

TITLE PAGE

Advancing an Open-Source Water Accounting and Scenario Planning Platform to Support the Successful Implementation of California’s Sustainable Groundwater Management Act

Proposal for WaterSMART- Applied Science Grants Funding Opportunity R21AS00289

Applicant:

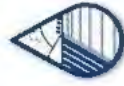
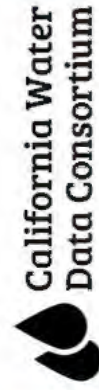
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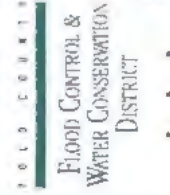


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TECHNICAL PROPOSAL AND EVALUATION CRITERIA

1. EXECUTIVE SUMMARY

Date: April 21, 2021

Background on CWDC: Founded in 2019, the California Water Data Consortium (Consortium) is a 501(c)(3) non-profit organization located in Sacramento, Sacramento County, California and is a Category B applicant. Formed to support implementation of the 2016 Open and Transparent Water Data Act, the Consortium provides an independent space for partnerships, collaboration and sustained engagement between state agencies, water agencies, industry, NGOs, tribes, academia and others to support data-driven water management decisions in California.

Need: Groundwater provides between 40-60% of California’s water supply. Despite its importance, groundwater resources remained largely unregulated until the passage of the Sustainable Groundwater Management Act (SGMA) in 2014. SGMA provides a statewide framework for the sustainable management of groundwater in all 515 alluvial groundwater basins throughout California. The legislation is driving a paradigm shift in how groundwater resources will be managed as local agencies transition from little to no management to a legal and regulatory system requiring comprehensive monitoring, planning and implementation of management actions to achieve groundwater sustainability by 2040 or 2042. Owing to the prior voluntary nature of groundwater management, most local groundwater management agencies have limited data management infrastructure, often relying on paper records or excel sheets to manage their agency’s data and develop water budgets. Consequently, there is now a massive onset of work that needs to be done to better understand, track, and account for groundwater use across designated basins. Robust water tracking and accounting systems will serve as the foundation in advancing coordinated and well-informed decision-making as local agencies work to bring groundwater basins into sustainable conditions over the next two decades.

Project Summary: The Consortium requests \$200,000 from WaterSMART to match the direct support from the California Natural Resources Agency and in-kind support from the Consortium, Environmental Defense Fund (EDF), the California Department of Water Resources (Category A partner), the State Water Resources Control Board (Category A partner), Olsson, Rosedale Rio Bravo Water Storage District (RRBWS) (Category A partner), Sonoma County Water Agency (Category A partner), Yolo County Flood Control and Water Conservation District (Category A partner), Kern Groundwater Authority (Category A partner), and Pajaro Valley Water Management Agency (Category A partner) to undertake an 18-month project to enhance and scale an open-source Water Accounting Platform (WAP) to serve as an optional baseline groundwater accounting and tracking tool available to GSAs across California. EDF is a sub-awardee on this proposal. Olsson will be subcontracted to provide technical support. Category A partners described above will be key project participants. This project will directly support WaterSMART management objectives to enhance water supply reliability by improving access to water elevation and extraction data, water accounting systems, and scenario planning and visualization tools critical for effective groundwater management. The WAP was co-developed by RRBWS and Environmental Defense Fund (EDF) to facilitate effective accounting and management of available water resources, enabling water managers and landowners to make California Water Data Consortium

informed water supply and land use decisions. Intentionally developed as an open-source tool to allow other water agencies to expand and customize the platform, the WAP was piloted and is now implemented in Rosedale Rio Bravo Water Storage District (RRBWS) in Kern County, California. This project focuses on expanding the capacity of the WAP to serve as an optional baseline groundwater accounting and tracking tool available to GSAs across California. The tool will be expanded to 1) integrate publicly available groundwater elevation and use data, 2) develop processes to integrate local data provided by pilot GSAs, and 3) integrate with an open-source groundwater modeling decision support tool engine to enable scenario planning and inform basin wide water decision making. The project's anticipated completion date is June 2023. The proposed project is not located in a federal facility.

Outcomes: This project will create an open-source platform (Water Accounting and Scenario Planning Platform or WASPP) to enhance the capacity of water managers across California to track water budgets, including water availability and use, and to leverage this information to assess and quantify the impacts and benefits of management actions through an easily accessible groundwater modeling decision-support tool. SGMA requires GSAs develop a basin wide water budget and, also requires GSAs to consider the interests of beneficial users and uses of groundwater, including overlying groundwater rights holders (both agricultural users and domestic well owners), municipal well owners, public water systems, local land use planning agencies, environmental users of groundwater, surface water users, the federal government, Native American tribes, and disadvantaged communities. This project will serve as an optional and freely available resource that GSAs can leverage to help meet these requirements at a lower cost and in a manner that facilitates coordination and scaling across broader geographies due to the incorporation of data standards (see Task 3) and the use of open-source technology. This methodology, combined with 1) strong state support from Category A partners - the California Department of Water Resources, State Water Resource Control Board, and multiple water management agencies; 2) robust stakeholder engagement, outreach and training planned as an integral part of this project; and 3) the demonstrated need at the local level for water accounting tools to support SGMA implementation, provide strong confidence that the platform will be a widely adopted and utilized tool to help GSAs better understand and track water use, and improve stakeholder engagement in groundwater management decision-making.

2. TECHNICAL PROJECT DESCRIPTION AND MILESTONES

Background: California's Sustainable Groundwater Management Act (SGMA) passed in 2014 has resulted in the creation of over 250 local groundwater sustainability agencies (GSAs) tasked with developing Groundwater Sustainability Plans (GSPs, Plans) that when enacted will achieve groundwater sustainability within 20 years of Plan implementation. In most groundwater basins, achieving groundwater sustainability will be accomplished through a combination of management actions to increase supply (e.g., increasing groundwater recharge through conjunctive management, purchase of alternative water sources, treatment of brackish water) or reduction in demand (e.g., water conservation, allocations, fallowing, etc.). This balancing of supply and demand is reinforced in SGMA with the requirement that GSAs develop a basin-wide water budget that “provides an accounting and assessment of the total annual volume of groundwater and surface water entering and leaving the basin...” (California Code of Regulations (CCR) Article 5, 354.18 (a)).

The California Department of Water Resources (DWR) and the State Water Resources Control Board (SWRCB or State Board) recognize the need for accounting tools to support local agencies in implementing SGMA, and have requested to partner with the California Water Data Consortium (CWDC) and Environmental Defense Fund (EDF) on this grant proposal to scale and enhance the functionality of an open-source water accounting platform (WAP) developed by Rosedale Rio Bravo Water Storage District (RRDWSD) and EDF as an optional resource for local water management agencies across California. The open-source format of the platform is especially appealing to state agencies because it means that the platform is available for anyone to use, contribute to, and modify without license fees or subscription services. Since many groundwater basins must now coordinate planning activities across multiple GSAs, there is a pressing need to develop cost effective tools that are scalable across GSAs to facilitate enhanced coordination and understanding of groundwater availability and use.

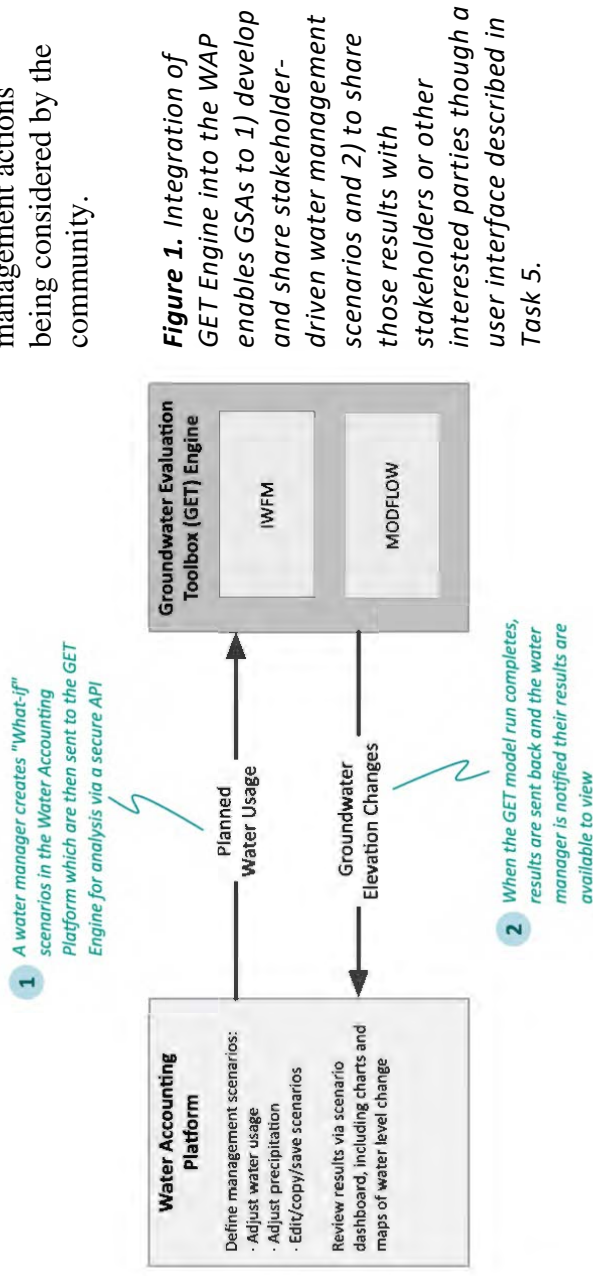
Project Overview: This project will leverage existing open-source tools to develop a robust state-supported platform to enable GSAs across California to track water budgets, including water availability and use, and to leverage this information to assess and quantify the impacts and benefits of management actions through integration of a scenario planning decision support tool. We propose enhancing and integrating two established, open-source software tools, the WAP and the Olsson Groundwater Evaluation Toolbox Engine (GET Engine) to realize these goals. Each tool is described below.

1) EDF Water Accounting Platform (WAP) is a browser-based web application that provides water managers and landowners with access to up-to-date information on their water supply and consumptive water use to inform water supply and land use decisions. The WAP currently supports water consumption data from OpenET, a web-based platform that uses publicly available data and open-source models to provide satellite-based information on evapotranspiration (ET). The WAP is an important part of SGMA compliance, and it was developed with open-source software to allow other water districts in the Central Valley and beyond to utilize and customize the platform. The platform also serves as the foundation to support further management actions, including water trading programs, that require a robust understanding of how water is accounted for across water user groups.

2) Olsson Groundwater Evaluation Toolbox Engine is a cloud-based application for executing groundwater models that can be used by groundwater managers and stakeholders to gain a better understanding of the potential impacts and benefits of water management strategies, such as water trading or recharge activities, prior to acting. Today GET is used by water managers in many US states, including by water managers in RRBWSD, to aid in their decision making. The GET Engine receives model inputs via an Application Programming Interface (API), executes a simulation using MODFLOW or another modeling program, and then post-processes results for retrieval via an API. Such APIs allow two software applications to talk with one another, sharing functionality while providing a more seamless and richer user experience. The GET Engine was recently made available as open-source software, making it easier for other systems to develop integrations with it. Leveraging Olsson’s recent open-sourcing of the GET Engine, this project will give water managers the ability to create “What If” management scenarios that are explicitly

associated with water accounts and parcels. Users will be able to streamline stakeholder-driven model run times so they can be used to facilitate discussions around community values and potential management outcomes (see Figure 1). For example, in Pajaro Valley Water Management Agency (one of our Category A partners), community members have invested heavily in the development of projects to support supplemental water supply projects to mitigate overdraft. Modeled scenarios that typically take days to weeks to run could be modeled in near real-time using minimal change to model input files enabling more timely analyses of

management actions being considered by the community.



This proposal refers to the integration and enhanced versions of the WAP and GET Engine tools as the Water Accounting and Scenario Planning Platform or WASPP. Rather than create a single, monolithic system this project will leverage existing APIs and add new ones to support data flows between these two tools and external data sources. This approach promotes an open ecosystem where data and functionality are freely exchanged between all tools (not just the two this proposal focuses on), fostering innovation and making science and policy advancements easier and quicker to incorporate.

To ensure WASPP is a valuable and accessible resource for GSAs across the state, this project focuses on three essential components (see Figure 2):

A) *Integration of additional data inputs*

- Integrate current and historic statewide groundwater elevation data from the [California Natural Resources Agency Open Data Portal](#).
- Integrate annual aggregated pumping volumes required as annual reporting under SGMA.

B) *Expanded accounting functionality*

- Enable scaled use of OpenET data as a metric for GSAs to estimate crop water use. [OpenET](#) is a web-based platform that uses publicly available data and open-source models to provide satellite-based information on evapotranspiration (ET)

- Develop a process to incorporate alternative water use data into the platform (e.g. the integration of metered data and/or aggregated annual pumping volumes required under SGMA).

C) Scenario planning and visualization

- Expand WAP to include a real-time integration with the open-source GET Engine to allow for the development and visualization of stakeholder-driven water management scenarios.
- Expand the GET Engine to include DWR’s open-source Integrated Water Flow Model code in addition to USGS’s open-source MODLOW model.
- Expand WAP to allow GSAs to display geospatial data provided via external web services to support specific water management scenarios (e.g., geospatial layers of groundwater dependent ecosystems, water quality, domestic wells, etc.) and identify areas where additional analyses are needed.
- Work with GSAs and state agency employees to develop a user-friendly interface that 1) depicts visualizations of current and historical groundwater elevation and water use data and 2) allows users to adjust management scenarios, and to view and analyze model-run results for each scenario using charts, interactive maps, and data tables.

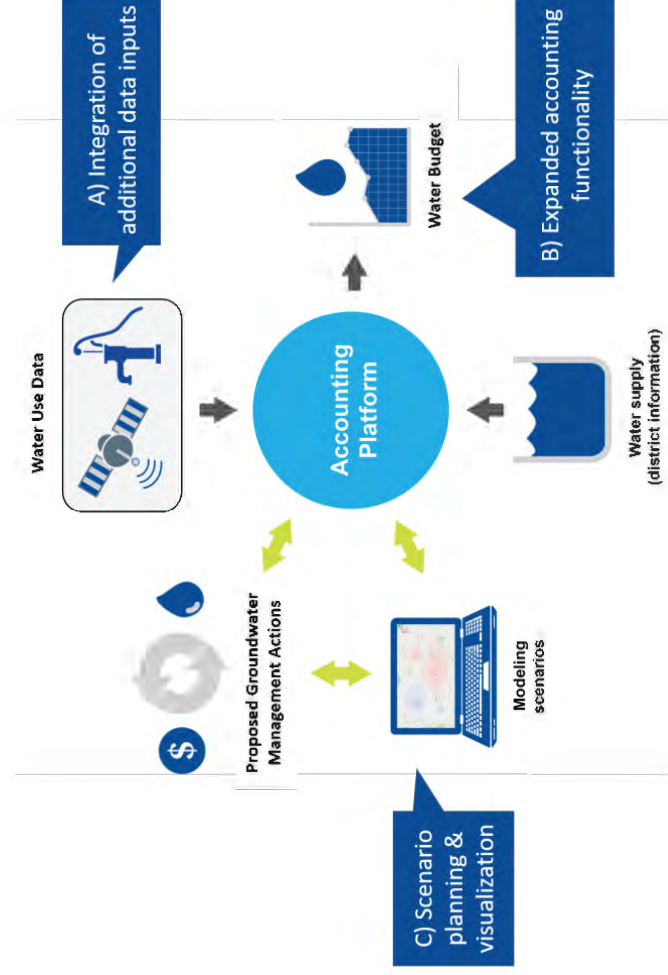


Figure 2. This graphic illustrates the main components of WASPP highlighting the three components that will be enhanced and/or developed as a part of the project.

The goal of this project is to leverage the collective expertise of the project team, a diverse group of GSAs and water agencies, and stakeholder input to design and build the WASPP with baseline functionality that is broadly beneficial and scalable across as many GSAs as possible. Importantly, due to differences in local conditions and context across the 250 GSAs formed under SGMA, we recognize that the platform will not be universally applicable as an off the shelf tool in every geography or management area. The baseline platform developed under this grant application will need to be tailored to some extent to ensure that platform functionality aligns with local circumstances (e.g. adding data for a particular geography to enhance modeling

results at finer resolutions to inform scenario planning or integrating with existing groundwater data reporting systems). To address this need, we will work with a diversity of state and local agencies to develop baseline functionality that is broadly applicable, as well with one to two pilot GSAs to establish processes needed to integrate local data and tailor the WASPP to local conditions.

To be successful long-term and support local management actions WASPP must provide: 1) local agencies with sufficient baseline information about their local water budgets and groundwater aquifer conditions to inform decision-making while enabling the integration of local agency information in a variety of formats, 2) sufficient flexibility to work with existing water accounting methodologies, and 3) the ability to develop stakeholder-driven model scenarios informed by local landowners, growers, community leaders, and other interested parties (SGMA requires GSAs to consider the interests of all beneficial users of groundwater when considering the management actions they will enact). To accomplish these objectives, this proposal includes Tasks 1-6 described below.

Task 1 – Stakeholder Engagement, Training and Outreach

WASPP development will take place through an iterative process that facilitates ongoing collaboration with GSAs and state agency staff to incorporate feedback and jointly develop platform functionality. To facilitate this process, we will establish a set of core forums and working groups to address the range of technical, policy, and usability requirements necessary for platform development and scaling, including:

- **An Advisory Committee:** Quarterly meetings with GSA leaders and director-level state agency employees to provide input on WASPP scaling, data integration and data standards development, and stakeholder outreach.
- **A Platform Scaling and Usability Working Group:** Quarterly working sessions with GSA, landowner, environmental NGO, and environmental justice NGO representation to solicit feedback on platform development, functionality and usability.
- **Technical Working Group:** Quarterly working sessions with GSA staff and state agency engineers and data scientists to ensure alignment on technical elements of WASPP development, including data standards and integration, open-source licensing, and other technical issues.
- **Public Outreach Meetings:** Host two public outreach meetings to raise awareness of WASPP development, solicit feedback, and build trust among water managers and stakeholders.

Additional public engagement, trainings and outreach will include:

- **Develop WASPP outreach material for distribution both online via Consortium, EDF, DWR and State Board networks, as well as hard copies that can be distributed at conferences that GSA leaders attend. For example, the Groundwater Resources Association of California hosts two annual events that GSAs throughout the state commonly attend. These are the Annual GSA Summit and the Western Groundwater Congress.**
- **Conduct two virtual training workshops at the conclusion of WASPP development. These workshops will be open to the public and will highlight the functionality and value-add of the platform.**

- Work with pilot GSA(s) to co-host two to four public events to demonstrate WASPP functionality and its potential to serve as a SGMA stakeholder engagement and scenario planning tool.

Task 2 – Support DWR’s Integrated Water Flow Model

In a 2016 survey of California water management agencies, Moran et al. (2016) found that three-quarters of survey respondents use a groundwater model in their jurisdictional area with two specific models - USGS’s MODFLOW and DWR’s Integrated Water Flow Model (IWFM) - accounting for 91% of reported use. Respondents indicated that models were used for a variety of management planning scenarios, including long-term water management planning, water budget development, groundwater extraction planning and recharge planning. However, developing and running the input files necessary for modeling different management scenarios is often a time consuming, expensive, and cumbersome process that can take days or weeks to accomplish and can limit stakeholder input. As described above, the GET Engine developed by Olsson is designed to reduce model run times and make it easier to visualize and examine results in near real-time, making GET a valuable stakeholder engagement and planning tool.

The GET Engine currently supports all versions of the USGS open-source model MODFLOW, including the most recently released version known as MODFLOW 6. MODFLOW simulates groundwater flows using numerical descriptions of a given groundwater system contained in a set of ASCII input files. MODFLOW solves the finite difference flow equations over time for a given set of aquifer parameters and aquifer stresses and produces simulation results consisting of the groundwater levels and flows as well as a global water budget, contained in ASCII and binary output files. The GET Engine enables model outputs to be viewed and analyzed as standalone outputs or to compare the results of the model run against a baseline model run. Importantly, this enables stakeholders to understand the modeled difference in change between different modeled scenarios.

Task 2 will update the GET Engine so that it can also execute models using the Integrated Water Flow Model (IWFM), developed by DWR to support GSAs in the development of GSPs. IWFM is a water resource-planning model capable of simulating groundwater flow, surface water flow, groundwater-surface water interactions, subsidence and other hydrologic processes. These processes can be run in confined and/or unconfined groundwater aquifer systems that interact with surface water systems through simulation of surface water flows, rainfall runoff, recharge, irrigation water demand and supply, and other surface water processes. A key feature of IWFM is the optional balancing of water supply (pumping and stream diversions) and agricultural and urban water demand through automated adjustments. Additionally, although pumping at individual wells can be simulated, IWFM can also estimate groundwater pumping and recharge in a spatially distributed manner where information on specific well locations or pumping does not exist (i.e., the model does not require pumping location, rather pumping estimates can be distributed across a region) (Brush et al., 2013).

While IWFM simulates the groundwater flow system in a very similar manner to MODFLOW, the specific user input files are organized differently. Thus, IWFM file formats are not consistent with the MODFLOW file formats. Integration of the IWFM into GET Engine should be

relatively straightforward as the IWFM is also written in Fortran and utilizes ASCII and binary file formats. To support IWFM, the GET Engine will need to be programmed to differentiate between IWFM and MODFLOW input files and to handle post-processing of IWFM output files. As noted above, the IWFM was designed specifically to simulate groundwater systems in California; therefore, updating the GET Engine to support the IWFM will make the GET Engine significantly more applicable to groundwater managers in California.

Task 3 – Integrate Groundwater Level Data

SGMA requires that GSAs develop thresholds to avoid undesirable results across six sustainability indicators, including significant and unreasonable lowering of groundwater levels, reductions in groundwater storage, seawater intrusion, degraded quality, land subsidence, and depletions of interconnected surface water (California Water Code 10721x). Groundwater levels may be used as a proxy for other sustainability indicators (CCR, Article 5, 354.36). As such, GSAs will use groundwater elevation information to assess the long-term health of their basin, the impacts of management outcomes, and progress toward groundwater sustainability.

Task 3 will expand WAP to integrate groundwater level data from the [California Natural Resources Agency Open Data Portal](#). Integration of these data will provide GSAs with current baseline and historical groundwater level data in their jurisdictional area.

Groundwater level data collected under SGMA and CASGEM are monitored, at a minimum, seasonally to represent seasonal high and low conditions (CCR, Article 5 354.35 (C)(1)(B)). Once integrated into WAP, visualizations of historical and current groundwater elevation data will be available through the user interface described in Task 5. Visualizations of groundwater level data will include both groundwater elevation contour maps with the seasonal high and low for each principal aquifer in the basin, as well as hydrographs depicting long-term groundwater levels, historical highs and lows, and hydraulic gradients between principal aquifer as required in SGMA regulations CCR, Article 5 354.16 (a).

In addition to ensuring that GSAs have the information needed to meet SGMA requirements, visualizations of groundwater levels allow landowners and GSAs the ability to better understand the overall health of the basin, see how the basin is changing over time, and identify areas with chronic groundwater declines. Finally, these data will be available to water managers within WASPP so they can compare current groundwater levels to the simulated groundwater levels per modeled scenarios run through the GET Engine.

In addition to incorporating state and USGS groundwater level data, the project team will also work with one to two pilot GSAs¹ to develop a process for inputting local groundwater elevation data to provide higher spatial and/or temporal resolution data where available. The extension of the WASPP to integrate local groundwater elevation data from pilot GSAs provides an opportunity to work with the state and local agencies to develop a common data standard for reporting groundwater levels to the state that, once adopted, will enable data sharing between agencies and support regional-scale analyses and modeling.

¹ The project team will leverage existing relationships and work in close partnership with DWR and State Board to identify one to two pilot GSAs to develop and test WASPP.

To date, GSAs have devoted significant resources to supporting inter- and intra-basin coordination and data integration to “ensure that the Plans are developed and implemented using the same data and methodologies” (CCR, Article 5, 357.4). The California Water Data Consortium in partnership with the DWR and SWRCB have developed a set of common groundwater data schema to facilitate intra- and inter-basin interoperability through improved data integration and alignment with DWR’s existing data management and reporting systems (e.g., DWR’s SGMA Reporting Portal).

However, because GSAs across California are at very different phases in the development of groundwater elevation collection and standards, a significant amount of work will be devoted to 1) developing templates or other tools to support adoption of groundwater level data standards, including a reference implementation of the standard in the form of a new API within the WASPP, and 2) developing functions or other tools to crosswalk between existing data standards and formats to the adopted data standard. This work will be done in partnership with our technical working group which includes local agency staff, as well as senior-level engineers from DWR and State Board.

Task 4 – Integrate Groundwater Use and Well Location Data

The WAP currently supports water consumption data from [OpenET](#). Similar to work in Task 3, we will expand the platform to provide a process to make OpenET data accessible to all GSAs who choose to use the platform. This baseline information will ensure that water managers and users have access to consistent baseline information about water use in their region to directly inform the development of the accounting portion of WASPP.

Additionally, we will work closely with DWR staff to integrate publicly annually aggregated water use data reported under SGMA into WASPP (these data are available from the [California Natural Resources Agency Open Data Portal](#)) and develop a process for integrating local water use data from one to two pilot GSAs.

SGMA does not require water use data collection using a single methodology. Rather it enables GSAs to report annual aggregated groundwater extraction data for the preceding water year (CWC 10728). Thus, GSAs collect or estimate water use data using a variety of direct and indirect methods, including estimating crop evapotranspiration using satellite-based ET data (e.g. OpenET) or crop coefficients, metered data, or electricity bills for groundwater pumping. We will work with one to two pilot GSAs to integrate water use data using metered well and/or crop coefficient data into WASPP.

Reporting of groundwater use or extraction data is often a politically sensitive topic in California due to privacy concerns. Thus, we will work closely with pilot GSAs in developing the user interface to ensure privacy concerns are respected as water use data are rolled up across water users and groups. For example, in the RRBWSD platform, landowners can only view water use data for parcels they own. By contrast, district managers can view individual landowner pages and aggregated district-level water use data within the accounting platform. We recognize that this is an issue that we will need to work closely with landowners and GSAs to ensure that we

are designing and building WASPP in a manner that balances privacy concerns with the need to make data available for data-driven water management decisions.

Depending on privacy concerns, visualization of well locations and groundwater extraction data may be limited. At a minimum, WASPP users will be able to view historical and current publicly available aggregated water use data. Where GSAs are comfortable making higher-resolution spatial or temporal water use data available, processes and workflows for integrating these data will be developed through collaborations with pilot GSAs.

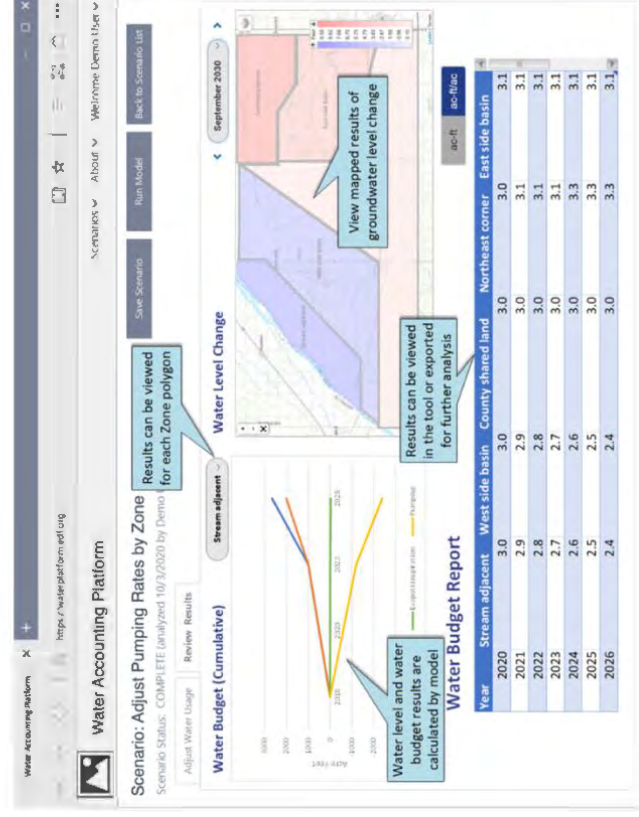
In addition to providing visualizations of groundwater extraction data, these data will inform GET Engine model runs. Leveraging IWFM's ability to estimate groundwater pumping and recharge in a spatially distributed manner (i.e., it does not require pumping location, rather pumping estimates can be distributed across a region), during Task 4 we will integrate well locations and GSA-level parcel and/or crop data for pilot GSAs into the WASPP to enable more spatially explicit modeling than is possible using spatially distributed extraction data. This information will establish the processes and workflows for GSAs to make more informed decisions about where management actions should be focused. For example, areas experiencing groundwater declines may prioritize conjunctive water management actions to facilitate groundwater recharge in the region. We will work closely with GSAs to understand their comfort around the scale that these data can be displayed for scenarios.

Task 5 – Enable Scenario Planning and Visualizations using the GET Engine

Task 5 will integrate the components developed in Tasks 2-4 with guidance from our Advisory, Technical and Platform Scaling and Usability Working Groups. This task has two main objectives.

Our first objective is to expand the accounting functionality to include both statewide publicly available annually aggregated groundwater extraction data and, to the extent feasible in work with pilot GSAs, local-level groundwater extraction. These data will be integrated with groundwater level data and water budget data, which can be viewed at a variety of user permission scales (depending on district manager preferences described in Task 4), including by management area or zone or district-scale (Figure 3).

Figure 3. Wireframe of a WASPP page displaying results of a management scenario that shows graphical, spatial and tabular results by zone and year.



Our second objective is to craft a user experience that both technical and non-technical users can easily navigate to create “What If” water management scenarios and view the modeled results from those scenarios. An enhanced understanding of the potential impacts and trade-offs associated with proposed management actions in a location will help groundwater managers and stakeholders make better management decisions. To exemplify the potential end user experience, Figures 4 and 5 provide two example scenarios developed as a part of a scoping exercise during the WAP pilot with RRBWSD. These examples were derived through a manual process to integrate GET Engine modeling results to demonstrate what would be possible through WAP and GET Engine integration.

Scenario 1 (Figure 4) shows a hypothetical “What If” water trading scenario that reduces groundwater use in the vicinity of a disadvantaged community whose primary water source is groundwater from domestic wells. In this scenario, the water buyer (represented by the red contour intervals) is purchasing 600 acre-feet of water per year from the seller (represented by the blue contour intervals). The scenario assumes the purchased water is pumped uniformly throughout the year. Because the water that the seller historically pumped is no longer used

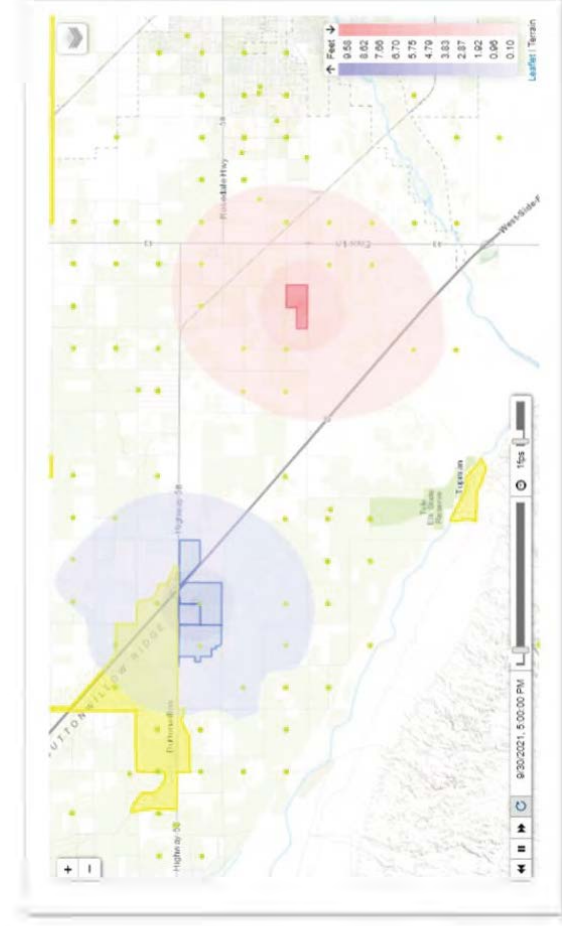


Figure 4. Depicts GET Engine Integration Scenario 1, which illustrates how a trading program can affect groundwater levels and the potential benefits and/or challenges to communities.

Scenario 2 (Figure 5) illustrates how GET Engine integration enables comparing and evaluating two options for recharging groundwater via district-owned recharge basins in either the western portion of RRBWSD or the eastern portion. Scenario 2 includes data showing the locations of known arsenic contamination in groundwater, nearby disadvantaged communities and the locations of private domestic wells. In both options, 500 acre-feet is recharged uniformly throughout the year.

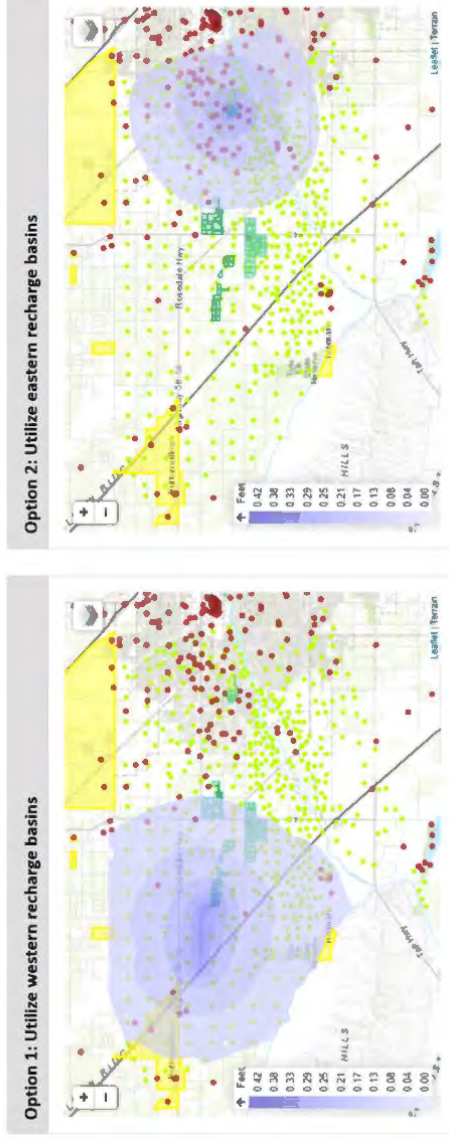


Figure 5. Depicts *GET Engine Integration Scenario 2*, which explores the potential outcomes of recharging waters in different managed aquifer recharge locations at district-owned recharge facilities.

The project team will implement the user interfaces described above within WASPP, leveraging the improvements to the GET Engine completed in Task 2 to run the IWFM or other numerical models (e.g. MODFLOW, MODFLOW6). The project team will also use the groundwater elevation data standard and API implemented in Task 3 and make use of the integration of water use data completed in Task 4.

By the end of Task 5, water managers, GSA staff, and stakeholders using just their web browser, will be able to:

- View a map of their management area, including available groundwater elevation and groundwater pumping data.
- Easily add externally-sourced geospatial data (e.g., groundwater dependent ecosystem, water quality) to overlay on interactive groundwater level maps.
- Define “What If” scenarios to better understand potential trade-off, impact and or benefits associated with proposed management actions.
- Within each scenario, adjust the pumping rates across multiple management zones.
- At the click of a button, run numerical models that simulate management actions, and their impacts on groundwater levels.
- Receive email notifications when results of model runs are available.
- View and analyze model-run results for each scenario using charts, interactive maps, and data tables.
- Adjust scenarios and re-run the model where necessary.
- Compare results across multiple model-runs or against a baseline model.
- Save countless hours currently spent manually managing and organizing model inputs and outputs.

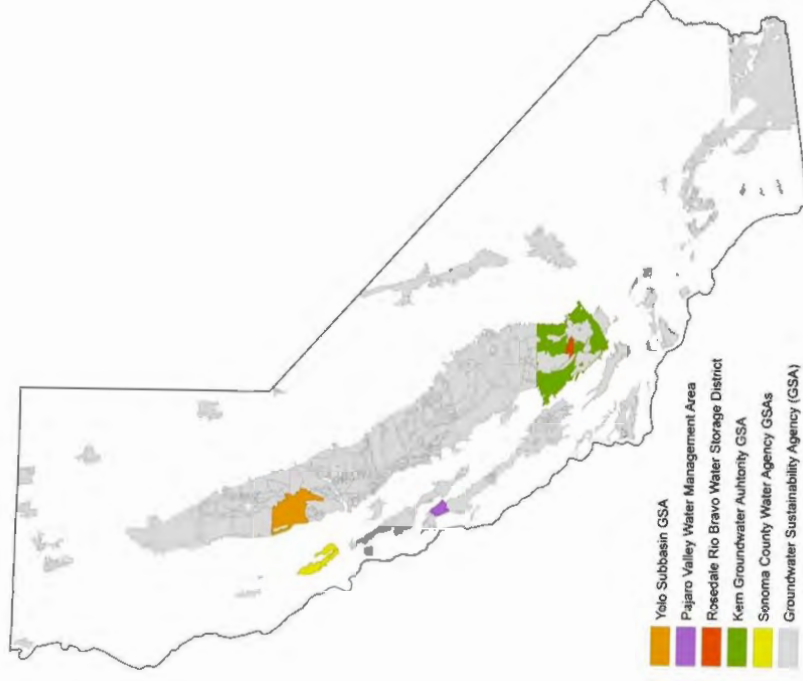
Task 6: Project Management and Grant and Financial Reporting

Task 6 captures project management and procurement activities, including advertising requests for contractor quotes, reviewing quotes and awarding contracts. Due to the desire for the involvement of many different stakeholders and the convening of multiple working groups throughout the duration of the project, there is a significant amount of time dedicated to project

management and coordination. Task 6 also includes grant and financial reporting and compliance activities to meet Bureau of Reclamation requirements throughout the grant period.

3. PROJECT LOCATION

To ensure that the WASPP is developed in a manner that is responsive to the diversity of management needs and challenges that exist across California, we propose to work closely with the following groundwater management agencies: 1) Kern Water Authority Groundwater Sustainability Agency, 2) Rosedale-Rio Bravo Water Storage District, 3) Sonoma Water, 4) Pajaro Valley Water Management Agency, and 5) Yolo County Flood Control and Water Conservation District (Figure 6).



Each agency has committed to serving as active project advisors and/or working group members for this project. Our goal is to leverage the collective expertise of these agencies to build the strongest foundational WASPP possible to ensure that the baseline functionality and design of the WASPP is broadly applicable and scalable across as many GSAs as possible. The two public workshops scoped in this project will serve to solicit feedback and participation from the broader array of GSAs throughout California.

Figure 6. Map of California showing all groundwater sustainability agencies (GSAs) that could benefit from WASPP development. Project partner GSA are shown in color.

4. DATA MANAGEMENT PRACTICES

Our proposal will build upon existing, proven, and accepted data management practices currently used in both WAP and the GET Engine to produce and integrate spatially explicit data sets, including parcel boundary data based on state tax assessor parcel boundaries, well locations, and other geospatial datasets representative of groundwater user needs and interests, including but not limited to water quality data, groundwater dependent ecosystem data, etc. These data will support display of a configurable number of externally-sourced geospatial data following Web Feature Service (WFS) or Web Mapping Service (WMS) standards from the Open Geospatial Consortium (OGC). The API for data exchange between WASPP and GET Engine will be developed using the GeoJSON standard, which is an open data exchange format compatible with modern and widely available GIS platforms. Consistent with open-source project practices, this GeoJSON data exchange API will be open and available for others to leverage. All APIs

implemented by this project will be RESTful web services, and thus have textual representation allowing them to be read and modified via simple HTTP requests that can be written in any programming language.

This project will produce additional metadata to support management scenarios and model run results. All metadata will conform to industry standard formats compatible with GIS platforms and will be available for viewing and export via the WASPP user interface and its API.

Application code generated by this project will be added to the existing open-source code base which is maintained in a publicly available Github repository. This source code has been reviewed by researchers at UC Merced and other institutions. The Github repository implements Azure Pipelines, a Continuous Integration / Continuous Delivery (CI/CD) service, that supports frequent code changes in a reliable, automated fashion where unit tests ensure proposed changes do not break existing functionality before being committed to the repository. All data produced by this project – not just spatially explicit data – will be managed and automatically backed up in Microsoft Azure.

5. EVALUATION CRITERIA

E.1.1. Evaluation Criterion A — Benefits to Water Supply Reliability (40 points)

Groundwater is a critical resource in California and throughout the western U.S. In California, groundwater provides 40% of the state’s water supply in average climatic conditions and upwards of 60% during periods of drought or scarcity (DWR 2021). Despite its importance, groundwater resources remained largely unregulated in the state until the passage of SGMA in 2014. The unconstrained use of groundwater led to widespread lowering of water tables, drying of domestic wells, land subsidence and corresponding damage to infrastructure, increased energy costs from pumping from greater depth, the reduction or elimination of baseflow to streams and rivers, diminished water quality, and the loss of groundwater dependent ecosystems (Moran and Wendell 2015). With the passage of SGMA, there is an increased need for local and state agencies and the public to easily access water data to make informed management decisions. The proposed project will provide GSAs and water districts with access to a freely available open-source water accounting and scenario planning platform that improves access to groundwater data, enabling GSAs to comprehensively assess water management actions to meet SGMA requirements and groundwater sustainability goals. Specifically, this project supports improved groundwater management activities, including:

Water supply reliability: As described above, groundwater accounts for a significant percentage of California’s water supply. However, most of the more than 250 groundwater management agencies formed under SGMA have limited data management infrastructure, often relying on paper records or Excel sheets to manage their agency’s data and develop water budgets. Our project focuses on two elements critical for long-term groundwater supply reliability. First is the implementation of groundwater level data standards to facilitate regional groundwater level visualizations that water managers and the state can use to assess the long-term health of groundwater basins, as well as their response to management actions undertaken under SGMA. Second, is the expansion of an open-source water accounting platform that supports data integration and a scenario planning tool to support data-driven planning and the

development of more accurate water budgets and GSPs to improve groundwater supply reliability.

Water marketing activities: Many of the groundwater sustainability plans submitted under SGMA cite groundwater trading as a potential tool to balance groundwater pumping with recharge in basins. In a few select areas of the state, the development of trading programs is already underway. However, expansion of water markets and trading across the state will remain limited until water agencies have the accurate water budgets and accounting systems to support reliable and trusted trading programs. The WASPP serves as an initial water accounting platform that can be tailored to local conditions and serve as the basis for water market activities. Additionally, integration of the open-source GET Engine will allow users to proactively access potential impacts from pumping, water trading, and recharge before specific actions are taken, helping ensure needed protections are in place.

Drought management activities: Groundwater provides a critical buffer for mitigating the economic, environmental, and social impacts of reduced surface water allocations and flows during periods of drought. Ensuring that groundwater can continue to serve this important role long-term requires that water agencies have the data and tools necessary to balance water budgets and, where necessary, mitigate chronic groundwater overdraft. The products being developed under this proposal provide water managers with the water accounting information necessary to help balance water budgets in their management area and to develop and test water management scenarios under different climatic conditions, including drought and to consider the tradeoffs of different actions on desired management outcomes.

Conjunctive use of ground and surface water: Conjunctive use of ground and surface water plays a central role in the GSPs developed under SGMA (Hanak et al. 2019). Specifically, the vast majority of GSAs in California intend to increase groundwater recharge using existing surface water supplies or through the capture of excess surface water flows during high flow periods (Dalke and Kocis 2018). Once recharged these waters can be pumped for use in dry periods. Having an accurate account of water supplies to understand water availability and recharge, pumping, or other beneficial uses is essential to successful conjunctive management. Our project will provide data and tools to allow managers to explore conjunctive use scenarios as a function of surface and groundwater water availability.

Water rights administration: California’s San Joaquin Valley is overdrafted by an estimated 1.8 million acre-feet per year (Hanak et al. 2019). Overreliance on the resource during the last drought resulted in historic groundwater declines of more than 100 feet below previous historic lows (DWR 2014). To arrest and reverse these declines, as required under SGMA, GSAs may need to impose pumping reductions (Babbitt et al. 2019). While SGMA did not change the longstanding framework of groundwater pumping rights established by California courts, the development and enforcement of groundwater allocations is acknowledged as a critical component of long-term groundwater sustainability (Garner et al. 2020). Importantly, the platform being developed under this proposal can help water managers assess different groundwater allocation scenarios and quantitatively analyze the impacts on groundwater levels,

in collaboration with water users to enhance mutual understanding of the potential water allocation strategies that will be needed to achieve sustainability under SGMA.

Ability to meet endangered species requirements: Groundwater is critical in supporting streams, wetlands and springs that in turn provide habitat for many of California’s native plants and animals. Over 80 federally and state listed species are affected by groundwater management decisions in California (Rhode et al. 2019). This list includes both species that rely directly on groundwater for their water needs, such as Chinook salmon that depend on groundwater supplied as baseflow in streams, and species that rely on water indirectly, such as riparian birds that use groundwater supported vegetation like willows and cottonwoods. Spatial datasets have recently been developed that identify the location of Groundwater Dependent Ecosystems (GDEs) indicators in California (Klausmeyer et al. 2018). Incorporating these mapped data into WASPP will empower groundwater managers to better assess how proposed management activities could affect groundwater level changes, enabling them to avoid or minimize impacts to the many endangered species that rely on GDEs.

Watershed health: SGMA requires groundwater managers to take a holistic approach to groundwater management as they work to achieve groundwater sustainability through the avoidance of six undesirable results, which includes avoiding depletions of interconnected surface water and degradation of water quality. As discussed above, maintaining groundwater levels in many areas in California is necessary to support streams, wetlands, and springs – all essential components of watershed health (Klausmeyer et al, 2018). Additionally, protecting and mitigating groundwater quality impacts is essential to both human and long-term ecosystem health (Fakhreddine et al. 2019). WASPP allows users to assess management actions across space and time, including analysis of water level changes that could impact interconnected surface waters or analysis of management actions that could exacerbate water quality degradation due to the presence of contaminants. Scenario planning can help water managers avoid management actions that result in unintended consequences, and in some cases, identify actions that improve conditions.

Conservation and efficiency: While most GSAs are working to increase water supply through groundwater recharge, imported supply or other sources, conservation and efficiency can provide a cost-effective means of reducing water demands in a basin. The WASPP, proposed under this grant, provides water managers and landowners with both the ability to track conservation efforts and the incentives essential for long-term sustainable groundwater management.

Complementarity: This project is complementary to several projects within the state of California, including:

- **OpenET:** WASPP integrates data from OpenET to make evapotranspiration data available to landowners and groundwater managers and provides initial estimates of urban and agricultural water use resulting from consumptive use.
- **DWR SGMA Reporting Portal:** data standards underpinning the WASPP will be co-developed with DWR to ensure that data are consistent with DWR’s SGMA Reporting Portal.
- **California Natural Resources Agency Open Data Portal:** SWAPP integrates current and historic statewide groundwater elevation and use data from the CNRA Open Data Portal.

- **Groundwater Level Data Standards Pilot:** the Consortium, DWR and the State Board are currently co-developing groundwater level data standards. This project will develop an API to assist in implementation of these data standards into the WASPP. These standards will enable interoperability with third-party DMS used by water managers throughout California.

E.1.2. Evaluation Criterion B — Need for Project and Applicability of Project Results

Water Resource Manager Need: The Consortium and EDF were approached by DWR, State Board, and program staff responsible for implementing the state’s Water Resilience Portfolio in response to direct feedback from local water resource managers requesting tools to support water accounting, data visualization, and scenario planning under SGMA, a critical component of California’s long-term water resilience planning efforts. Since the passage of SGMA in 2014, the state has provided a host of tools and materials to support sustainable groundwater management under the legislation. However, many local agencies continue to struggle developing accurate water budgets and water accounting systems, as well as the integration of data into these tools owing to inconsistent data collection and management systems between regions and agencies. Easier access to consistent data will facilitate the development of more reliable and accurate groundwater management plans in compliance with SGMA reporting requirements. This work will immediately benefit water management efforts in our pilot GSAs, providing them with a “locally-tailored” WASPP that provides individual landowners within their region with the ability to view their individual water “bank account” in a secure manner, while integrating this data at the manager-level to support local management decisions with the SGMA framework. During the development of our pilot projects, we will also be integrating statewide groundwater levels and water use datasets and developing workflows and processes to enable scaling of the platform for GSAs across California.

a. Expressed need: See above response and the accompanying letters of support from the State Board, DWR, Secretary of Natural Resources, and five GSAs/water management districts.

b. Immediate Management Use: The work products proposed in this project will be made available immediately to pilot GSAs to meet critical water management needs. We will be working with additional project partner GSAs as well as an advisory group throughout the project duration to 1) ensure that all products developed under this proposal align with water manager needs and are readily available and 2) ensure that once developed the open-source platform code is broadly available for use by GSAs across California. Platform development is directly related to decisions surrounding groundwater management, drought, and conjunctive use.

c. Transferability: The water accounting platform originally developed by EDF and RRBWSD was developed using open-source code available on GitHub. The open-source code was chosen to 1) facilitate trust with water managers and 2) enable scaling of the platform to other agencies across the state. Tasks 3 and 4 outlined above will integrate statewide groundwater level and use data to facilitate transferability of the platform to other water management agencies in California. Additional pilots are being conducted using the WAP in other areas of the western U.S. The processes and workflows developed with pilot GSAs under this proposal will serve to ensure the transferability of the work conducted under this grant to agencies in California and beyond.

d. Role of project beneficiaries: The Consortium is a Category B applicant. However, we have devoted significant time to ensuring that primary project beneficiaries at both the state and local

level are directly involved in WASPP development throughout the duration of the project. See task 1 above and the Figure 7 for additional details.

E.1.3. Evaluation Criterion C — Project Implementation (20 points)

Approach & Methodology: The WASPP and data standards underpinning its development will be developed in the six project tasks outlined in the technical project description. WASPP development will follow an iterative design process to ensure feedback from project beneficiaries are incorporated, tested, and refined on an ongoing basis. Specifically, the project includes three working groups: an advisory committee; a platform scaling and usability working group; and a technical working group providing venues for ongoing feedback from state agency employees and GSAs/water district partners. Additionally, we will host several public meetings to ensure broader dissemination of our results. Project partner feedback and public outreach throughout project implementation are integral to the approach and methodology pursued in this project.

Work Plan: This project consists of six tasks. Tasks 1 & 6 will be sustained efforts for the life of the project. Tasks 2-5 will be more focused, requiring 4-7 months each with some overlap.

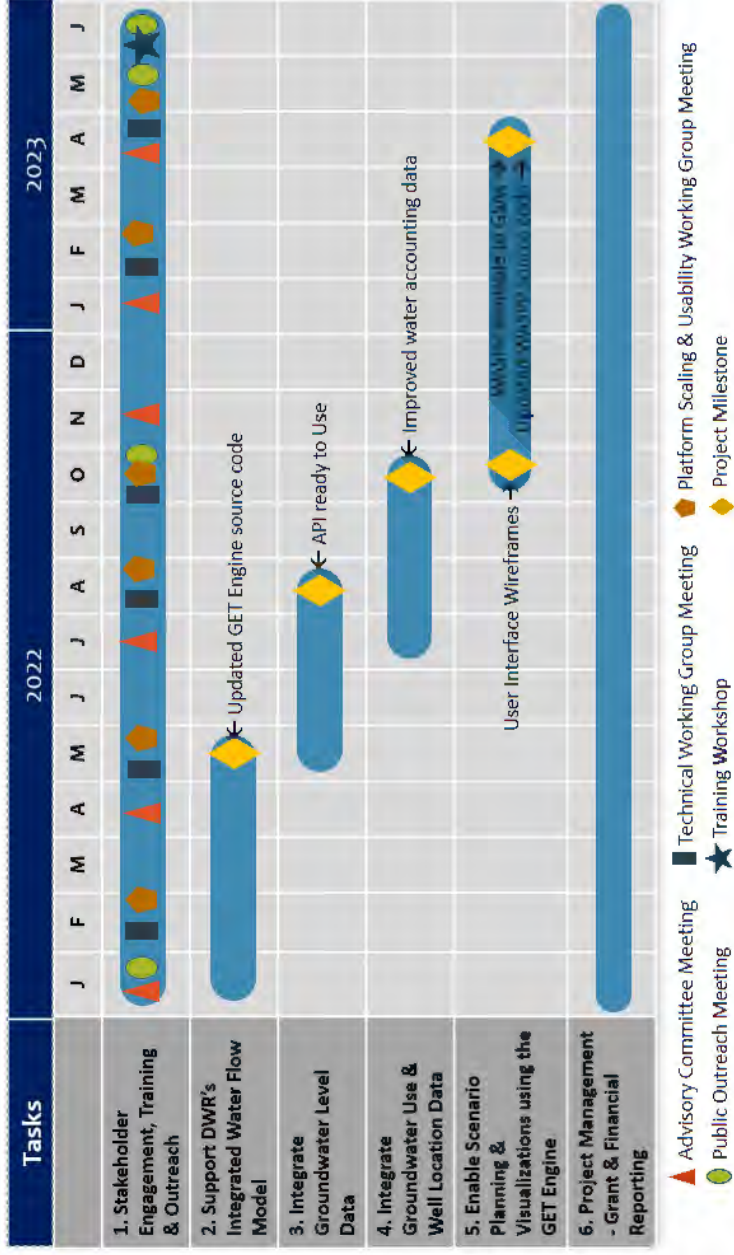


Figure 7. Project schedule by task with key milestones.

Products: This project will deliver the following outputs or products:

Product	Description
GET Engine source code	Updated code supporting DWR's IWFM and additional APIs.
WASPP source code	Updated code supporting various integrations and new functionality.
WASPP web application	Instances of WASPP tailored to the specific needs of one or two GSAs.
API Documentation	Documents describing how the open data APIs work so that others can use them as-is or extend/adapt them for their purposes.
Outreach materials	Online and print outreach materials that provide information on WASPP.

Staff: a. Project team capability: Project member bios are provided below. As outlined in the bios, this team has extensive experience both as project leads and members of projects similar in scope to this project. They are well-equipped to manage this project. Additional technical support with expertise in open-source software development will be selected to execute, in conjunction with the Consortium and EDF, Tasks 1-5 in this project. The Consortium commits to follow the BOR procurement methods, if this project is selected.

b. Project team ability to implement: We do not anticipate any delays in proceeding with the proposed project once a financial assistance agreement is in place.

Tara Moran, Ph.D. is the Chief Executive Officer and President of the California Water Data Consortium and will serve as the Project Manager for this project. Prior to joining the Consortium, Tara led the Sustainable Groundwater Program with Water in the West at Stanford University where she led many multi-year, multi-party projects focusing on groundwater management, the role of data in decision-making, and data collection, sharing, and integration. Tara holds a Ph.D. in Geography and a first-class honors B.Sc. in Environmental Science both from the University of Calgary, Canada.

Amanda Miller is the Program Operations Manager at the California Water Data Consortium. Prior to joining the Consortium, Amanda was a Senior Operations Specialist at the S.D. Bechtel, Jr. Foundation, providing support for finance and accounting, communications and facilitation, contract negotiation and procurement, and grant reporting. She holds a Master's in Business with an emphasis in sustainable business and a B.S in Business.

Christina Babbitt, Ph.D. is a Senior Manager for the California Groundwater Program at Environmental Defense Fund, where she works to advance and scale groundwater sustainability policies and practices across the Central Valley. Christina was the project manager for the EDF Water Accounting Platform, co-developed with Rosedale-Rio Bravo Water Storage District. Christina earned a Ph.D. in natural resources from the University of Nebraska, Lincoln and an MSc in environmental science from Florida International University.

Erik Ekdahl is the Deputy Director for the State Water Board's Division of Water Rights. The Division is responsible for establishing and maintaining a stable system of water rights to

develop, conserve, and use the water resources of the State, while protecting vested rights, water quality, and the environment. Erik has worked in the Board's Division of Financial Assistance, Division of Water Quality, and as Director for the Board's Office of Research, Planning and Performance, which is responsible for developing and implementing the Board's requirements under the Sustainable Groundwater Management Act (SGMA). Erik is a licensed Engineering Geologist, with a Ph.D. in Geology from the University of Michigan.

Steven Springhorn, P.G., is the acting Deputy Director of Department Water Resources' Statewide Groundwater Management Program. The Program oversees the strategic planning, assistance, and oversight of the implementation of DWR's roles and responsibilities under the Sustainable Groundwater Management Act.

Jim Schneider, Ph.D. is a Technical Leader at Olsson with 23 years of experience. In this role, Jim performs groundwater modeling for public and private clients. Previously, Jim was Deputy Director at the State of Nebraska Department of Natural Resources (NDNR), where he administered state water policies, reviewed water permit applications, and compiled water supply and demand data. Jim holds a Ph.D. in Geology from the University of South Florida-Tampa and a M.S and B.S. in Geology from Northern Illinois University-DeKalb.

Brian Dunnigan, P.E. is an Industry Expert at Olsson. He is a seasoned water resources engineer with 40 years of experience. Before Olsson, Brian directed the State of Nebraska Department of Natural Resources where he was responsible for the state's water planning efforts. Brian oversaw the development of basin-wide planning efforts and coordinated regional integrated surface water and groundwater planning in collaboration with local stakeholders.

E.1.4. Evaluation Criterion D — Dissemination of Results (10 Points)

The Consortium is a Category B applicant. However, extensive work has gone into ensuring ongoing venues for dialogue and collaboration with our state and local Category A partners, including three working groups that will meet quarterly (technical, advisory, and platform scaling working groups). These same venues will be used to disseminate our results to water managers and state agency employees. In addition to the working groups described above, we will develop outreach materials and host public and pilot GSA-specific events to disseminate our results. Materials and events, include:

- Developing online and print outreach materials for distribution via partner networks and at conferences that water managers attend.
- Conducting two virtual training workshops at the conclusion of WASPP development. These workshops will be open to the public and will highlight the functionality and value-add of the platform.
- Co-hosting two to four public events with pilot GSAs to demonstrate WASPP functionality and its potential to serve as a SGMA stakeholder engagement and scenario planning tool.

All technology developed under this project will be made available via open-source license to any interested users. The source code will be published in a publicly accessible repository with instruction on how to build and use the applications.

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PROJECT BUDGET

A. Funding Plan: The non-Federal share of project costs will be obtained from the following sources:

1. The California Water Data Consortium will provide \$41,118.50 in in-kind support. Calculated as 275 hours at a rate of \$91.34 hour for a total of \$25, 118.50 plus \$9,000 contract for a data support consultant and \$7,000 for materials and supplies for a total of \$41,118.50.
2. Environmental Defense Fund will provide \$12,590 in in-kind support. See attached letter of funding commitment.
3. The Department of Water Resources will provide \$20,400 in in-kind support. See attached letter of funding commitment.
4. The State Water Resources Control Board will provide \$16,200 in in-kind support. See attached letter of funding commitment.
5. Sonoma County Water agency will provide \$2,160 in in-kind support. See attached letter of funding commitment.
6. Pajaro Valley Water Management agency will provide \$3,000 in in-kind support. See attached letter of funding commitment.
7. Yolo County Flood Control & Water Conservation District will provide \$2,544 in in-kind support. See attached letter of funding commitment.
8. Kern Groundwater Authority will provide \$1,800 in in-kind support. See attached letter of funding commitment.
9. Olsson will provide \$17,400 in in-kind support. This support was calculated as 10 hours at a rate of \$240/hour plus \$15,000 in GET hosting. See attached letter of funding commitment.
10. California Natural Resources Agency will provide \$226,817.87 in direct funding. See attached letter of funding commitment.

Total non-Federal funding sources: \$344,030.37

Table 1. Total Project Cost Table

Source	Amount
Costs to be reimbursed with the requested Federal funding	\$200,000
Costs to be paid by the applicant	\$41,118.50
Value of third-party contributions	\$302,911.87
TOTAL PROJECT COST	\$544,030.37

Federal share is 36.7% of total project cost.

B. Budget Proposal

We propose an 18-month project budget of \$544,030.37 of which \$200,000 in federal funding is requested in this application.

Table 2. California Water Data Consortium budget proposal

Table 2. California Water Data Consortium Budget Proposal

Budget Item Description	Computation		Quantity	Quantity Type	In-Kind	Federal, State or other funds	TOTAL COST
	\$/Unit						
Salaries and Wages							
Tara Moran, CEO (Project Manager)	\$ 91.34		840	hour	\$ 25,118.50	\$ 51,607.10	\$ 76,725.60
Amanda Miller, Program Operations Manager	\$ 44.47		408	hour	\$ -	\$ 18,143.76	\$ 18,143.76
Fringe Benefits							
Tara Moran, CEO (Project Manager)	\$ 14.61		840	hour	\$ -	\$ 12,276.10	\$ 12,276.10
Amanda Miller, Program Operations Manager	\$ 7.32		408	hour	\$ -	\$ 2,986.56	\$ 2,986.56
Equipment							
None							\$ -
Supplies and Materials							
Publication and Outreach materials	\$ 7,000.00		1		\$ 7,000		\$ 7,000.00
Subawards							
Environmental Defense Fund (see separate budget)	\$ 94,133.00		1		\$ 12,590	\$ 81,543	\$ 94,133.00
Contractual/Construction							
Contractor 1	\$224,460		1	per contract	\$ -	\$ 224,460	\$ 224,460.00
Contractor 2	\$15,000		1	per contract	\$ -	\$ 15,000	\$ 15,000.00
Data Standards Consultant	\$9,000		1	per contract	\$ 9,000	\$ -	\$ 9,000.00
Olsson	\$9,800		1	per contract	\$ 17,400	\$ 9,800	\$ 27,200.00
Third Party In-Kind							
Department of Water Resources	\$ 20,400.00			Multiple rates, 1 see narrative	\$ 20,400		\$ 20,400.00
State Water Resources Control Board	\$ 16,200.00		1		\$ 16,200		\$ 16,200.00
Sonoma	\$ 2,160.00		1		\$ 2,160		\$ 2,160.00
Pajaro	\$ 3,000.00		1		\$ 3,000		\$ 3,000.00
Yolo	\$ 2,544.00		1		\$ 2,544		\$ 2,544.00
Kern	\$ 1,800.00		1		\$ 1,800		\$ 1,800.00
TOTAL DIRECT COSTS							\$ 211,265.02
Modified Total Direct Costs						\$ 110,013.52	
Indirect Costs (percentage/base)							
Type of rate	\$ 110,013.52		0.1	10% rate		\$ 11,001.35	\$ 11,001.35
TOTAL ESTIMATED PROJECT COSTS							\$ 544,030.37

Budget Narrative

Table 3. Salaries and Wages

All salaries and wages included in the budget will be paid to regular Consortium employees at their current hourly rate.

Employee	Task #	Activity	Hours	Rate	Total direct costs
Tara Moran, Project manager	3	Data standard implementation	200	\$91.34	\$18,268.00
Tara Moran	1	Advisory group/Usability group/Outreach/Lead Technical workshops	232	\$91.34	\$21,190.88
Tara Moran	6	Project Management including coordination with EDF and managing contracts (average 5 hours/week)	360	\$91.34	\$32,882.40
Tara Moran	6	Financial and grant reporting (3 interims & 1 final for each)	48	\$91.34	\$4,384.32
SUBTOTAL			840	\$91.34	\$76,725.60
Amanda Miller, Program Operations Manager	1	Virtual meeting support (advisory group, usability group meetings – 1 hour prep + meeting time)	42	\$44.47	\$1,867.74
Amanda Miller	1	Outreach meetings/technical workshops	62	\$44.47	\$2,757.14
Amanda Miller	1	Communications/Dissemination/Education	50	\$44.47	\$2,223.50
Amanda Miller	6	Meeting logistics and facilitation core team meetings (bi-weekly, 2 hours prep, 1 hour meeting)	108	\$44.47	\$4,802.76
Amanda Miller	6	Accounting and finance tasks to support grant administration	82	\$44.47	\$3,646.54
Amanda Miller	6	Grant tracking, reporting and financial reporting (3 interim reports & 1 final)	64	\$44.47	\$2,846.08

SUBTOTAL		408	\$44.47	\$18,143.76
TOTAL				\$94, 869.36

Fringe Benefits

The value of fringe benefits is based on actual costs and was determined using the estimate of hours in the salaries and wages category and multiplying by the hourly fringe benefits rate for each employee.

Tara Moran: 840 hours * \$14.61/hour = \$12,276.10

Amanda Miller: 408 hours *\$7.32/hour = \$2,986.56.

Travel

No travel costs are anticipated.

Equipment

The Consortium is not expecting to lease or purchase any equipment as part of this project. Accordingly, no “Equipment” expenses have been included in Table 2.

Materials and Supplies

\$7,000 in printing and publication costs are expected as part of the communication and dissemination plan, which may include white papers, one-pagers, blogs, and other forms of communication. The Consortium is providing these materials in-kind and makes no budget request for them.

Contractual

A consulting firm (**Contractor 1** in the budget) with expertise in open-source software development will be selected to execute, in conjunction with the Consortium and EDF, Tasks 1-5 in this project. Total amount for the work will be \$224,460. These costs were estimated by working with consultants with similar expertise. The Consortium understands that if the proposed project is selected procurement methods indicated by the BOR will be followed.

Task budgets:

1. **Task 1:** Stakeholder engagement, training and outreach \$15,000
2. **Task 2:** Support integration of DWR’s Integrated Water Flow Model (IWFm), including updating Groundwater Evaluation Tool (GET) architecture to support distinct model pipelines, adding IWFm as a supported model and analysis/testing/project management \$69,460
3. **Task 3:** Integrate groundwater levels data, including developing a REST API for groundwater level data within the Water Accounting and Scenario Planning Platform (WASPP) and developing functions to crosswalk groundwater level data with existing data standards \$55,000

4. **Task 4:** Integrate groundwater use and well location data, including integrating publicly annually aggregated water use data into WASPP and developing a process for integrating local water use data \$40,000
5. **Task 5:** Enable scenario planning and visualizations using the GET Engine, including updating GET with REST API endpoints for custom scenario file uploads \$45,000

As part of Task 5, a consulting firm, **Contractor 2** in the budget, will be selected to configure two basin models in GET. Total amount for the work will be \$15,000. The Consortium understands that if the proposed project is selected, procurement methods indicated by the BOR will be followed.

To support Task 3, a **data standards consultant** will be provided by the Consortium for 45 hours at \$200/hour to do assist with tools and/or functions to crosswalk groundwater level data with existing data standards. The Consortium will cover the cost, \$9,000, as in-kind support - there is no request for Reclamation funds for this contract.

Olsson has been selected to update the GET Engine to support Integrated Water Flow Model (IWFEM) to support Task 2. The Consortium will contract with Olsson for 50 hours at \$100/hr for Colby Osborn and 24 hours at \$200/hr for Jim Schneider for a total of \$9,800.

Subawards

Subaward will be issued to the Environmental Defense Fund for \$81,543 for Tasks 1 and 6. EDF is also providing \$12,590 in in-kind services (see their subaward budget narrative).

Third- Party In-Kind Contributions

State/public employee rates were estimated using publicly available data for the corresponding role and seniority level or based on information provided by the agency in their support letter.

To support Task 1, the Department of Water Resources (DWR) will provide two Executive level employees for the advisory group (12 hours each) at \$200/hr for a total of \$4800. DWR will also provide two senior level engineers for the technical workshops (24 hours each) at \$150/hr for a total of \$3,600. DWR will also provide an additional 80 hours of staff time to support and vet data standards development at \$150/hour rate for a total of \$12,000. Total in-kind from DWR is calculated at \$20,400.

To support Task 1, the State Water Resources Control Board (SWRCB) will provide one director level employees for the advisory group (12 hours) at \$200/hr for a total of \$2,400. SWRCB will also provide one senior level engineer to participate in the technical workshops (12 hours) at \$150/hour for a total of \$1,800. SWRB will also provide an additional 80 hours of staff time to support and vet data standards development at \$150/hour for a total of \$12,000. Total in-kind from SCWRB is calculated at \$16,200.

To support Task 1, Sonoma County Water Agency will provide one director level employee for the advisory group (12 hours) at \$100 hr/ for a total of \$1,200. They will also provide one senior

level engineer to attend the technical workshops (12 hours) at \$80/hr for a total of \$960. Total in-kind is calculated at \$2,160.

To support Task 1, Pajaro Valley Water Management Agency will provide one director level employee for the advisory group (12 hours) at \$100/hour for a total of \$1,200. They will also provide one direct-level employee to attend the usability working group (18 hours) at \$100/hour for a total of \$1,800. Total in-kind is calculated at \$3,000.

To support Task 1, Yolo County Flood Control & Water Conservation District will provide one director level employee for the advisory group (12 hours) at \$106/hour for a total of \$1,272. They will also provide one director level employee for the technical workshops (12 hours) at \$106/hour for a total of \$1,272. Total in-kind is calculated at \$2,544.

To support Task 1, Kern Groundwater Authority will provide one director level employee for the usability working group (18 hours) at \$100/hr for a total of \$1,800.

To support the completion of Task 2, *Update GET to support IWFM*, Olsson will provide GET hosting, budgeted at \$15,000, as in-kind to the project. Olsson will also provide in-kind staff time for project advising. Brian Dunnigan, Industry Expert and professional engineer, will advise on the project for 10 hours at \$240 (his regular rate) for a total of \$2,400. Total in-kind from Olsson is calculated at \$17,400.

Environmental and Regulatory Compliance Costs

No environmental or regulatory compliance costs are included in project costs.

Other Expenses

No other expenses are included in project costs.

Indirect Costs

The indirect costs were calculated using the *de minimis* 10% rate based on the modified total direct cost (sum of salaries, fringe benefits, and \$25,000 of the EDF sub-award) of \$110,013.25 for a total of \$11,001.35.

Total Costs

The total Proposed Project cost is equal to \$544,030.37.

Advancing an Open-Source Water Accounting and Scenario Planning Platform to Support the Successful Implementation of California’s Sustainable Groundwater Management Act

Table 4. EDF Budget Proposal

1/1/22 to 6/30/23

	GOVERNMENT FUNDS			IN KIND			PROJECT COSTS		
	YEAR 1	YEAR 2	TOTAL	YEAR 1	YEAR 2	TOTAL	YEAR 1	YEAR 2	TOTAL
	\$	\$	\$	\$	\$	\$	\$	\$	\$
EXPECTED REVENUE:									
Donors Committed/Proposed	53,788	27,755	81,543	-	-	-	53,788	27,755	81,543
SALARY & MGMT. EXPENSES:									
Salaries									
Babbitt, Christina	37,964	19,590	57,554	1,214	571	1,784	39,178	20,161	59,339
Hayden, Ann				2,336	1,166	3,502	2,336	1,166	3,502
Hall, Maurice				2,393	1,206	3,600	2,393	1,206	3,600
Benefits	10,934	5,642	16,576	1,711	848	2,559	12,645	6,490	19,135
Subtotal Salary	48,898	25,232	74,130	7,654	3,791	11,445	56,552	29,023	85,575
OTHER DIRECT COSTS:									
Professional Fees	-	-	-	-	-	-	-	-	-
Travel	-	-	-	-	-	-	-	-	-
Other/Miscellaneous	-	-	-	-	-	-	-	-	-
Grants & Passthroughs	-	-	-	-	-	-	-	-	-
Supplies	-	-	-	-	-	-	-	-	-
Subtotal Other Direct	-	-	-	-	-	-	-	-	-
TOTAL DIRECT COSTS	48,898	25,232	74,130	7,654	3,791	11,445	56,552	29,023	85,575
INDIRECT COSTS	4,890	2,523	7,413	765	379	1,144	5,655	2,902	8,558
TOTAL EXPENDITURES	53,788	27,755	81,543	8,420	4,170	12,590	62,207	31,925	94,132

Salaries and Wages

Dr. Christina Babbitt is the Environmental Defense Fund Senior Manager, California Groundwater Program and will be the Co-PI on the project. She will be the project manager for the EDF efforts and will lead the stakeholder engagement and public outreach (Task 1) and will work with the Consortium on project management and grant reporting (Task 6).

Her work will include managing expansion and scaling of the open-source groundwater accounting and decision support platform, in close coordination the California Water Data Consortium and technical subcontractors. Christina will support overall project implementation and planning, including 1) leading and facilitating quarterly project advisory group meetings that will bring together state and local water agency leadership to ensure project alignment and buy-in with current groundwater management planning efforts, 2) co-leading quarterly platform scaling working sessions to engage and solicit iterative feedback from local groundwater agencies, landowners, and stakeholders on platform functionality and design, and 3) supporting and participating in quarterly technical working sessions on data standards, open source licensing and other technical topics that arise during platform development. Dr. Babbitt will also support

activities to ensure broad stakeholder engagement throughout development and scaling of the groundwater accounting platform, including planning, and facilitating public outreach meetings and developing project outreach materials.

Because of the value and importance that EDF places on this project, we will commit in-kind support from Dr. Maurice Hall and Ann Hayden. Their time will include effort on the project itself, in addition to serving on the advisory group (12 hours for each). Dr. Babbitt will also contribute in-kind support to the project.

ENVIRONMENTAL AND CULTURAL RESOURCE COMPLIANCE

D.2.2.5 Environmental and Cultural Resource Compliance

To allow Reclamation to assess the probable environmental and cultural resources impacts and costs associated with each application, all applicants should consider the following list of questions focusing on the NEPA, ESA, and NHPA requirements. Please answer the following questions to the best of your knowledge. If any question is not applicable to the project, please explain why. The application should include the answers to:

Will the proposed project impact the surrounding environment (e.g., soil [dust], air, water [quality and quantity], animal habitat)? Please briefly describe all earth-disturbing work and any work that will affect the air, water, or animal habitat in the project area. Please also explain the impacts of such work on the surrounding environment and any steps that could be taken to minimize the impacts.

Not applicable. Not applicable. This is a software development project that will not be undertaken in a physical project area. No earth-disturbing work will be undertaken.

Are you aware of any species listed or proposed to be listed as a Federal threatened or endangered species, or designated critical habitat in the project area? If so, would they be affected by any activities associated with the proposed project?

Not applicable. The proposed project is a software development project that will not be undertaken in a physical project area.

Are there wetlands or other surface waters inside the project boundaries that potentially fall under CWA jurisdiction as “Waters of the United States?” If so, please describe and estimate any impacts the proposed project may have.

Not applicable. The proposed project is a software development project that will not be undertaken in a physical project area.

When was the water delivery system constructed?

Not applicable. The proposed project is a software development project that will not be undertaken in a physical project area.

Will the proposed project result in any modification of or effects to, individual features of an irrigation system (e.g., headgates, canals, or flumes)? If so, state when those features were constructed and describe the nature and timing of any extensive alterations or modifications to those features completed previously.

Not applicable. The proposed project is a software development project that will not be undertaken in a physical project area.

Are any buildings, structures, or features in the irrigation district listed or eligible for listing on the National Register of Historic Places? A cultural resources specialist at your local Reclamation office or the State Historic Preservation Office can assist in answering this question.

Not applicable. The proposed project is a software development project that will not be undertaken in a physical project area.

Are there any known archeological sites in the proposed project area?

Not applicable. The proposed project is a software development project that will not be undertaken in a physical project area.

Will the proposed project have a disproportionately high and adverse effect on low income or minority populations?

Not applicable. The proposed project is a software development project that will not be undertaken in a physical project area.

Will the proposed project limit access to and ceremonial use of Indian sacred sites or result in other impacts on tribal lands?

Not applicable. The proposed project is a software development project that will not be undertaken in a physical project area.

Will the proposed project contribute to the introduction, continued existence, or spread of noxious weeds or non-native invasive species known to occur in the area?

Not applicable. The proposed project is a software development project that will not be undertaken in a physical project area.

REQUIRED PERMITS AND APPROVALS

D.2.2.6. Required Permits or Approvals

Applicants must state in the application whether any permits or approvals are required and explain the plan for obtaining such permits or approvals.

No permits or approvals are necessary for this proposed project.

LETTERS OF SUPPORT

D.2.2.8 Letters of Support and Letters of Participation

See Appendix A (below).

OFFICIAL RESOLUTION

D.2.2.9 Official Resolution

Due to the timing of the California Water Data Consortium’s April Board meeting, the Consortium will submit the Official Resolution to the appropriate USBR email address by no later than May 12th.

UNIQUE ENTITY IDENTIFIED

D.3. Unique Entity Identified and System for Award Management

APPENDIX A



Finding the ways that work

April 19, 2021

Dr. Tara Moran
CEO, California Water Data Consortium
555 Capitol Mall Suite 1155
Sacramento, CA 95814

Dear Tara Moran,

Climate change and population growth are stretching our freshwater resources beyond their limits. This challenge is particularly urgent in the American West, where historic drought and overallocation have put major river systems at risk. EDF is working hard in California to help rebalance water systems and make them more resilient to climate change. California's Sustainable Groundwater Management Act mandates more proactive decision-making and offers promising opportunities for innovation and collaborative solutions. We strongly support this grant application, as the proposed project work exemplifies innovation and collaboration that aligns with our strategic programmatic priorities to modernize groundwater management, improve and expand healthy water trading programs, and incentivize the sustainable use of agricultural water.

Dr. Christina Babbitt, Dr. Maurice Hall, and Ann Hayden, employees of Environmental Defense Fund (EDF), are committed to supporting the proposal as a subaward recipient from the California Water Data Consortium under Principal Investigator Dr. Tara Moran. This proposal, entitled "Advancing an Open-Source Water Accounting and Scenario Planning Platform to Support the Successful Implementation of California's Sustainable Groundwater Management Act" is submitted in response to the WaterSMART – Applied Science Competitive Grants Program (R21AS00289) under the United States Department of Interior (USDOI) – Bureau of Reclamation. The requested budgeted amount of support to EDF is \$81,543 for the proposed time period of January 1, 2022 – June 30, 2023 (18 months).

EDF commits to support the project as follows:

Dr. Christina Babbitt will serve as Environmental Defense Fund's Principal Investigator for this project. Her work will include:

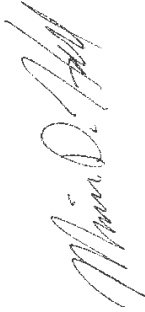
- Managing expansion and scaling of the open-source groundwater accounting platform, in close coordination the California Water Data Consortium and technical subcontractors.
- Supporting overall project implementation and planning, including 1) leading and facilitating quarterly project advisory group meetings that will bring together state and local water agency leadership to ensure project alignment and buy-in with current groundwater management planning efforts, 2) co-leading quarterly platform scaling working sessions to engage and solicit iterative feedback from local groundwater agencies, landowners, and stakeholder on platform functionality and design, and 3) supporting and participating in quarterly technical working sessions on data standards, open source licensing and other technical topics that arise during platform development.

- Supporting activities to ensure broad stakeholder engagement throughout development and scaling of the groundwater accounting platform, including planning and facilitating public outreach meetings and developing project outreach materials.

Because of the value and importance that EDF places on this project, we will commit in-kind support from Dr. Maurice Hall and Ann Hayden. They will serve as advisors to the project and commit to participating in quarterly advisory group meetings, providing strategic advice and project guidance. We expect their in-kind contribution to be valued at \$12,590.

Should you have any questions about this proposal, please do not hesitate to contact EDF's Administrative Contact, Lindsay Ross, Senior Government Grants Officer, at lross@edf.org or 212-616-1307.

Sincerely,



Maurice Hall
Vice President, Ecosystems – Water
(916) 492-7071
mhall@edf.org



CALIFORNIA DEPARTMENT OF WATER RESOURCES
SUSTAINABLE GROUNDWATER
MANAGEMENT OFFICE

901 P Street, Room 313-B | Sacramento, CA 95814 | P.O. Box 942836 | Sacramento, CA 94236-0001

April 19, 2021

Dr. Tara Moran
CEO, California Water Data Consortium
555 Capitol Mall Suite 1155
Sacramento, CA 95814

RE: Advancing an Open-Source Water Accounting and Scenario Planning Platform to Support the Successful Implementation of California’s Sustainable Groundwater Management Act

Dear Dr. Moran,

I write on behalf of the California Department of Water Resources (DWR) in strong support of the California Water Data Consortium’s proposal to the U.S. Bureau of Reclamation WaterSMART – Applied Science Grant NOFO No. R21AS00289 to support the “Advancing an Open-Source Water Accounting and Scenario Planning Platform to Support the Successful Implementation of California’s Sustainable Groundwater Management” project.

DWR is responsible for implementing California’s Sustainable Groundwater Management Act (SGMA) passed in 2014, which requires the formation of local water management agencies to develop and implement groundwater sustainability plans in all groundwater basins designated as high and medium priority basins and is encouraged in the rest of California’s groundwater basins. More than 250 local agencies have formed and are actively working to bring groundwater basins into sustainable conditions over the next two decades. With the passage of SGMA, there is an increased need for local and state agencies, water users and stakeholders to easily access water data to enable informed management decisions.

DWR is providing guidance and technical assistance to support local agencies as they work to better understand and collectively manage groundwater resources across basins, including significant investments to advance different methods and tools for local agencies to collect and visualize their local data, and support more informed water management decisions through model development and other decision support tools.

We are excited to partner with the California Water Data Consortium and Environmental Defense Fund (EDF) to further develop and scale the EDF open-source water accounting platform, which will be an optional tool available to GSAs across California to support GSA development and adoption of water accounting systems and promote transparent intra- and inter-basin coordination and regional analyses and review. We are committed to partnering with the Consortium and EDF on this important project to ensure that the platform meets both

state and local needs long-term. Specifically, DWR will provide expertise and support on the integration of key datasets into the Platform, the co-development of data standards to enable data sharing between agencies, and integration of the open-source Olsson groundwater evaluation tool (GET) engine and making it compatible with DWR's existing models and information management systems.

We strongly support this grant application and agree to its submittal. DWR SGMA leadership will serve on the project advisory group and DWR technical staff will actively participate as members of the project technical working group throughout the duration of the project. We estimate our in-kind support for this project to \$20,400, calculated as follows:

- Advisory Group - \$4,800. Assumes: Two Executive-level employees to attend all six 2-hour meetings. 24 hours*\$200/hour = \$4,800.
- Technical Working Group - \$3,600. Assumes: Two Senior-level Engineers to attend all six 2-hour meetings. 24 hours*\$150/hour = \$3,600.
- Data Standards Development - \$12,000. Assumes An additional 80 hours of staff time to support and vet data standards development and integration. 80 hours*\$150/hour = \$12,000.

Sincerely,

Steven Springhorn

Steven Springhorn
Acting Deputy Director, Statewide Groundwater Management
Sustainable Groundwater Management Office
California Department of Water Resources



State Water Resources Control Board

April 14, 2021

Dr. Tara Moran
CEO, California Water Data Consortium
555 Capitol Mall Suite 1155
Sacramento, CA 95814

RE: Advancing an Open-Source Water Accounting and Scenario Planning Platform to Support the Successful Implementation of California's Sustainable Groundwater Management Act

Dear Dr. Moran,

I write on behalf of the California State Water Resources Control Board (SWRCB) in strong support of the California Water Data Consortium's proposal to the U.S. Bureau of Reclamation WaterSMART – Applied Science Grant NOFO No. R21AS00289 to support the “Advancing an Open-Source Water Accounting and Scenario Planning Platform to Support the Successful Implementation of California’s Sustainable Groundwater Management” project.

The Sustainable Groundwater Management Act (SGMA) is landmark legislation in California that empowers local agencies to sustainably manage groundwater resources in all 515 of the state’s alluvial groundwater basins. Under SGMA, the SWRCB serves as the state’s backstop for SGMA compliance. Our role is to manage pumping in areas of the state where local agencies are unwilling or unable to comply with SGMA requirements. To facilitate enforcement, where necessary, the SWRCB has developed a proprietary Groundwater Extraction Reporting System (GEARS) to collect required data to help manage probationary basins and collect fees. During the development of GEARS, we were approached by many local management agencies and water user groups about the possibility of making our software available for local data collection and management. While open-sourcing our software was not possible, we are excited to be able to support the development of an alternative platform to meet these needs. The Water Accounting Platform developed by Environmental Defense Fund (EDF) in partnership with a local water management agency was designed using open-source software capable of scaling to other regions.

We are excited to partner with the California Water Data Consortium and Environmental Defense Fund to further develop and scale the open-source water accounting platform and see many areas of alignment in our goal of supporting sustainable groundwater management in California at the local level.

E. JOAQUIN ESQUIVEL, CHAIR | EILEEN SOBECK, EXECUTIVE DIRECTOR

We strongly support this grant application and agree to its submittal. SWRCB staff will serve on the project advisory group and technical working group throughout the duration of the project. We estimate our in-kind support for this project to \$16,200, calculated as follows:

Advisory Group: \$2,400. Assumes: One Director-level employees to attend all six 2-hour meetings. 12 hours*\$200/hour = \$2,400.

Technical Working Group. \$1,800. Assumes: One Senior-level Engineer to attend all six 2-hour meetings. 12 hours*\$150/hour = \$1,800.

Data Standards development. \$12,000. Assumes an additional 80 hours of staff time to support and vet data standards development. 80 hours*\$150/hour = \$12,000.

Sincerely,



Erik Ekdahl
Deputy Director, Division of Water Rights
State Water Resources Control Board
Erik.Ekdahl@Waterboards.ca.gov



April 15, 2021

Dr. Tara Moran
CEO, California Water Data Consortium
555 Capitol Mall Suite 1155
Sacramento, CA 95814

RE: Advancing an Open-Source Water Accounting and Scenario Planning Platform to Support the Successful Implementation of California's Sustainable Groundwater Management Act

Dear Dr. Moran,

I write on behalf of Sonoma County Water Agency in support of the California Water Data Consortium's proposal to the U.S. Bureau of Reclamation WaterSMART – Applied Science Grant NOFO No. R21AS00289 to support the "Advancing an Open-Source Water Accounting and Scenario Planning Platform to Support the Successful Implementation of California's Sustainable Groundwater Management" project.

In 2014, the California legislature passed the Sustainable Groundwater Management Act (SGMA), which requires the formation of local water management agencies to develop and implement groundwater sustainability plans in all groundwater basins designated as high and medium priority basins. Within Sonoma County, three Groundwater Sustainability Agencies have been established to implement SGMA and Sonoma County Water Agency sits on the board of each agency.

Our agency has devoted significant time and financial resources to the development of data and information to support sustainable groundwater management in our region. We support this grant application and the focus on making the groundwater evaluation tool (GET) by Olsson open-source and making it compatible with both DWR's Integrated Water Flow Model and USGS's MODFLOW model, as well as the co-development data standards to enable data sharing between agencies and regional analyses. We think this is a critical tool to enable data-informed groundwater management in California that is protective of agriculture, groundwater dependent ecosystems, and communities.

We strongly support this grant application and agree to its submittal. Sonoma County Water Agency staff have agreed to serve on the project advisory group and technical working group throughout the duration of the project. We estimate our in-kind support for this project to \$2,160, calculated as follows:

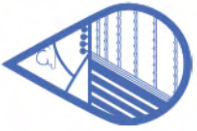
Advisory Group: \$1200. Assumes: One director-level employee to attend all six 2-hour meetings. 12 hours*\$100/hour = \$1200.
Technical Working Group: \$960. Assumes: One senior-level engineer to attend all six 2-hours meetings. 12 hours*\$80/hour = \$960.

We strongly support this grant application and look forward to working with you.

Sincerely,

A handwritten signature in blue ink that reads "James Jasperse".

James Jasperse
Chief Engineer and Director of Groundwater Management



PAJARO VALLEY WATER MANAGEMENT AGENCY

36 BRENNAN STREET • WATSONVILLE, CA 95076
TEL: (831) 722-9292 FAX: (831) 722-3139
email: info@pvwater.org • <https://www.pvwater.org>

April 16, 2021

Dr. Tara Moran
CEO, California Water Data Consortium
555 Capitol Mall Suite 1155
Sacramento, CA 95814

RE: Advancing an Open-Source Water Accounting and Scenario Planning Platform to Support the Successful Implementation of California's Sustainable Groundwater Management Act

Dear Dr. Moran,

I write on behalf of Pajaro Valley Water Management Agency (PV Water) in support of the California Water Data Consortium's proposal to the U.S. Bureau of Reclamation WaterSMART – Applied Science Grant NOFO No. R21AS00289 to support the “Advancing an Open-Source Water Accounting and Scenario Planning Platform to Support the Successful Implementation of California's Sustainable Groundwater Management” project.

In 2014, the California legislature passed the Sustainable Groundwater Management Act (SGMA), which required the formation of local water management agencies to develop and implement groundwater sustainability plans in all groundwater basins designated as high and medium priority basins. PV Water was formed as a Special Act District in 1984 to managing existing and supplemental water supplies to address long-term overdraft in the basin. In 2015 we became a Groundwater Sustainability Agency under SGMA. Our agency has devoted significant time and financial resources to the development of data and information to support sustainable groundwater management in our region.

We support this project's focus on making the groundwater evaluation tool (GET) by Olsson open-source and making it compatible with both DWR's integrated Water Flow Model and USGS's MODFLOW model, the latter of which we use as our primary water resource planning tool. We also support the co-development data standards to enable data sharing between agencies. We think this is a critical tool to enable data-informed groundwater management in California that is protective of agriculture, groundwater dependent ecosystems, and communities.

We strongly support this grant application and agree to its submittal. PV Water staff agree to serve on the project advisory group and technical working group throughout the duration of the project. We estimate our in-kind support for this project to \$3,000, calculated as follows:

Advisory Group: \$1,200. Assumes one director-level employee will attend six 2-hour meetings.
12 hours*\$100/hour = \$1,200.

Platform Scaling and Usability Working Group: \$1,800. Assumes one director-level employee will attend six 3-hour meetings. 18 hours*\$100/hour = \$1,800.

Sincerely,

A handwritten signature in blue ink, appearing to read "Brian Lockwood".

Brian Lockwood, MS, PG, CHG
General Manager

April 16, 2021

Dr. Tara Moran
CEO, California Water Data Consortium
555 Capitol Mall Suite 1155
Sacramento, CA 95814



RE: Advancing an Open-Source Water Accounting and Scenario Planning Platform to Support the Successful Implementation of California's Sustainable Groundwater Management Act

Dear Dr. Moran,

The Yolo County Flood Control & Water Conservation District (YCFCWCD) supports the California Water Data Consortium's proposal to the U.S. Bureau of Reclamation WaterSMART – Applied Science Grant NOFO No. R21AS00289 titled, "Advancing an Open-Source Water Accounting and Scenario Planning Platform to Support the Successful Implementation of California's Sustainable Groundwater Management" project.

Our agency has devoted significant time and financial resources to the development of data and information to support sustainable groundwater management in our region.

We support the focus on making the Groundwater Evaluation Tool (GET) by Olsson open-source and making it compatible with both DWR's Integrated Water Flow Model and USGS's MODFLOW model, as well as the co-development data standards to enable data sharing between agencies and regional analyses. We think developing data standards is especially important to enable data-informed groundwater management in California that is protective of agriculture, groundwater dependent ecosystems, and communities.

We strongly support this grant application and agree to its submittal. YCFCWCD staff have agreed to serve on the project advisory group and technical working group throughout the duration of the project. We estimate our in-kind support for this project to \$2,544, calculated as follows:

Advisory Group: \$1200. Assumes: One director-level employee to attend all six 2-hour meetings. 12 hours*\$106/hour = \$1272.

Technical Working Group. \$1,200. Assumes: One director-level employee to attend all six 2-hour meetings. 12 hours*\$106/hour = \$1272.

Sincerely,

Max Stevenson, PhD
Assistant General Manager



April 15, 2021

Dr. Tara Moran
CEO, California Water Data Consortium
555 Capitol Mall Suite 1155
Sacramento, CA 95814

RE: Advancing an Open-Source Water Accounting and Scenario Planning Platform to Support the Successful Implementation of California's Sustainable Groundwater Management Act

Dear Dr. Moran,

I write on behalf of the Kern Groundwater Authority in support of the California Water Data Consortium's proposal to the U.S. Bureau of Reclamation WaterSMART – Applied Science Grant (NOFO No. R21AS00289) titled, "Advancing an Open-Source Water Accounting and Scenario Planning Platform to Support the Successful Implementation of California's Sustainable Groundwater Management".

Under California's Sustainable Groundwater Management Act (SGMA), the Kern Subbasin has been identified as a "critically overdraft basin" and the Kern Groundwater Authority (KGA) is coordinating local groundwater management efforts across the basin – an area that covers approximately 1.2 million acres and includes 16 member entities made up of water districts/agencies, groundwater banking projects, and organized nondistricted lands. To support compliance with SGMA, the KGA recently kicked off a process to develop a groundwater data management system for the KGA groundwater management area. We see great value in collaborating and coordinating with the California Water Data Consortium, Environmental Defense Fund, and state partners in our work to facilitate the effective accounting and management of available water resources to enable water managers and landowners to make informed water supply and land use decisions. We believe the open-source accounting and scenarios analysis platform will serve as a powerful and accessible resource for water managers and stakeholders to better understand and evaluate management outcomes under SGMA.

We strongly support this grant application and agree to its submittal. KGA staff have agreed to serve on the project platform scaling and usability working group throughout the duration of the 18-month project. We estimate our in-kind support for this project to be \$1,800, calculated as follows:

Platform Scaling and Usability Working Group: \$1800. Assumes: One director-level employee to attend all six 3-hour meetings. 18 hours * \$100/hour = \$1800.

We strongly support this grant application and look forward to working with you.

Sincerely,

A handwritten signature in blue ink, appearing to read "Dan Waterhouse".

Dan Waterhouse
Chair
Kern Groundwater Authority



April 15, 2021

Dr. Tara Moran, CEO
California Water Data Consortium
555 Capitol Mall, Suite 1155
Sacramento, CA 95814

Re: Advancing an Open-Source Water Accounting and Scenario Planning Platform to Support the Successful Implementation of California's Sustainable Groundwater Management Act

Dear Dr. Moran,

I write on behalf of Olsson in support of the California Water Data Consortium's proposal to the U.S. Bureau of Reclamation WaterSMART – Applied Science Grant NOFO No. R21AS00289 to support the “Advancing an Open-Source Water Accounting and Scenario Planning Platform to Support the Successful Implementation of California’s Sustainable Groundwater Management” project.

We are looking forward to partnering with the California Water Data Consortium to make Olsson's Groundwater Evaluation Toolbox (GET) compatible with both USGS's MODFLOW model and DWR's Integrated Water Flow Model. Integration of GET into the Water accounting and Scenario Planning Platform will provide an enhanced understanding of the potential impacts and trade-offs associated with proposed management actions and empower water managers and stakeholders to make better management decisions. We think this is a critical tool to enable data-driven groundwater management in California that is protective of agriculture, groundwater dependent ecosystems, and communities.

We strongly support this grant application and agree to its submittal. I agree to provide in-kind support as a project advisor to help with GET integration. We estimate our in-kind support for this project as \$17,400, which includes in-kind for my time, calculated as 10 hours at a rate of \$240/hour plus \$15,000 in GET platform hosting that Olsson will provide in-kind to the project.

I strongly support this grant application and look forward to working with you.

Sincerely,

A handwritten signature in blue ink that reads "Brian P. Dunning".

Brian P. Dunning, PE
Industry Expert



April 15, 2021

Dr. Tara Moran
CEO, California Water Data Consortium
555 Capitol Mall Suite 1155
Sacramento, CA 95814

RE: Advancing an Open-Source Water Accounting and Scenario Planning Platform to Support the Successful Implementation of California's Sustainable Groundwater Management Act

Dear Dr. Moran,

I write on behalf of the California Natural Resources Agency in strong support of the California Water Data Consortium's proposal to the U.S. Bureau of Reclamation WaterSMART – Applied Science Grant NOFO No. R21AS00289 to support the “Advancing an Open-Source Water Accounting and Scenario Planning Platform to Support the Successful Implementation of California's Sustainable Groundwater Management” project.

In 2020, California completed its Water Resilience Portfolio, developed in accordance with Governor's Executive Order N-10-19, which directs state agencies to develop recommendations to sustainably manage water resources under climate change and enable water security for all Californians. A critical component of the Portfolio is ensuring that local agencies have the information and tools necessary to manage local water resources sustainably.

In 2014, the California legislature passed the Sustainable Groundwater Management Act (SGMA), which requires the formation of local water management agencies to develop and implement groundwater sustainability plans in all groundwater basins designated as high and medium priority basins. Approximately 250 local agencies have formed and are actively working to bring groundwater basins into sustainable conditions over the next two decades. With the passage of SGMA, there is an increased need for local and state agencies and the public to easily access water data to make informed management decisions.

We see the development of tools to support more informed water management decisions as a critical component in the successful implementation of the Governor's Water Resilience Portfolio and the long-term goal of a water resilient future for all Californians.

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We are excited to partner with the California Water Data Consortium and Environmental Defense Fund (EDF) to support the development and scaling of the open-source water accounting platform originally developed by EDF in partnership with Rosedale Rio-Bravo Water Storage District. The Platform will be an optional tool available to GSAs across California to support the effective accounting and management of available water resources, enabling water managers and landowners to make informed water supply and land use decisions. Integration of the open-source Olsson Groundwater Evaluation Tool (GET) Engine will serve as a valuable planning tool to help GSAs engage with stakeholders as they evaluate management actions to ensure community and environmental protections.

We strongly support this grant application and agree to its submittal. We recognize there is a state match required and we are committed to providing that match through existing or future state resources.

Sincerely,

A handwritten signature in black ink that reads "Nancy Vogel". The signature is written in a cursive, flowing style.

Nancy Vogel
Deputy Secretary for Water, California Natural Resources Agency



ROSEDALE – RIO BRAVO

WATER STORAGE DISTRICT

April 14, 2021

Dr. Tara Moran
CEO, California Water Data Consortium
555 Capitol Mall Suite 1155
Sacramento, CA 95814

RE: Advancing an Open-Source Water Accounting and Scenario Planning Platform to Support the Successful Implementation of California's Sustainable Groundwater Management Act

Dear Dr. Moran,

California's Kern Basin is home to some of the most valuable and productive cropland in the world. To maintain the agricultural land that is at the heart of our community while complying with statewide legislation regulating groundwater pumping, we decided to try something new. In partnership with Environmental Defense Fund, Rosedale-Rio Bravo Water Storage District co-created an open-source water accounting platform to facilitate the effective accounting and management of available water resources. In 2020, the platform tracked over 120,000 acre-feet of water usage on 674 billing accounts across 1,107 separate parcels.

Rosedale-Rio Bravo Water Storage District located in the Kern County Subbasin of California, is one of 21 groundwater basins required by the state to balance groundwater demand and supply within 20 years under the Sustainable Groundwater Management Act (SGMA). We developed this platform because we want to provide landowners and growers with as many tools as possible to manage their water budgets in response to SGMA. The platform was developed using open-source code which was intended to both facilitate trust in software development and enable scaling of the tool long-term. We hope the Platform will serve as a valuable resource to water managers and landowners across California.

In partnership with the California Water Data Consortium, the California Department of Water Resources, the State Water Resources Control Board, the California Natural Resources Agency, Environmental Defense Fund, and fellow groundwater managers, we can leverage the work started in Rosedale and make it available to water managers throughout the state. We are excited to partner with the Consortium and EDF on this important project to ensure that the platform meets both state and local needs long-term.

Efforts to expand the functionality of the accounting platform align closely with the critical work being led by the Consortium to integrate co-developed water standards to enable intra- and inter-basin data sharing, essential for coordinated and informed groundwater management.

We strongly support this grant application and agree to its submittal. Rosedale Rio Bravo Water Storage District staff will serve on the project advisory group to provide strategic advice, share lessons learned from our work in Rosedale, and help further scale development of the open-source accounting platform.

We strongly support this grant application and look forward to working with you.
Sincerely,


Dan Bartel

Engineer-Manager
Rosedale-Rio Bravo Water Storage District