA – Chowchilla Subbasin. In DWR's January 2022 "incomplete" determination for the Subbasin GSP, DWR identified three deficiencies pertaining to (1) insufficient information to support the selection of chronic lowering of groundwater levels sustainable management criteria, (2) insufficient information to support the selection of land subsidence sustainable management criteria, and (3) insufficient information to support the determination that interconnected surface water or undesirable results related to depletions of interconnected surface water are not present and are not likely to occur in the Subbasin.

Over the 180-day period from January 2022 to July 2022, DE supported the Joint GSP GSAs in developing and implementing a strategy for the GSP revisions and consulting with DWR staff to discuss and verify that the revisions were on track toward approval. DE led and supported technical revisions to the GSP through weekly and biweekly technical coordination meetings, several formal consultation meetings with DWR, and other touchpoints to work through the many technical and policy decisions involved in the GSP revisions. DE also teamed with Luhdorff & Scalmanini Consulting Engineers (LSCE) to complete various hydrogeologic technical analyses and revisions to the GSP document related to these discussions and decisions.

Project(s)

1183.04

Client

Chowchilla Water District

Funder

DWR SGMA Grant

Location

Chowchilla Subbasin, Madera County, CA

Date

2021 - ongoing

Budget

$336,306 (in partnership with LSCE)

Contact

Doug Welch, Water Resources Manager
Chowchilla Water District
dwelch@cwd.com
559.479.6050

Chowchilla Subbasin Groundwater Sustainability Plan Revisions

During the GSP revisions process, DE supported the GSAs in the initial development of a domestic well mitigation program Memorandum of Understanding (MOU) to address and mitigate domestic well impact concerns in the Subbasin related to groundwater level decline. As of summer 2023, the Domestic Well Mitigation Program in the Chowchilla Subbasin is funded and up and running in the Chowchilla Subbasin. To the best of DE's knowledge this is the only fully developed, GSA led, and up and running domestic well mitigation program in the San Joaquin Valley.

In March 2023, DWR determined that the Revised GSP for the Subbasin was inadequate. Once DWR determines that a GSP is inadequate, primary jurisdiction shifts from DWR to the State Water Resources Control Board (SWRCB). Immediately after DWR's inadequate determination, DE and the GSAs began formal consultations with the SWRCB. Those discussions concluded in the submission of a draft set of GSP revisions on May 5, 2023. Since submission of the draft revised GSP, DE as the technical lead has worked extensively with the SWRCB on next steps. To date, the Subbasin is at the bottom of the SWRCB's priority list for the six subbasins that have been sent to DWR and DE is optimistic that the Subbasin won't have to proceed with a Probationary Hearing.

Appendix B – Key Staff Resumes

Jeffrey C. Davids, Ph.D., P.E.

Vice President, Chief Technology Officer

DAVIDS ENGINEERING, INC

EDUCATION

Ph.D., Civil Engineering, Water Management, Delft University of Technology, Delft, Netherlands

M.S., Hydrology and Hydrogeology, Graduation with Distinction, California State University, Chico, CA

B.Sc., General Engineering, California Polytechnic State University,
San Luis Obispo, CA

REGISTRATION

Civil Engineer
No. C75656

YEARS OF EXPERIENCE

20+ Years

DISTINGUISHING QUALIFICATIONS

- Innovative methods for measurement and data management of hydrologic fluxes (*e.g.*, remote sensing and citizen science)
- Stakeholder capacity building and communication of complex materials to diverse audiences
- Spatial hydrology, data science, database development, quality control, data visualization, and data communication

SUMMARY

Dr. Davids's keenness for water resources and food production blossomed amongst the vast agricultural lands of California's Great Central Valley and pristine streams of the Sierra Nevada Mountains. His educational background, broad consulting experience, and dedication to the development of human resources from diverse backgrounds demonstrate his commitment to improved and sustainable management of the Earth's limited natural resources through appropriate applications of engineering and technology, education, and research. Dr. Davids is a licensed Professional Engineer (PE) in the State of California and has a Ph.D. in Civil Engineering (Water Management) from Delft University of Technology, an M.Sc. from California State University Chico in Geosciences and Hydrogeology, and a B.Sc. in General Engineering from California State University San Luis Obispo.

Jeff's interest and experience focus on how sustainable management of water, energy, and food are supported by innovative sources of data (e.g., low-cost sensors, remote sensing, citizen science), education, integrated systems thinking, modeling tools, social engagement, storytelling, and outreach. Jeff has consulted for a variety of water managers and suppliers (local, state, and federal) in all the major irrigated regions of California, including the Imperial, San Joaquin, Sacramento, and Shasta Valleys. Dr. Davids also consults for the UN Food and Agriculture Organization (FAO) in Afghanistan, Myanmar, and China, along with various clients in Nepal, Ghana, Thailand, and the Netherlands. Jeff has managed diverse international teams and large projects, including the design, installation, calibration, and maintenance of several large flow measurement and data acquisition networks in the US and abroad.

RELEVANT EXPERIENCE

Madera County Groundwater Sustainability Agency Groundwater Allocation Program Implementation Support. Madera County GSA, Madera County, CA.
Dr. Davids developed accounting methodology, implementation logic, and data collection and management protocols and procedures in coordination with County staff to administer Madera County's groundwater allocation resolutions. This work included the conceptual development and Python coding for monthly groundwater allocation reports including tabular summaries, mapping, and data visualizations (e.g., histograms). Dr. Davids worked with a team of remote sensing experts (IrriWatch) to develop an online platform for growers to view and interact with crop evapotranspiration data and groundwater allocations. Dr. Davids supervised the creation of a Django PostGIS web-based database allowing the Madera GSAs real-time concurrent access to a central repository of data about their growers, parcels, fields, crops, wells, etc. Dr. Davids also led the development of a mobile data collection platform that enables growers to submit flowmeter readings from their smartphones, including GPS coordinates, text and numerical entries, and photographs. The data collection platform also

facilitates concurrent review from County staff of the submitted flowmeter readings and keeps an auditable record of all corrections made to the grower-supplied data. The data collection platform also includes a map-based interface for viewing single grower submissions, or an aggregation of submissions over time from a single site. Finally, data can be exported from the platform to Excel. In addition to grower-supplied flowmeter readings, the Madera County GSAs use the data collection platform to collect, view, and store other field data including inspections of fallowed fields and on-site evaluations of flowmeters.

Colusa Subbasin Groundwater Sustainability Plan Revisions. Colusa Groundwater Authority and Glenn Groundwater Authority, Colusa and Glenn Counties, CA.

Together with his colleague Dr. Klug, Dr. Davids co-led the Groundwater Sustainability Plan (GSP) revisions for the Colusa Subbasin. On October 26, 2023, DWR completed its evaluation of the Initial GSP and transmitted a letter to the Colusa Groundwater and Authority and Glenn Groundwater Authority (GSAs) communicating its determination that the Initial GSP was "incomplete." As noted in DWR's October 26, 2023 letter, the GSAs had 180 days, the maximum allowed by GSP Regulations, to address three identified deficiencies and submit the Revised GSP to DWR by April 23, 2024. A summary of the three deficiencies identified in DWR's letter is as follows: (1) DWR found that the Initial GSP did not include a reasonable assessment of overdraft conditions and a reasonable means to mitigate overdraft, (2) DWR found that the sustainable management criteria (SMC) for chronic lowering of groundwater levels were not substantially compliant with the GSP regulations, and (3) DWR found that the SMC for subsidence were not substantially compliant with the GSP regulations. Dr. Davids worked closely with the GSAs, West Yost and Associates, other DE team members to develop a Revised GSP, and met with DWR five (5) times from December 2023 through March 2024 to ensure the revisions were on track. The revised GSP included the following elements: Memorandums of Understanding (MOUs) for domestic well mitigation and demand management, revisions to sustainable management criteria (SMCs) associated with groundwater levels and subsidence, analysis of critical infrastructure, quantitative reassessment of overdraft conditions in the Colusa Subbasin, and development of a five-year workplan for implementation of the Revised GSP.

Corning, Red Bluff, Antelope, and Los Molinos Subbasins Groundwater Sustainability Plan Implementation Support. Tehama County Flood Control and Water Conservation District and Corning Subbasing Groundwater Sustainability Agency, Tehama and Glenn Counties, CA.

As a key partner in the Luhdorff and Scalmanini Consulting Engineers (LSCE) team, Dr. Davids is leading GSP implementation efforts in the Corning subbasin related to maximizing use of existing surface water supplies in support of sustainable groundwater management. This involves quantification of available surface water supplies, and identification, evaluation, selection, design, and implementation of projects that increase surface water applications for irrigation within the Subbasin. Additionally, Dr. Davids supports identification of project concepts and piloting designs for a number of direct recharge efforts in the Corning, Red Bluff, Antelope, and Los Molinos Subbasins. Direct recharge projects include: (1) multi-benefit recharge projects, (2) Thomes Creek recharge projects, (3) stormwater recharge projects, (4) recharge through unlined canals, (5) recharge through dedicated basins, (6) recharge on the California Olive Ranch, and (7) Stony Creek recharge projects.

North and South Yuba Subbasins Groundwater Sustainability Plan Implementation Support. Yuba Water Agency, Yuba County, CA. Davids Engineering is supporting the Yuba Water Agency (YWA) with GSP implementation related to: (1) the characterization of interconnected surface waters, (2) implementation of improved subbasin surface water boundary flow monitoring, and (3) ongoing development, calibration, and application of the Yuba Groundwater Model (YGM; in a supporting role to Woodard & Curran) in support of sustainable groundwater management in the North and South Yuba Subbasins. Dr. Davids is leading ongoing synoptic streamflow measurements on the Feather River, Yuba River, Bear River, and Honcut Creek in efforts to improve characterization of stream-aquifer interactions and numerical modeling of these processes. Dr. Davids is also supporting improvements to a number of subbasin surface water boundary flow monitoring sites that will be used to improve confidence in the partitioning of unused applied water between deep percolation and

surface water outflow. Together with Dr. Klug on the DE team, Dr. Davids is supporting various refinements to the YGM, including moving from a monthly to daily timestep. Dr. Davids has also led the development of various processes to integrate spatially explicit evapotranspiration (ET), precipitation, and land use land cover (LULC) datasets into the monthly and daily YGMs.

Teaching Spatial Hydrology, Irrigation, GIS and Remote Sensing, and Water Resources Engineering. California State University, Chico, Butte County, CA.
Dr. Davids served as an assistant professor for three years, and is currently an adjunct professor, with the California State University, Chico. During his time at Chico State, Dr. Davids developed new curriculum and taught courses on Spatial Hydrology (CIVL 564), Water Resources Engineering (CIVL 461), GPS and GIS in Agriculture and Natural Resource Management (AGET 340), and Irrigation (AGET 360). During this time, he also continued research on the applications of citizen science in water resources management and agriculture. Dr. Davids secured $1 million in funding from the U.S. Bureau of Reclamation (USBR) as the Principal Investigator for the Irrigation Training Facility at the California State University, Chico Farm, and two grants from the California Agricultural Research Initiative (ARI) related to monitoring of the soil-plant-water-atmosphere continuum and using videos to measure surface flows in stream and canals.

Idled Rice Habitat Evapotranspiration (ET) Study. The Nature Conservancy, Yolo and Colusa Counties, CA.
Dr. Davids led the implementation of eddy covariance (EC) and remote sensing methods for quantifying incremental evapotranspiration from brief shallow flooding of fallowed rice fields. This included the comparison of evapotranspiration results from eddy covariance measurements, simplified surface renewal, and remote sensing to determine strengths and weaknesses of each approach. Dr. Davids developed recommendations to the California Department of Water Resources (DWR) and the United States Bureau of Reclamation (USBR) for methods to estimated incremental evapotranspiration of applied water (ETAW) and resulting adjustments to land-idling transferable water due to shallow flood events on fallowed rice fields.

Water Accounting Training and Implementation. Food and Agriculture Organization of the United Nations (UN-FAO). Afghanistan and Myanmar.
Dr. Davids served as the development team member for open-source pixel-based water balance software called Scalable Water balances from Earth Observations (SWEO). Additionally, Dr. Davids was the lead author for the development of comprehensive curricula for water accounting training including packages on: the water cycle; water balances; agricultural water use; environmental data acquisition; spatial and temporal domains; fluxes and changes in storage; geographical information systems (GIS); remote sensing (RS); hydrological modeling; green, blue, and grey water; crop physiology and transpiration processes; crop yields; consumptive vs. non-consumptive water uses; water productivity; climate change; Water Accounting Plus (WA+); interpretation of WA+ fact sheets; UN sustainable development goals; and development of appropriate water sector intervention packages. This included leading a diverse teaching team of international specialists from the Netherlands, Nepal, Thailand, UK, Afghanistan, the US, and the UAE. Water accounting training packages were implemented via an eight series training for 3o water resources specialists from three different Afghan water related ministries spread out over two years and a three series training for 25 water managers and researchers in Myanmar over the course of 6 months.

Citizen Science Based Hydrological Monitoring. SmartPhones4Water (S4W). Nepal, Vietnam, Ghana, Israel, Palestine, Afghanistan, and Myanmar.
Dr. Davids is the founder and president of SmartPhones4Water (S4W), a California-based 501(c)(3) non-profit organization focused on mobilizing young researchers and citizen scientists to quantitatively tell their water stories. These stories generally include versions of the three toos of water management: too little, too much, or too dirty. For three years, Dr. Davids lived and worked in Nepal to help launch a sister non-profit organization in Nepal (S4W-Nepal). S4W sees water data gaps as educational opportunities. S4W uses smartphones to collect data about water with citizen scientists led by young researchers. Over the last decade, S4W has successfully complete projects in Nepal, The Netherlands, Vietnam, Ghana, Israel, Palestine, Afghanistan, and Myanmar.

Flow Measurement Improvement Project. Reclamation District No. 108, Colusa County, CA.
Since 2008, Dr. Davids has worked with Reclamation District No. 108 to improve their flow measurement, data management, and decision support systems. This work has included drain pump calibrations, testing of alternative turnout flow measurement options, training of water system operators, database development, and development of a wireless acoustic doppler flow measurement device. Dr. Davids led the pilot testing of alternative measurement methods that were potentially capable of achieving heightening regulatory standards, including: existing orifice gates, weirs set in precast boxes, and a recently introduced portable acoustic Doppler flow measurement device. The pilot program included (1) customization of the portable measurement device for District needs, (2) selection and inventory of a test reach, (3) calibration of upstream and downstream measurement devices, (4) development of an automated data transfer process and (5) development of a Water Information System for water accounting and billing.

Flow Measurement Plan Development and Implementation., South San Joaquin Irrigation District, San Joaquin County, CA.
Dr. Davids supported the development and implementation of a Flow Measurement Plan (Plan) for the South San Joaquin Irrigation District (SSJID). The goals of the Plan are (1) to provide cost-effective service to customers; (2) generate improved operational records for planning and analysis, and; (3) comply with recently passed California legislation (SBx7-7). As part of this effort, Dr. Davids has designed a range of flow measurement methodologies and site improvements for SSJID involving standard critical depth structures (e.g. flumes and weirs) and acoustic Doppler flow measurement devices. Dr. Davids also participated in the field testing of acoustic Doppler devices.

Turnout Flow Measurement Program Piloting and Implementation. Glenn-Colusa Irrigation District, Princeton-Codora-Glenn Irrigation District, Provident Irrigation District, Sutter Mutual Water Company, South Sutter Water District, Reclamation District 1004, Richvale Irrigation District, Biggs-West Gridley Water District, and Western Canal Water District, Reclamation District No. 108, Glenn, Yolo, Colusa, Butte, and Sacramento Counties, CA.
Dr. Davids led the development, piloting, implementation of an innovative turnout flow measurement solution for the irrigation which is now in use on over 600,000 acres. Dr. Davids has conducted various training sessions with district operators in the basics of open channel flow measurement, critical flow devices, and hydroacoustics. For each district, Dr. Davids has inventoried district distribution systems, established standardized naming conventions, pilot tested alternative measurement devices, selected preferred measurement alternatives, and developed custom database applications for quality controlling and managing turnout flow data.

Stream and Canal Flow Measurement Improvements and Environmental Data Acquisition. Shasta County, CA.
Over the last 20 years, Dr. Davids has designed, installed, commissioned, and maintained dozens of flow monitoring stations in natural and man-made channels in the Shasta Valley. The flow monitoring stations have employed a range of technologies from low-cost solutions like using temperature to monitor the operation of wells, to higher cost hydroacoustic technologies for measuring water velocities directly. Dr. Davids has also employed a variety of techniques to characterize stream-aquifer interactions. Dr. Davids has been involved in hydrogeologic quality investigations looking at stable isotopes and bulk chemical constituents. Stable isotopes of oxygen were used to delineate apparent recharge elevations. Samples were also plotted on the meteoric water line to determine water rock interactions and degree of re-evaporation.

Measurement Improvement Plan Development and Implementation. Yuba Water Agency, Yuba County, CA.
In 2013, The Yuba Water Agency (YWA) developed an agricultural water management plan (AWMP) in 2012 as required by the Water Conservation Act of 2009. As part of the larger AWMP effort, Dr. Davids led the development of a Measurement Improvement Plan to improve customer delivery measurement and quantification of key boundary inflows and outflows. Development of the Measurement Improvement Plan included an inventory and inspection of existing open channel and pipe flow measurement sites, in-situ verification measurements to assess existing measurement site accuracy, in addition to development of designs and cost estimates for improvements required to ensure that YCWA is

compliant with the Agricultural Water Measurement Regulation (CCR §597). Part of the implementation included the construction of two concrete lined sections. Dr. Davids led the design, bidding, and construction management process.

Orifice Gate Coefficient Analysis. Imperial Irrigation District, Imperial County, CA.
Colorado River water has transformed the Imperial Valley landscape from a barren desert to one of the most agriculturally productive regions in the country. Dr. Davids developed the flow verification methodology for a study aimed at aiding in the verification of historical water use records. Dr. Davids provided training and oversight for field personnel tasked with the collection of verification flow measurement data. The effort was part of a larger project involving the 2003 Quantification Settlement Agreement.

Customer Delivery Measurement Plan. Turlock Irrigation District, Stanislaus County, CA.
Dr. Davids developed and implemented Customer Delivery Measurement Plan (Plan) to ensure compliance with the Agricultural Water Measurement Regulation (CCR §597). Dr. Davids reviewed and refined spot flow measurement protocols for performing current metering measurements of farm-gate flows. Led the development of customized procedures for gate/parcel specific ratings, in addition to the field testing of acoustic Doppler velocimeters.

Montague Weir Flow Measurement and Fish Passage Alternatives. AquaTerra Consulting, Siskiyou County, CA.
Dr. Davids assessed existing weir structure from fish passage and measurement perspectives. Developed alternatives for modification of the weir to satisfy the identified co-equal fish passage and flow measurement goals. Presented results to US Geological Survey, US Fish and Wildlife, Shasta Valley Resource Conservation District and others and worked with stakeholders to identify a preferred alternative.

SELECTED PUBLICATIONS

Metzger, S., Burba, G.G., Davids, J.C., Desai, A.R., Durden, D., Jones, P., Paleri, S., and Papale, D., 2025. Footprint Meets Energy Balance: Real-World Continuity with 4D Virtual Control Volume Flux Mapping, Chapman Conference on the Energy Balance Closure Problem, Boulder, CO, USA.

Hessels, T., Davids, J.C., Bastiaanssen, W., 2021. Scalable Water balances from Earth Observations (SWEO): results from 50 years of remote sensing in hydrology, Water - Special Issue in memoriam of Tony Allan, Water International, 47(6), 866-886.

Prajapati, R., Talchabhadel, R., Thapa, B.R., Upadhyay, S., Thapa, A.B., Ertis, B., and Davids, J.C., 2021. Measuring the unseen: mobilizing citizen scientists to monitor groundwater in Nepal. Environmental Monitoring and Assessment, 193(9), pp.1-21.

Davids, J.C., Devkota, N., Pandey, A., Prajapati, R., Ertis, B.A., Rutten, M.M., Lyon, S.W., Bogaard, T.A. and van de Giesen, N., 2019. Soda bottle science-citizen science monsoon precipitation monitoring in Nepal. Frontiers in Earth Science, 7, p.46.

Davids, J.C., Rutten, M.M., Pandey, A., Devkota, N., Oyen, W.D.V., Prajapati, R. and van de Giesen, N., 2019. Citizen science flow–an assessment of simple streamflow measurement methods. Hydrology and Earth System Sciences, 23(2), pp.1045-1065.

Davids, J.C., 2019. Mobilizing Young Researchers, Citizen Scientists, and Mobile Technology to Close Water Data Gaps - Methods Development and Initial Results in the Kathmandu Valley, Nepal, Delft University of Technology, Netherlands, PhD Dissertation.

Davids, J.C., Rutten, M.M., Shah, R.D.T., Shah, D.N., Devkota, N., Izeboud, P., Pandey, A. and van de Giesen, N., 2018. Quantifying the connections—linkages between land-use and water in the Kathmandu Valley, Nepal. Environmental monitoring and assessment, 190, pp.1-17.

Davids, J.C. and Mehl, S.W., 2015. Sustainable capture: Concepts for managing stream-aquifer systems. Groundwater, 53(6), pp.851-858.

John B. Davids, P.E.

President, Principal Engineer

EDUCATION

B.S., BioResource and Agricultural Engineering
California Polytechnic University, San Luis Obipso

REGISTRATION

Civil Engineer, CA
No. C73036

YEARS OF EXPERIENCE

23 Years

DISTINGUISHING QUALIFICATIONS

- Building and fostering relationships with stakeholders, outside agencies, and representatives to deliver best possible professional solutions.
- Proficient at coordinating multi-disciplinary projects, communicating changes and progress, and completing projects on time and within budget.
- Aptitude to navigate dynamic regulatory and legislative climate.

SUMMARY

Mr. Davids joined Davids Engineering (DE) in June of 2021 and currently serves as a Principal Engineer, working across all three of DE's solutions – Water, Infrastructure, and Technology. Mr. Davids has 20 years of progressive experience in public policy, FERC relicensing, water resources master planning, irrigation system modernization, permitting, design, construction, and groundwater management. Mr. Davids is an active member of the United States Committee on Irrigation and Drainage, past member of the Association of California Water Agencies Groundwater Committee and Agriculture Committee, past Chair of the Stanislaus and Tuolumne Rivers Groundwater Basin Association Groundwater Sustainability Agency, and past member of the Oakdale Rotary Club where he served as the Sergeant at Arms.
Prior to joining DE, Mr. Davids worked for Modesto Irrigation District (MID) as one of their Assistant General Managers overseeing MID's Water Operations (ag water and domestic water), Federal Energy Regulatory Commission (FERC) relicensing of Don Pedro Reservoir, Voluntary Agreement negotiations with the State of California related to Phase I of the Bay-Delta Water Quality Control Plan and Chair of the Stanislaus and Tuolumne Rivers Groundwater Basin Association Groundwater Sustainability Agency. From 2004 to 2013, Mr. Davids managed Oakdale Irrigation District's (OID) Engineering Department coordinating all department functions including, subdivision/parcel map review, California Environmental Quality Act (CEQA) compliance, master planning and capital project design. Prior to OID, from 2002 to 2004, Mr. Davids worked for a large international consulting firm, working on a wide variety of water resources projects in the Western United States including projects for irrigation districts, various municipalities and the Los Angeles Department of Water and Power.

RELEVANT EXPERIENCE

Madera Subbasin Groundwater Sustainability Plan Revisions. County of Madera, Madera, CA.

The Madera Subbasin Joint Groundwater Sustainability Plan (GSP) was developed jointly by four GSAs that represent approximately 94% of the Subbasin area: the City of Madera GSA, the County of Madera GSA – Madera Subbasin, the Madera Irrigation District (MID) GSA, and the Madera Water District (MWD) GSA. In September 2022, the Department of Water Resources (DWR) issued an "incomplete" determination for the Joint GSP and the other three GSPs in the Madera Subbasin. Over the 180-day period from September 2022 to March 2023, Mr. Davids led a multi-disciplinary team that supported the Joint GSP GSAs in developing and implementing a strategy for the GSP revisions and consulting with DWR staff to discuss and verify that the revisions were on track toward approval. Serving on behalf of and at the direction of the Joint GSP GSAs. Further, Mr. Davids facilitated coordination across all technical

consultants supporting technical revisions across all GSPs (Joint GSP and the other three GSPs) through weekly and biweekly technical coordination meetings, several formal consultation meetings with DWR, and other touchpoints to work through the many technical and policy decisions involved in the GSP revisions. During the GSP revisions process, Mr. Davids advised and guided the GSAs in the initial development of a domestic well mitigation program Memorandum of Understanding (MOU) to address and mitigate domestic well impact concerns in the Subbasin related to groundwater level decline. In December 2023, DWR formally approved the revised GSPs for the Madera Subbasin.

Chowchilla Subbasin Groundwater Sustainability Plan Revisions. Chowchilla Water District, Chowchilla, CA.

The Chowchilla Subbasin GSP was developed jointly by four GSAs that cover the entirety of the Chowchilla Subbasin (Subbasin): the Chowchilla Water District (CWD) GSA, the County of Madera GSA – Chowchilla Subbasin, the Triangle T Water District (TTWD) GSA, and the Merced County GSA – Chowchilla Subbasin. In January 2022, the DWR issued an "incomplete" determination for the Chowchilla GSP. Over the 180-day period from January 2022 to July 2022, Mr. Davids led a multi-disciplinary team that supported the Chowchilla GSAs in developing and implementing a strategy for the GSP revisions and consulting with DWR staff to discuss and verify that the revisions were on track toward approval. In March 2023, DWR determined that the Revised GSP for the Subbasin was inadequate. Immediately after DWR's inadequate determination, DE and the GSAs began formal consultations with the SWRCB. Those discussions concluded in the submission of a draft set of GSP revisions on May 5, 2023. Since submission of the draft revised GSP, Mr. Davids as Project Manager has worked extensively with the SWRCB on next steps. To date, the Subbasin is at the bottom of the SWRCB's priority list for the six subbasins that have been sent to DWR and DE is optimistic that the Subbasin won't have to proceed with a Probationary Hearing.

Madera County Recharge Study. County of Madera, Madera, CA.

Mr. Davids is serving as Team Leader of a multi-firm and multi-disciplinary team of professional and has successfully expedited the preliminary development of 10 recharge projects – 5 in the Chowchilla Subbasin and 5 in the Madera Subbasin. In general, the projects include a mix of dedicated recharge basins and Flood-MAR and range in total recharge capacity at full build-out from 8,000 acre-feet (AF)/year to nearly 30,000 AF/year. Collectively, the total recharge potential in wet years is approximately 80,000 AF in the Chowchilla Subbasin and nearly 116,000 AF in the Madera Subbasin. Stemming from this planning work, Madera County has been successful at receiving 4 grants for early implementation of recharge projects, totaling more than $12 million dollars.

Madera/Chowchilla Recharge Projects, County of Madera, Madera, CA.

Mr. Davids is serving as Team Leader of a multi-firm and multi-disciplinary team of professionals designing, permitting, and constructing recharge projects in both the Madera and Chowchilla Subbasin. To date, both projects are approaching 60% design and construction is expected to commence on at least one of the projects during the summer of 2024. Collectively, the projects will be designed to have a recharge capacity of approximately 15,000 AF per year when flood flows are available. Completion of the projects is being funded by a grant from the Department of Water Resources (DWR) and a local cost share. DE prepared the successful grant applications for these two projects.

Non-District East Groundwater Recharge Project Development and Ranking, L.F. Brichetto, Oakdale, CA.

In an effort to prepare for upcoming grant funding opportunities and on behalf of approximately 15,000 acres of privately developed agricultural in the white area of the Modesto Subbasin, Mr. Davids led the DE Team tasked with completing a Groundwater Recharge Project Development and Ranking Project. Tasks for this project included acquisition of GIS data, completion and distribution of a recharge survey interest form, completion of GIS base mapping, completion of a recharge suitability analysis, water supply negotiations, and conceptual project development and ranking. A ranking of the projects developed has served as a "menu" of recharge options as funding becomes available. It is contemplated that further design, environmental permitting, construction management, and monitoring and assessment will be performed as part of subsequent work activities following successful grant award.

Executive Director of Water Resources, Modesto Irrigation District, Modesto, CA.
In a contract capacity, Mr. Davids currently serves as the Executive Director of Water Resources for Modesto Irrigation District (MID). In Mr. Davids' capacity as the Executive Director of Water Resources, Mr. Davids' oversees and manages a multi-disciplinary team (engineers, scientists, and attorneys) focused on MID's relicensing of Don Pedro Reservoir and Voluntary Agreement development, negotiations, and early implementation of the Tuolumne River Voluntary Agreement. This includes oversight and co-management of more than $80 million in proposed habitat restoration on the lower Tuolumne River. Mr. Davids' reports directly to and serves at the pleasure of the MID Board of Directors.

Assistant General Manager, Water Operations, Modesto Irrigation District, Modesto, CA.
As Assistant General Manager, it was Mr. Davids' responsibility to plan, organize, direct and review the activities and operations of the Water Operations Division including civil engineering, water use, planning and conservation, irrigation services, construction management, domestic water operations, and to coordinate assigned activities with other divisions and outside agencies and provide highly responsible and complex administration support to the General Manager and the Board of Directors. Mr Davids was responsible for transparent development and implementation of the Water Operations Division annual budget – approximately $40M (2020).

District Engineer, Oakdale Irrigation District, Oakdale, CA. As District Engineer, it was Mr. Davids' responsibility to manage and direct all Engineering Department activities. During Mr. Davids decade at Oakdale Irrigation District, Mr. Davids lead the implementation of the Comprehensive Water Resources Plan and the subsequent design and construction of over $50M in capital improvements.

REPRESENTATIVE PROJECTS

- Don Pedro and La Grange Federal Energy Regulatory Commission Relicensing and Licensing, Modesto Irrigation District
- Main Canal Regulating Reservoir, Modesto Irrigation District
- Water Operations Cost of Service Model, Modesto Irrigation District
- Development and implementation of volumetric billing, Modesto Irrigation District
- Development and implementation of special drought programs and drought surcharge, Modesto Irrigation District
- Creation, development and implementation of Water Resources Planning Department, Modesto Irrigation District
- Annual revisions to Rules and Regulations Governing the Distribution of Irrigation Water with the Modesto Irrigation District, Modesto Irrigation District
- 2015/2020 Agricultural Water Management Plans, Modesto Irrigation District
- Successful introduction and use of new aquatic herbicides in irrigation conveyance infrastructure, Modesto Irrigation District
- Modesto Regional Water Treatment Plant Phase II construction activities, contract closeout and commissioning, Modesto Irrigation District
- Oral testimony to State Water Resources Control Board at December 20, 2016 public hearing regarding revisions to the Water Quality Control for the Bay-Delta, Modesto Irrigation District
- Successful coordination and operation of 2017 flood management operations, Modesto Irrigation District
- Development and implementation of 2017, 2018 and 2019 Groundwater Replenishment Plan, Modesto Irrigation District (1st place award in the 2020 CMUA Resource Efficiency & Community Service Awards)
- Creation of Stanislaus and Tuolumne Rivers Groundwater Basin Association Groundwater Sustainability Agency, Modesto Irrigation District
- Successful good faith negotiation of Tuolumne River Voluntary Agreement, Modesto Irrigation District
- Settlement Agreement with the U.S. Bureau of Land Management regarding Don Pedro Relicensing, Modesto Irrigation District

- Revised 10(j) conditions with U.S. Fish and Wildlife Service regarding Don Pedro Relicensing, Modesto Irrigation District
- Memorandum of Understanding with U.S. Fish and Wildlife Service regarding early implementation of habitat improvement projects on the Lower Tuolumne River, Modesto Irrigation District
- Water Resources Plan, Oakdale Irrigation District
- North Side Regulating Reservoir, Oakdale Irrigation District (2009 ASCE Project of Merit)
- Honolulu Bar Habitat Restoration Project on the Stanislaus River, Oakdale Irrigation District
- Cashman Dam Rehabilitation Project, Oakdale Irrigation District
- Little Johns Creek Diversion, Oakdale Irrigation District
- Fairbanks Crossing at South San Joaquin Irrigation District, Oakdale Irrigation District
- 2012 Standard Details, Oakdale Irrigation District
- System-wide GIS Mapping, Oakdale Irrigation District
- Numerous automation projects, Oakdale Irrigation District
- Numerous flow measurement projects, Oakdale Irrigation District
- Numerous pipeline replacement projects, Oakdale Irrigation District
- Numerous canal rehabilitation projects, Oakdale Irrigation District
- Total Channel Control Pilot Program, Oakdale Irrigation District
- 2012 Agricultural Water Management Plan (SBx7-7 Measurement and Volumetric Billing Sections), Oakdale Irrigation District
- Glenn Colusa, Canal Enlargement Study, CH2MHill (now Jacobs)
- Orland Unit, Modernization Analysis, CH2MHill (now Jacobs)
- L.A. Department of Water and Power, Owens Lake Mitigation Project, CH2MHill (now Jacobs)

Saujan Maka, M.Eng.

Lead Developer

SUMMARY

Saujan Maka has completed a bachelors in Computer Engineering from Institute of Engineering (IOE), one of the best engineering colleges of Nepal and is currently pursuing a masters in Computer Engineering from Nepal College of Information Technology located in Nepal. Saujan possesses a good foundation of knowledge in software development but does not limit himself to it. Saujan is actively involved in researching new technologies and trends in the fields. By staying updated, Saujan continuously expands his knowledge beyond his formal education. Saujan applies his research to solve real world problems through innovative software development. His approaches combine theoretical knowledge with experience skills.

Saujan has gained valuable experience by working in Rooster Logic Pvt. Ltd. as a Data Analyst and web developer in Nepal. Saujan also worked as a remote developer at Whitehat Engineering (US based IT Company), where Saujan held the position of Lead Developer. In this role, Saujan was responsible for managing projects and guiding a team of developers. Working remotely required him to be highly organized and self-disciplined. His time at Whitehat significantly improved his professionalism and communication skills. Leading a distributed team helped him understand how to collaborate effectively across different time zones and cultures. This experience has made him a more confident and capable leader in the field of software development.
These opportunities have helped him build strong technical and professional skills. After years of dedicated work, Saujan is now working full time with the H2oTech, LLC development team.

RELEVANT EXPERIENCE

H2oTech FLOW Web Application

Saujan is currently working full-time at H2oTech, LLC as a Lead Developer. In this role, Saujan leads a team of developers and oversees the entire software development process. Saujan is primarily focused on developing the FLOW Web Application, an innovative application designed to support sustainable water measurement and accounting in the Western US and beyond. The FLOW App helps monitor water usage, track water quality, and provide valuable insights for conservation efforts to support sustainable water measurement and accounting in the Western US and beyond. By leveraging modern technologies and efficient coding practices, Saujan ensures that the app is reliable, user-friendly, and scalable. His responsibilities include designing the system architecture, writing clean and maintainable code, and guiding junior developers. Saujan also collaborates closely with environmental experts to make sure the app addresses real-world water management challenges.

EDUCATION

M.Eng., Computer Engineering, Nepal College of Information Technology (NCIT), Kathmandu, Nepal
Bachelors, Computer Engineering, Institute of Engineering of Tribhuvan Engineering, Kathmandu, Nepal

REGISTRATION

Computer Engineer
No. 16314

YEARS OF EXPERIENCE

10 Years

DISTINGUISHING QUALIFICATIONS

- Strong leadership, project management, and collaboration skills essential for leading an interdisciplinary development team
- proven track record of building and managing complex systems through hands-on experience in software development, data analysis, and web technologies
- Actively researches emerging technologies and applies that knowledge to develop real-world software solutions, blending academic theory with practical implementation

Through his work at H2oTech, LLC, Saujan aims to contribute to the long-term sustainability and preservation of our vital water resources.

WhiteHat Engineering (US based Company) and LeaveLogic WebApp

Saujan worked as a Lead Developer at WhiteHat Engineering, a US-based company, for 6 years. During this time, Saujan primarily contributed to the development and maintenance of the LeaveLogic WebApp, a robust leave management solution. Saujan became highly proficient in using the Ruby on Rails framework and advanced SQL queries to build and optimize application features. Working with an international team helped him adapt to a professional global work culture, improving his collaboration and communication skills. This experience not only strengthened his technical expertise but also shaped him into a responsible team leader capable of delivering high-quality software solutions. About Product: https://leavelogic.com/

S4W-Nepal and QA control WebApp

Saujan worked with S4W-Nepal, where Saujan was involved in developing and maintaining the Data Portal and its associated platforms. The Data Portal is an online platform designed to make water-related data easily accessible through interactive visualizations and maps. This portal enables researchers, policymakers, and the public to explore information about rainfall, soil moisture, and other hydrological parameters. In addition to the Data Portal, Saujan also worked on the Admin Portal, which serves as a backend platform for managing data quality control and user access. Through the Admin Portal, users can review, validate, and manage measured data such as rainfall and soil data to ensure accuracy and reliability. For these projects, Saujan primarily used Django for backend development and React for building dynamic, user-friendly interfaces. Saujan also configured and managed the necessary web servers and database servers to ensure smooth deployment and stable performance. This experience greatly enhanced his skills in full-stack web development, server management, and building practical solutions for environmental data management. Data Portal: https://data.smartphones4water.org

Rooster Logic Pvt. Ltd. and its product Remo WebApp

Saujan worked at Rooster Logic Pvt. Ltd., where Saujan contributed as a senior Python Developer. During his time there, Saujan was actively involved in developing and maintaining Remo WebApp, one of the company's flagship products. This role allowed him to gain in-depth experience with professional web development practices and workflows. Saujan became proficient in using industry-standard tools and frameworks such as Git, Django, Python, Pandas, and SQLite. Working with these technologies helped him strengthen his skills in writing efficient code, managing databases, and performing complex data processing tasks. Overall, his experience at Rooster Logic played a vital role in shaping him into a capable and detail-oriented software developer. About Remo WebApp: https://roosterlogic.com/product/remo

ACADEMIC PROJECTS

3D Solar System

Saujan developed a 3D Solar System Project using advanced 3D projection system techniques. In this project, a realistic model of the solar system was created, featuring nine planets revolving smoothly around the sun. The system simulates the orbital motions to help users visualize the dynamics of planetary movement. Users can interact with the simulation by pressing the up, down, left, and right keys to change the viewport or adjust the camera position. This project not only demonstrates his skills in 3D graphics and simulation but also serves as an engaging educational tool for learning about the solar system.

Sudoku Game

Saujan developed a Sudoku Game as a desktop application using Java. The game provides users with an interactive platform to play and solve Sudoku puzzles on their computer. It features an intelligent solver that uses the Depth First Search (DFS) algorithm to find solutions efficiently. This algorithm explores possible number placements systematically until the puzzle is solved correctly. Through this project, Saujan demonstrated his understanding of algorithms, problem-solving techniques, and Java-based desktop application development.

Website analytics

Saujan developed a Website Analytics tool to help website owners gain valuable insights into user behavior. This tool measures overall website traffic and provides detailed reports on visitor counts and trends. It includes a heatmap feature that visually shows which parts of the content were most popular and received the most attention. It also tracks which URLs were clicked by users and how far each page was scrolled. All this information is presented clearly to the website owner through an easy-to-understand dashboard. Based on these analytics, the owner can make informed decisions to customize and optimize the page content. This helps improve user engagement, enhance navigation, and increase overall website performance. By developing this tool, Saujan showcased his skills in web tracking, data visualization, and user experience enhancement.

AI and Image Processing

Saujan is currently conducting research on AI implementation in image processing to explore innovative ways to analyze and interpret visual data. His focus is on applying advanced machine learning and deep learning algorithms to improve the accuracy and efficiency of image recognition tasks. This includes developing models that can detect patterns, classify objects, and extract meaningful information from complex images. Saujan is experimenting with techniques such as convolutional neural networks (CNNs) and image segmentation to handle various real-world scenarios. Through this research, Saujan aims to create intelligent solutions that can be applied in fields like medical imaging, environmental monitoring, and automated visual inspections. By integrating AI with image processing, Saujan seeks to contribute to cutting-edge technological advancements that solve practical problems and enhance decision-making.

TECHNICAL TOOLS

- Python programming language
- Pandas and Geopandas Python modules
- React programming language
- Django framework
- GeoDjango framework
- Ruby On Rails framework
- SQL queries and Spatial SQL queries and MongoDB
- Git, Postman, Jira

Daniel Smith, Ph.D., E.I.T.

Staff Engineer I

DAVIDS ENGINEERING, INC

EDUCATION

Ph.D., Biological Systems Engineering
Virginia Polytechnic Institute and State University

B.S., Civil and Environmental Engineering, minor in Soil Science
University of Maryland

REGISTRATION

Engineer in Training
No. 53251

AFFILIATIOINS

Member – American Geophysical Union

Member – Soil Science Society of America

YEARS OF EXPERIENCE

3 Years

DISTINGUISHING QUALIFICATIONS

- Spatial data processing, analysis, and visualization in R and Python.
- Multivariate statistics and regression analysis.
- Assembly and interpretation of soil morphological datasets
- Authored and presented various planning documents, technical reports, and grant applications for diverse clients and audiences.

SUMMARY

Dr. Smith's love for water and soil expanded when he took his first Introduction to Soil Science course in college. That experience, combined with his passion for applied science, propelled Dr. Smith to pursue a B.S. in Civil and Environmental Engineering with a specialization in Soil Science while at the University of Maryland, College Park. Following his B.S., Dr. Smith sought to work on an interdisciplinary research project that combined his passion for both water and soil. This desire led him to complete a Ph.D. in Biological Systems Engineering from the Virginia Polytechnic Institute and State University in Blacksburg, VA. This degree has given Dr. Smith a strong foundation in soil biogeochemistry, hydrology and hydrological modeling, and data analysis/visualization in Python. Dr. Smith's specific interest focuses on understanding how water, soil, and plants interact to influence the transfer of water and/or sediment from one location to another.

RELEVANT EXPERIENCE

Management and Processing of the Soil Survey Geographic (SSURGO) Database. Multiple Locations, CA.

Dr. Smith led the development of a California wide, 30m raster product based on the existing SSURGO dataset. Dr. Smith used his knowledge of soil morphological properties to extract relevant information from the SSURGO database and calculated weighted-average soil property values based on horizon thickness. The SSURGO-based dataset includes percent sand, silt, and clay content, hydraulic conductivity, depth to a restrictive layer (e.g., bedrock), soil water holding capacity, and more. The SSURGO 30m raster product has supported a variety of DE projects, including the Madera County Allocation Support and El Dorado County applied water model refinement projects.

Madera County Groundwater Sustainability Agency Allocation Program Implementation Support. Madera County Groundwater Sustainability Agencies (GSAs), Madera County, CA.

The GSAs managed by Madera County are currently implementing Groundwater Sustainability Plans (GSPs) for the "white areas" of the Chowchilla, Madera, and Delta-Mendota Subbasins, which are solely dependent on groundwater for irrigation of agricultural lands in most years. An important component of GSP implementation and achieving sustainability is reducing consumptive use of groundwater, which may be accomplished through implementation and enforcement of groundwater allocation. In 2024, Dr. Smith took leadership of this allocation support program. Dr. Smith modified or developed new allocation reports, participated in field inspections of established irrigation units, and mentored junior team members in completing necessary priority tasks. In addition, Dr. Smith led the development of updating the land use land cover,

parcel, and parcel-field coverage for all Madera County GSA growers. This work included the conceptual development and spatial data processing in Python to generate tabular summaries, maps, and visualizations of updated datasets. Dr. Smith also supervised a major update to a Django PostGIS web-based database that allows the Madera County GSAs real-time concurrent access to a central repository of data about their growers, parcels, fields, crops, wells, etc. Lastly, Dr. Smith anticipates and plans for future work needed to continue the successful implementation of the allocation support program.

Verification Project to Quantify Groundwater Use per Groundwater Allocations, Madera County Groundwater Sustainability Agencies (GSAs), Madera County, CA.

The Madera Verification Project was developed to configure, implement, and test the methods Madera County selected to monitor groundwater extraction and consumptive use prior to the enforcement of allocations and penalties. Allocation methods included measuring groundwater extraction directly via flowmeters and two remotely-sensed methods of groundwater consumptive use by crops (IrriWatch and Land IQ). In 2023, Dr. Smith led the effort to wrangle, clean, analyze, and visualize all the data collected for the Verification Project. Dr. Smith set up an automated data processing workflow using Python to ensure all results were high quality and reproducible. Dr. Smith's automated data analysis process led to the identification of errors and necessary refinements of the remotely-sensed datasets. Dr. Smith also performed multivariate statistical analysis to statistically compare the three measurement methods and expand on the results highlighted by DE during the 2022 Verification Project. Lastly, Dr. Smith was one of the main contributors to the final 2023 Verification Project report. This report outlined all results, conclusions, and recommendations that will be used by the Madera County GSAs to guide management decisions for the allocation program.

Presidential Postdoctoral Fellow, School of Plant and Environmental Sciences. Virginia Tech, Blacksburg, VA (September 2022 – October 2023).

Dr. Smith independently developed and funded a multidisciplinary project that investigated how the application of different types of soil organic matter could influence soil stability and erodibility for engineering and agricultural purposes. Throughout the duration of this project, Dr. Smith secured $120,000 in funding and mentored three additional undergraduate and graduate students on various subsets of this project. Additional tasks included experimental design, data collection and analysis, project management and budgeting, and project publication and presentation to interested stakeholders.

Graduate Research Assistant, Biological Systems Engineering Department, Virginia Tech, Blacksburg, VA (August 2017 – August 2022).

Under the direction of an advisor, Dr. Smith developed an interdisciplinary and externally funded research project that investigated how the interaction between water, plants, and soil organic matter influenced the erodibility of streambank soils. To complete this project, Dr. Smith deployed an Acoustic Doppler Profiler and developed new/modified existing code to analysis the data produced. In addition, Dr. Smith secured $140,000 in grant funding spread over three years from the National Science Foundation to perform this work. Lastly, Dr. Smith was broadly trained in modeling hydraulic flows and the analysis of remotely sensed/geospatial datasets for water resources and environmental applications.

SELECTED PUBLICATIONS

Smith D.J., Ph.D.; Abdelaziz S.L., Ph.D., P.E., A.M.ASCE; and Badgley B.D., Ph.D. (2024). Short-term changes in soil aggregate stability in biopolymer-amended, coarse-grained soil. In IFCEE 2024 (pp. 208-215). https://ascelibrary.org/doi/abs/10.1061/9780784485415.022.

Smith, D. J., Duston, S., Barney, J. N., Strahm, B. D., Agarwal, P., Mangru, A., & Badgley, B. D. (2024). Dissolved organic carbon characteristics are associated with changes in soil microbiome under different plant species. Applied Soil Ecology,

196. https://doi.org/10.1016/j.apsoil.2024.105313.

Smith, D.J., Wynn-Thompson, T.M., Stremler, M.A., Hession, W.C., Williams, M.A., & Seiler, J.R. (2023). Root Reinforcement and Soil Microbial Glue Reduce Streambank Fluvial Erosion. Science of The Total Environment, 896, 165125. https://doi.org/10.1016/j.scitotenv.2023.165125.

Smith, D. J., Snead, M*., & Wynn-Thompson, T. M. (2022). Soil amended with organic matter increases fluvial erosion resistance of cohesive streambank soil. Journal of Geophysical Research: Biogeosciences, 127, e2021JG006723. https://doi.org/10.1029/2021JG006723. *Undergraduate mentee

Smith, D.J., Wynn-Thompson, T.M., Williams, M.A., Seiler, J.R. (2021). Do Roots Bind Soil? Comparing the Physical and Biological Role of Plant Roots in Fluvial Streambank Erosion: A Mini-JET Study. Geomorphology 375, 107523. https://doi.org/10.1016/j.geomorph.2020.107523

Muerdter, C.P., Smith, D.J. and Davis, A.P. (2019). Impact of vegetation selection on nitrogen and phosphorus processing in bioretention containers. Water Environ Res., 92(2), 236-244. https://onlinelibrary.wiley.com/doi/10.1002/wer.1195.

Nancy Navarro

Staff Specialist I

EDUCATION

B.S., Computer Science and Engineering
University of California, Merced

YEARS OF EXPERIENCE

3 Years

DISTINGUISHING QUALIFICATIONS

- Programming Languages:
  - Python
  - C++
  - C
  - Java
- Geospatial data analysis using Python and APIs
- Experience in training teams in developing python skills for cutting edge tech development.
- Experience in training clients in data analysis and quality assurance/control procedures.

SUMMARY

Ms. Navarro received her bachelor's degree in computer science and engineering at University of California, Merced. Prior to joining DE in January 2024, Ms. Navarro worked at Turlock Irrigation District (TID) in the Hydrology department. Her primary scope of responsibility consisted of applying cutting edge data science and analysis to past, current, and future water operation strategies. The list of tasks included watershed modeling, water accounting, creation of specialty tailored software programs, database navigation tools, spatial hydrology, drought/flood operations, and Delta operations. Ms. Navarro's background in hydrology and agriculture further drives her passion in working with Davids Engineering clients to develop cutting edge water resources technology, with the goal of ensuring long-term water resource sustainability. In her free time, Ms. Navarro enjoys knitting, painting, and taking long walks in the parks with her family.

RELEVANT EXPERIENCE

Designed and implemented a Dynamic Report Engine. Multiple locations, CA.

Ms. Navarro designed and implemented a dynamic report engine that streamlined the report creation process by developing a structured template that automatically formats and organizes data, making reports faster to produce and easier to read. Ms. Navarro has also provided training for team members on its usage for seamless adoption. This dynamic report engine has been incorporated amongst many DE projects to help clients analyze key metrics and drive strategic decisions.

Designed and implemented a Dynamic Email Automation System. Multiple locations, CA.

Ms. Navarro designed and implemented a dynamic email automation system that customizes messages and includes individualized file attachments. This system has been deployed for both DE clients and the public they work alongside, enabling them to monitor and create strategic decisions.

Madera County Groundwater Sustainability Agency Allocation Program Implementation Support. Madera County GSA, Madera County, CA.

The GSAs managed by Madera County are currently implementing Groundwater Sustainability Plans (GSPs) for the "white areas" of the Chowchilla, Madera, and Delta-Mendota Subbasins, which are solely dependent on groundwater for irrigation of agricultural lands in most years. An important component of GSP implementation and achieving sustainability is reducing consumptive use of groundwater, which may be accomplished through implementation and enforcement of groundwater allocation. Ms. Navarro has modified and developed new reports related to the allocation program, alongside these reports she also oversaw the delivery of these reports through the dynamic

email automation system. Ms. Navarro supported junior team members to develop cutting edge technology for the implementation of groundwater allocation. Ms. Navarro has also collaborated with DE team members in designing and updating the Django PostGIS web-based database that contains the agricultural data for the Madera County GSA's.

Verification Project to Quantify Groundwater Use per Groundwater Allocations, Madera County Groundwater Sustainability Agencies (GSAs), Madera County, CA.

The Madera Verification Project was developed to configure, implement, and test the methods Madera County selected to monitor groundwater extraction and consumptive use prior to the enforcement of allocations and penalties. Allocation methods included measuring groundwater extraction directly via flowmeters and two remotely-sensed methods of groundwater consumptive use by crops (IrriWatch and Land IQ). Ms. Navarro assisted with the development of ODK forms used to help Madera County in their flowmeter verification efforts. Ms. Navarro integrated the dynamic report engine along with the ODK forms to design and deliver study reports, presenting critical data insights for the study. Ms. Navarro also provided training and guidance to clients on data analysis and quality assurance/control procedure, enabling them to independently manage and validate data. Ms. Navarro also provided on-call support, addressing client inquiries and offering timely assistance for any questions or issues.

RemoteTracker Support for Delivery Measurement and Data Management. Richvale Irrigation District, Western Canal Water District, Biggs-West Gridley Water District, Reclamation District No. 108, Sutter Mutual Water District, South Sutter Water District, Butte, Glen, Colusa, and Sutter Counties, CA.

Ms. Navarro worked alongside DE team members to generate real-time monitoring reports using the dynamic report engine for RemoteTracker clients to use to track their water delivery measurements on a weekly basis, delivered by the dynamic email automation system. She developed a custom app leveraging the Dropbox DBX console to facilitate data downloads and integrate Python for automated retrieval.

Brandon Ertis, M.S., P.E.

Senior Engineer

DAVIDS ENGINEERING, INC

EDUCATION

M.S., Environmental Science
California State University, Chico

B.S., Civil Engineering
University of California, Davis

REGISTRATION

Civil Engineer, CA
No. C84037

YEARS OF EXPERIENCE

10+ Years

DISTINGUISHING QUALIFICATIONS

- Assembly and analysis of historical land and water use data for water budget development.
- Development of water management tools for agricultural water suppliers, including tool implementation and staff training.
- Geographic Information Systems – mapping and spatial analyses.

SUMMARY

Mr. Ertis has provided a variety of water and environmental management services to clients in California for over 10 years. These services include environmental data acquisition; designing and completing detailed water budgets; utilizing GIS techniques for a variety of mapping and spatial analysis procedures and processes; development of water management tools for agricultural water suppliers (including tool design, implementation and staff training, and ongoing support); presenting technical information orally to stakeholders and the public, and preparation of technical reports and documents. He has been involved in dozens of successful projects for a variety of clients.

RELEVANT EXPERIENCE

Sustainable Groundwater Management Act (SGMA) Groundwater Sustainability Plan (GSP) Development. Multiple Locations, CA.

Mr. Ertis has both led and assisted with multiple components of Groundwater Sustainability Plan (GSP) development in multiple groundwater basins in California including the Madera, Chowchilla, Solano, Colusa, Corning, Red Bluff, Los Molinos, Antelope, Bowman, Butte, Vina, and Wyandotte Creek Subbasins. His contributions include preparing draft and final GSP documentation, preparing draft and final Annual Report documentation, reviewing and editing all GSP documentation to ensure SGMA compliance, coordination and planning with Groundwater Sustainability Agency (GSA) representatives, reviewing and responding to public comments, developing water budgets, evaluating sustainable management criteria, developing projects and management actions, evaluating projects and management actions, developing maps and figures, and preparing and presenting information to GSA Boards, stakeholders, and the public. Multiple GSPs that he has worked on have been approved by the California Department of Water Resources (DWR).

Feather River Regional Agricultural Water Management Plan, Northern California Water Association. Sacramento, CA.

The Northern California Water Association (NCWA) engaged Davids Engineering to develop the Feather River Regional Agricultural Water Management Plan (FRRAWMP). A detailed plan for the 470,000 acre region was developed, including extensive consultation with nine water suppliers, several refuge and wildlife area managers, and representatives of Butte County and the California Department of Water Resources. The FRRAWMP includes a detailed inventory of surface water and groundwater supplies and uses and, through multiple water budget analyses spanning scales of individual suppliers to the region as a whole, characterizes the interaction between surface water and underlying groundwater systems in the region. Mr. Ertis was involved for the duration of

the project in a supporting role, developing maps and completing spatial analyses in GIS, assembling supplier infrastructure inventories, identifying potential system improvement projects, preparing conceptual cost estimates for improvement projects, assisting in the preparation and calculation of water balances, drafting sections of the report, analyzing datasets, and meeting with agricultural water suppliers in the region. Mr. Ertis has also led state-mandated periodic updates to AWMPs for individual water suppliers included in the FRRAWMP region.

Implementation of Delivery Measurement, Data Management and Accounting, and Volumetric Billing. Reclamation District No. 108 (RD108), Richvale Irrigation District (RID), Biggs-West Gridley Water District (BWGWD), Butte, Colusa, and Sutter Counties, CA.

According to California Water Code Section 597 (CWC §597), agricultural water providers over 25,000 acres are required to measure the volume of water delivered to customers with sufficient accuracy to: (1) report aggregated farm-gate delivery data to the state and (2) adopt a pricing structure based at least in part on the volume of water delivered to each field. Mr. Ertis performed surveys of farm-gate deliveries to evaluate existing conditions, supported an effort to test alternative measurement methods that are potentially capable of satisfying the accuracy requirements of CWC §597 by performing flow measurements and data acquisition in the field and completing a water balance using different measurement methods on a specific canal reach, processing and analyzing datasets, estimating costs for flow measurement improvements, and developing a report detailing existing conditions and presenting various options of improving flow measurement in order to comply with the accuracy standards presented in CWC §597.

Following this effort, Mr. Ertis assisted in the development and implementation of a customer delivery measurement program that will satisfy the requirements of CWC §597. This included design and development of customer delivery measurement and water management tools used by district staff to record and manage deliveries and volumetric billing, specification and in-field review of infrastructure improvements required for delivery measurement, implementation of tools and training with district staff members, and ongoing support for the customer delivery measurement program.

Water Budget Development and Water Management Planning. Oakdale Irrigation District, Oakdale, CA.

Mr. Ertis prepared the 2020 Agricultural Water Management Plan (AWMP) update for submittal to the California Department of Water Resources. This preparation included drafting and/or editing all document text; communicating with Oakdale Irrigation District (OID) staff to identify District efforts to implement Efficient Water Management Practices (EWMPs); presenting updated AWMP results to the OID Board; and updating the OID system-wide water budget. The water budget updates involved quantifying agricultural water demand and water use using a daily root zone water balance model on the basis of cropping, soil characteristics, weather (evaporative demand and precipitation), and crop coefficients developed from remotely-sensed surface energy balance results. In addition to meeting state-mandated requirements, the AWMP is used by OID to review the ongoing implementation of their Water Resources Plan.

Agricultural Water Management Plan and Measurement Improvement Plan Development and Implementation. Yuba Water Agency, Yuba County, CA.

Mr. Ertis assisted with development of the original Agricultural Water Management Plan (AWMP) for the Yuba Water Agency (YWA) and led preparation of the 2020 AWMP update for submittal to the California Department of Water Resources. This preparation included drafting and/or editing document text; communicating with YWA staff to identify Agency efforts to implement Efficient Water Management Practices (EWMPs); and updating the YWA system-wide water budget (which included quantification of water demand and use).

The YWA also moved forward to implement measures described in the Agency's AWMP. This effort included the installation of multiple permanent flow measurement stations and the construction of conveyance system infrastructure. Mr. Ertis led the surveying and design of infrastructure improvements, participated in measurement station installations, and contributed to the construction management and inspection of the new infrastructure. Mr. Ertis also performed discharge measurements for velocity indexing purposes at the permanent flow measurement stations.

Agricultural Development Feasibility Assessment. El Dorado County Water Agency, El Dorado County, CA.
The El Dorado County Water Agency (EDCWA) engaged Davids Engineering and ERA Economics to complete an agricultural development feasibility assessment by developing baseline data regarding historical cropping trends, spatial distribution of crops, and irrigation practices and evaluating historical, current, and projected future cropping and water demands within El Dorado County. This effort informs an evaluation of the feasibility of developing additional water supplies to expand irrigated agriculture in the County. Mr. Ertis assisted in this project through assembly and evaluation of datasets (including assembly and review of inputs for and results of the water demand model), developing maps and completing spatial analyses in GIS, drafting sections of the report, and presenting project results to an Agricultural Advisory Group comprised of local stakeholders formed to provide feedback and inform the feasibility assessment process.

Verification Project to Quantify Groundwater Use per Groundwater Allocations, Madera County Groundwater Sustainability Agencies (GSAs), Madera County, CA.
The GSAs managed by Madera County are currently implementing Groundwater Sustainability Plans (GSPs) for the "white areas" of the Chowchilla, Madera, and Delta-Mendota Subbasins, which are solely dependent on groundwater for irrigation of agricultural lands in most years. An important component of GSP implementation and achieving sustainability is reducing consumptive use of groundwater, which may be accomplished through implementation and enforcement of a groundwater allocation. Mr. Ertis led an effort to evaluate the accuracy of the method chosen by the GSAs to quantify groundwater use for the allocation. This effort included identification of and close coordination with participating growers within the GSAs, extensive field data collection by a team of Davids Engineering field staff, collection and aggregation of additional data sources, coordination with Madera County GSA staff, data analysis, development of a final report, and dissemination of results. The report and its conclusions and recommendations have been used by the GSAs to guide management decisions, and a continuation of the project has been funded.

Boundary Outflow Monitoring. Sacramento Valley, CA.
Mr. Ertis has both led and assisted in multiple boundary outflow measurement projects for multiple agricultural water suppliers in the Sacramento Valley. These data provide suppliers with an improved understanding of boundary outflows and overall flow through their distribution and drainage systems. They can be used to make operational changes, improve water budgets (which are often used to make long-term planning decisions, such as capital improvement projects), or meet regulatory requirements. Mr. Ertis has assisted with identification of boundary outflow monitoring sites, development of monitoring plans and specification of monitoring equipment, coordination with clients' operational managers and staff, equipment installation and maintenance, data processing and analysis, and development of technical reports (including recommendations) that summarize monitoring results.

Groundwater Risk Assessment. Tehama County, CA.
Mr. Ertis assisted in a high level risk assessment of SGMA undesirable results, assessing localized groundwater declines, subsidence risks, overdraft, and impacts due to climate change. He prepared maps and figures for public presentation showing historical and recent trends in groundwater conditions using publicly available information provided by state and local agencies.

Western Canal Implementation of Computer-Based Customer Delivery Measurement Data Collection and Accounting. Western Canal Water District, Butte and Glenn Counties, CA.
According to California Water Code Section 597 (CWC §597), agricultural water providers over 25,000 acres are required to measure the volume of water delivered to customers with sufficient accuracy to: (1) report aggregated farm-gate delivery data to the state and (2) adopt a pricing structure based at least in part on the volume of water delivered to each field. Since its inception in 1984, WCWD has measured volumetric water deliveries and utilized volumetric billing. However, only recently have they transitioned from a paper-based data collection and accounting system to a computer-based system. Mr. Ertis assisted in the effort to implement computer-based measurement tools and methods for

customer delivery measurement in the field and automated data processing and accounting in the office through the design and configuration of data communication protocols and processes, development of a districtwide inventory and accounting database, training of staff members, and ongoing support during implementation.

Colusa and Yolo Counties In-Lieu Groundwater Recharge Investigation. Reclamation District No. 108, Grimes, CA.

Mr. Ertis assisted with an analysis of the potential to use RD108 surplus water, when available, to supplement available water supplies in Colusa County Water District and in Dunnigan Water District (Yolo County). An operations model spanning a 65-year planning horizon quantifying water demands, water supplies, and associated costs was developed that simulated the purchase of water by growers in each district. Mr. Ertis assisted in the project effort with data analysis and development of maps and figures using GIS and other software. Based on the model results, the parties have moved forward with a multi-year water transfer pilot program to test the water transfer concept and terms.

Snake Marsh Hydromonitoring and Water Budget Analysis. The Nature Conservancy, Sacramento County, CA.

The Nature Conservancy (TNC), as a partner of the Cosumnes River Preserve, hired Davids Engineering to design and implement an environmental monitoring and data collection program for Snake Marsh, a 160-acre freshwater perennial wetland, and complete a water budget for the Marsh for the monitoring period. Mr. Ertis led the field data collection effort to characterize surface water hydrology and surface water-groundwater interactions, with particular emphasis on characterizing water sources for the marsh and relative inflows, as well as evaluating marsh water quality as it relates to Giant Garter Snake health and invasive plant growth through strategic sampling of important water quality parameters. He performed flow measurements, bathymetric surveys, surface water and groundwater level measurements, water level surveys, water quality testing, and other types of data acquisition and analysis. After the monitoring period was complete, under the supervision and guidance of a principal engineer, he completed a water balance for the marsh and summarized the results in a final report. As an added component, TNC staff were trained in the collection of flow measurement data using standard stream gaging procedures as well as collecting water quality samples and performing laboratory analysis of the samples for purposes of continued monitoring.

South San Joaquin Flow Measurement Plan Development and Implementation. South San Joaquin Irrigation District, Manteca, CA.

Mr. Ertis assisted in the development and implementation of a Flow Measurement Plan (Plan) for the South San Joaquin Irrigation District (SSJID). The goals of the Plan are (1) to provide cost-effective service to customers; (2) generate improved operational records for planning and analysis, and; (3) comply with recently passed California legislation (SBx7-7). As part of this effort, Mr. Ertis installed data collection equipment at a series of sites to estimate flow measurement accuracy and performed flow measurements at existing measurement sites within the district in order to develop corresponding flow ratings for each specific site.

Analysis of Cardoza Diversion on Parks Creek. AquaTerra Consulting, Siskiyou County, CA.

Davids Engineering performed an analysis of alternate modifications to the Cardoza Diversion on Parks Creek in the Shasta Valley, which involved a data collection program including monitoring equipment, flow measurement, and a ponded seepage test. Mr. Ertis assisted with the project effort through preparation of monitoring equipment and configuration of data loggers and sensors, performing flow measurements and data acquisition during visits to the field, and completing a ponded seepage test with his colleagues. He analyzed the results of the ponded seepage test, and helped process the results of the data collection program and develop a document for transmittal to the client.