



Request for Approval to Enter into an Interagency Agreement with the Regents of the University of California for \$1,497,611 to Provide Monitoring Support for the Delta Drought Response Pilot Program

Scope of Work and Tasks

SCOPE OF WORK

The Regents of the University of California Davis (University) shall assist the Sacramento-San Joaquin Delta Conservancy (State) to (1) measure and estimate water budgets for up to six fields in the Sacramento-San Joaquin Delta (Delta) and (2) assess the application of OpenET to estimate consumptive water use of these six fields, recommend improvements to OpenET, and recommend improvements to the calculation of the OpenET ensemble value as applicable. The University and the State will work with the Delta Drought Response Pilot Program (DDRPP) Oversight Committee to choose six field sites. Before the initiation of any sampling, the University will work with each individual landowner across the six fields to explain the full sampling schedule, the spatial extent and locations of sampling equipment, and field access needs for sampling. For each field site, the University shall acquire and install one set of research-grade eddy covariance, biometeorological, and soil measurement equipment to continuously measure and monitor micrometeorological conditions including evapotranspiration and CO₂ exchange. In addition to continuous evapotranspiration measurements, the University shall equip each field with the proper instruments to collect the following measurements that will enable the calculation of the full water budget: (1) continuous soil moisture to be monitored at six locations that provide vertical profiles at nine depths down to 40 inches, (2) soil core sampling twice per year at multiple locations across each field to quantify change in soil moisture storage at depths down to eight feet, which will account for depths beyond the root zone), (3) local precipitation, (4) applied water through irrigation, and (5) runoff. After collecting data, the University shall calculate the monthly water budget for each field

TASKS

Task 1 – Coordination for field selection

The University shall attend up to three (3) 1-hour meetings related to field selection with the Delta Drought Response Pilot Program (DDRPP) Oversight Committee or other group formed and designated by the State. Based on criteria proposed by the University, the University shall prioritize fields recommended for measurements. The DDRPP Oversight Committee and the University will consider representative crop types (including field fallowing), irrigation types and status, and field size (minimum 20 acres because large and uniform sites increase data quality from eddy covariance measurements). A Field Selection Memorandum (Deliverable 1.1) will document the rationale behind the fields identified for the study. Due to supply chain delays in obtaining equipment, in the first year, the University will be working with data available from

previous studies of annual crops in the Delta, and use common modeling approaches (i.e., various levels of theoretical complexity for suite of estimates) and OpenET, to estimate ET. In the following project years, the University anticipates including the full deployment of field equipment to refine the model and remote sensing ET estimates.

Task 2 – Instrumentation and Measurement

The University will enter into agreements (either formal or informal) with each individual landowner to host the sampling equipment for two or more consecutive years. For each of the six selected fields, the University shall install measurement systems to collect data on a half-hourly basis: (1) one eddy covariance system to measure evapotranspiration and carbon dioxide dynamics, (2) one rain gauge per field to continuously measure precipitation, (3) six vertical profile sensors for soil moisture measurements at nine depths using Time Domain Reflectometry (TDR) down to 40 inches below surface, and (4) one pressure transducer in a shallow well at each field to monitor the shallow groundwater table (down to 8 feet below surface if possible). At the beginning and end of each growing season, across all six fields the University shall conduct soil core samples at multiple locations within each field site for depths down to eight feet (unless there are limitations at individual fields such as tile drainage system being lower than 8 ft) to measure soil water storage beyond the root zone. The soil samples will be used as a backup method to determine the change in soil water storage if the soil moisture profile sensors fail or are damaged. In addition, the University shall deploy either self-logging flowmeters or weirs with pressure transducers at the inlet and outlet of each field to quantify irrigation applications and potential surface runoff, depending on the irrigation type and need for selected sites.

During the entire measurement period, the University shall download data daily by remote access. Approximately every 14 days, instrumentation will be maintained and repaired, and data will be directly downloaded. To avoid data loss, the University will aim to repair equipment within 72 hours if an outage occurs. The University will alert the State promptly via email about any data gaps greater than 72 hours. The University shall download data and conduct quality assurance and quality control (QA/QC) to review collected data on a regular basis and maintain the collection of data during the full year. The University shall regularly submit all field measurement records in MS Excel spreadsheet or another agreed upon format (Deliverable 2.1).

On behalf of the Principal Investigator (Suvočarev), The University may purchase equipment under this Agreement only if specified in the budget tables in Exhibit B and equipment will only be considered for purchase approval if no other equipment under the purview of the University Principal Investigator (Suvočarev) is available and suitable for the project. Equipment includes nonexpendable, tangible personal property having a useful life of more than one (1) year and an approximate unit price of \$5,000 or more, as well as theft-sensitive items of equipment costing less than \$5,000 (such as electronics). All equipment purchased or built by the University is owned by the University during the Funding Term. The University is required to provide documentation that the equipment costs are fair and reasonable and maintain accountability for all property purchased and to keep, and make available to the State, adequate and appropriate records of all equipment purchased with funds from this agreement.

The State may, at its option, repair any damage or replace any lost or stolen items and deduct the cost thereof from the University's invoice to the State, or require the University to repair or replace any damaged, lost, or stolen equipment to the satisfaction of the State with no expense to the State. In the event of theft, a report must be filed immediately with the California Highway Patrol (State Administrative Manual (SAM), § 8643). During the field deployment, the University shall build a protective fence around the eddy covariance towers for improved equipment safety.

The University shall maintain an inventory record for each piece of equipment purchased with funds provided under the terms of this Agreement, which shall be submitted to the State by the University (Deliverable 2.2). At a minimum, the inventory record of each piece of equipment shall include:

- a) The date acquired.
- b) The cost of the equipment, including the cost of any necessary accessories and all incidental costs incurred to put the asset into place and ready for its intended use.
- c) A serial number.
- d) The model identification number (on purchased equipment).
- e) Any other information or description of the equipment.
- f) Identification of the Agreement number under which the equipment is acquired.
- g) The location, use, and condition of the equipment.
- h) Any ultimate disposition information including date of disposal and sale price of the equipment.

If the fair market value of equipment purchased with these funds is \$5,000 or more per item at the Funding End Date of this Agreement or if the equipment is theft-sensitive, the use and management of the equipment after the Funding Term is subject to approval by the State. Title may be retained by the University or State upon end of the Funding Term; final disposition will be determined and approved by the State. The University agrees to promptly initiate arrangements to account for and return said equipment if required by State.

- a) A request for disposition of equipment shall be submitted in writing to the State for approval, not less than 90 calendar days prior to the Funding End Date. The request shall include:
 - The current fair market value of each piece of equipment purchased with grant funds.
 - A description of the proposed disposition.

- b) Requests shall be approved or denied, or an alternate disposition offered, by the University no later than 60 business days from the date the request for disposition is received.

Should this Agreement be cancelled for any reason, any equipment purchased with grant funds may be retained by the University or State, at the State's sole discretion. The University agrees to promptly initiate arrangements to account for and return said equipment if required by the State.

Task 3 – Data Analysis and Water Budget Calculation

The University shall analyze and perform QA/QC on collected field data (including, but not limited to, plant evapotranspiration, soil evaporation, precipitation, irrigation, carbon dioxide emission/sequestration, soil water storage, shallow groundwater level, and runoff) monthly (see Deliverable 2.1). The University shall provide water budget calculations monthly, or other frequency agreed upon in writing by the State, for each of the six experimental fields over the entire measurement period, and inform the State of the draft results monthly or at another frequency agreed upon in writing by the State. The shallow well with pressure transducer will be used for monitoring shallow ground water levels, down to 8 feet (unless there is a limitation in digging to the depth of 8 ft, in which case the well will be installed at lower depth). In the final year of the agreement, the University shall submit one draft (Deliverable 3.1) and one final (Deliverable 3.2) Water Budget Calculations Memorandum to the State documenting and summarizing the field measurements and calculations.

Task 4 – Ground Truth OpenET Based on Direct Measurements

The University shall use eddy covariance systems (including 3D sonic anemometers, infrared gas analyzers, four-component net radiometers, and soil heat flux instrumentation), as the most direct way to measure evapotranspiration and CO₂ exchange known to the date, to ground truth the OpenET remote sensing product as an ensemble of multiple remote sensing products and evaluate the individual products involved in OpenET estimation of crop water use. QA/QC, energy balance closure analysis, and correction will be performed on the eddy covariance data. The scope of this task will depend on the products and data provided by OpenET, which will either be via the publicly available products or the application programming interface (API). The University shall develop a draft (Deliverable 4.1) and final (Deliverable 4.2) OpenET Remote Sensing Evapotranspiration Memorandum to document the comparison between the ground measurements and the remote sensing products used in OpenET methodology.

Task 5 – Meetings and Presentations

The University shall prepare for and attend up to ten (10) project meetings per year in the Delta Region. The purpose of these meetings can include, but is not limited to, updating and problem solving with the DDRPP Oversight Committee or briefing to the stakeholders. The University shall develop meeting materials (Deliverable 5.1) including agendas and presentations in MS PowerPoint format. Finally, the University will follow up each meeting with notes (Deliverable 5.2).

Task 6 – Contract Management

The University shall submit to the State quarterly progress reports (Deliverable 6.1) and invoices (Deliverable 6.2). Invoices shall adhere to the guidelines set out in the University Terms and Conditions. The University shall document all activities and expenditures in quarterly progress reports, including work performed by subcontractors. Progress Report shall directly address tasks, timelines, deliverables, and associated costs as scheduled in Scope of Work and Budget; deliverables should be included as attachments to the report. The description of activities shall be in sufficient detail to provide a basis for payment of invoices. The State reserves the right to require reports more frequently than quarterly, if necessary, but no more than once a month. The University must submit a Draft Final Report (Deliverable 6.3) to the State for review and approval no less than 30 days prior to the Funding End Date. The Draft Final Report shall use a report template provided by the State and will summarize the life of the Agreement and describe the results of the work and of the project. Following any comments from the State, the University shall submit the revised Final Report (Deliverable 6.4) for review and approval within 60 days after the Funding End Date. A final Progress Report will also be due at the time of the Final Report. The University must post the Final Report on their website and submit the link to the State.