Position title: Cooperative Extension (CE) Specialist in Food-Energy-Water Nexus.

Developed and proposed by: UC Merced Department of Civil & Environmental Engineering (CEE) and UC ANR Research and Extension Centers (RECs). This position was identified by UC Merced CEE as a high priority and received support from both UC ANR RECs and California Institute of Water Resources during priority matching. External collaborators include Turlock Irrigation District San Luis Delta Mendota Water Authority, and multiple groundwater sustainability agencies. After further discussion, this position is being submitted by RECs as their top priority.

Headquarter location and coverage area: The position will be in the Department of Civil and Environmental Engineering at UC Merced with statewide responsibilities. The proposed position aligns perfectly with ongoing research and extension work led by faculties and research at UC Merced, including Solar Aquagrid, UC Merced Energy Center, and the Experimental Smart Farm. UC Merced's demonstrated collaboration with local/regional partners on developing science and decision-tools for navigating water, land, and energy challenges and exploiting new opportunities provides the key foundation. As California accelerates the dual-use of land for food and energy production, driven by SGMA and climate change in general, UC Merced stands at the geographical heart of this transition, where this position will directly influence the large-scale adoption of solar solutions for the state's vital land and water resources. The CE Specialist will serve in a statewide position and work with UCCE colleagues across the state to develop solutions for food-energy-water challenges that enhance agricultural productivity and ensure climate and economic resilience.

Position overview, briefly describe: *a) general discipline focus:* Food-Energy-Water Nexus, *b) educational and professional background requirements:* Ph.D. in agrohydrology, agronomy, electrical engineering, civil and environmental engineering, or a related discipline, *c) Reporting structure:* The successful candidate will be a CE Specialist affiliated and housed within the Department of Civil & Environmental Engineering (CEE) at UC Merced. The CE Specialist will work closely with RECs, UCCE academics, and UC ANR statewide programs in developing research and extension programs related to Agro-Photovoltaic applications (e.g., agrivoltaics, solar grazing, solar Aquagrid etc.) that can provide climate and water management solutions.

Justification: Increasing temperatures and water shortages are challenging California's water and agricultural landscape that feeds millions of people and brings about $25 billion in annual revenue to the state. California's water supply is dwindling with water managers looking towards water-energy integration as a water saving tool. Agricultural land is being moved out of production to conserve water. Based on recent estimates, nearly 1.5 million acres of productive agricultural land will be pushed out of production to meet requirements of the Sustainable Groundwater Management Act that will reduce groundwater overdraft. The use of Agrivoltaics (growing crops under solar panels), Aquagrids (covering canals and reservoirs with solar panels), and other forms of food-energy-water integrations have the potential to protect high value agricultural lands from retirement, protect plants from heat stress, and reduce evaporation from water ways while generating clean electricity without using additional land.

By seamlessly integrating engineering, agricultural, biological, and environmental sciences, this position directly drives multiple positive outcomes across the three core areas and seven challenges defined in ANR's 2040 vision document. It advances innovative solutions to encourage renewable energy production, storage, and transmission, while simultaneously supporting land access, land use planning, and management strategies that foster sustainable stewardship. Furthermore, the role focuses on developing effective adaptation and management strategies to mitigate the severe impacts of extreme weather events—such as drought, floods, heat, and other climate extremes—on communities, agriculture, and natural ecosystems. In addition to promoting sustainable, innovative agricultural practices and inputs that enhance farming and ranching resilience without compromising human health or environmental integrity, the position actively bridges the gap between technology developers, researchers, and policymakers to ensure new tools

are commercialized equitably and safely for vulnerable populations. Finally, it prioritizes inclusive conservation by engaging diverse land managers, including Tribes and Tribal communities, in vital biodiversity efforts, habitat restoration projects, and the management of protected natural areas and habitat corridors.

UC Merced is working with our clientele and stakeholders on foundational applied research and extension at the food-energy-water nexus. For instance, as part of the project Nexus, UC Merced faculty and researchers are working with California Department of Water Resources, Turlock Irrigation District, and other partners on piloting a one-of- its-kind solar aquagrid project. Our faculties are working with growers, non-profits (e.g., Environmental Defense Fund, The Nature Conservancy, Sustainable Conservation) and agencies (e.g., Bureau of Reclamation, Turlock ID, San Luis Delta Mendota Water Authority, Pixley ID) on developing multi-benefit land-purposing with Agro-PV as one of the main tools in the toolbox.

Extension: Extension activities to be fulfilled by this position will include development and implementation of educational programs on food-energy-water nexus, with a focus on conserving water and land while safeguarding agricultural productivity and specialty crops. This includes assessment of water conservation and food production potential within fields with photovoltaic panels and, in collaboration with ANR colleagues, development of scaling and adoption strategies. These efforts will be conducted in different modalities and approaches for CE advisors and farmers, which provide knowledge of food-energy-water nexus. This CE Specialist will develop extension publications, newsletters, web pages, blogs, and grower workshops. The CE Specialist will also participate in and/or co-organize CE Advisor meetings, on-site visits to farmer locations, validation workshops with clientele, and educational conferences. The CE Specialist will contribute to ANR's network of water and agronomy experts, including ANR Workgroups and Program Teams. This position may also contribute to the development of tools and guidelines for crop-specific water conservation in jointly managed fields for both CE Advisors and farmers. The candidate is expected to participate in statewide and regional land and water management committees and coordinate with other relevant local, regional, state, and federal agencies. Information generated by the successful candidate's research efforts will contribute to ANR's strategic framework and vision on international engagement by extending the research outputs to a variety of international clientele and stakeholders, including those involved in California AgTech Alliance and California-Catalonia Partnership. The CE Specialist will engage with networks of land and water management professionals throughout the state, including the Groundwater Resources Association, and provide expertise to agencies responsible for implementing and overseeing groundwater management, including the California Department of Water Resources, the State Water Resources Control Board, irrigation districts, and regional Groundwater Sustainability Agencies.

Research: Areas of research that the specialist will perform include, but are not limited to, studying plant physiology and microclimate optimization, technological innovations, economic and social frameworks, life-cycle assessment, ecosystem and biodiversity impact, and impacts on food quality and nutrition. The specialist will develop/use models of food-energy-water optimization and simplify the outputs in policy briefs to support policy and regulatory processes. They will design robust conjunctive use scenarios for sustainable farming under different shading and cropping patterns. The research efforts also include evaluation of Agro-PV applications as climate adaptation tools. Based on the field assessment and trials, the CE Specialist will provide recommendations to assist the development of innovative strategies and implement practical solutions to protect California's land, water, and food production at various scales (field, meso, and macro). Key outcomes are anticipated to include identification of a) which plants can most successfully be grown in Agro-PV systems, b) which Agro-PV system designs are most effective for those crops, c) how much water can be saved, and d) best practices for farmers' practical implementation of Agro-PV.

UC ANR network: Collaborative interactions are already in place between faculty and CE academics on various UC campuses, RECs, as well as with county farm advisors and various growers. These

ongoing collaborations will be utilized and strengthened by the new hire. This position would greatly enhance the ability of irrigation, agronomy, nutrition, climate change, technology, and soil focused CE advisors to extend research and guidance for land and water management. The candidate will be expected to collaborate and work closely with ANR Institutes, Program Teams, including the Water, Climate Change, Agronomy, Agriculture technology, the California Institute for Water Resources (CIWR), and others. Ongoing research and collaborations at RECs (including grazing at Sierra Foothill and Hopland; veg crops at Hansen and forage at Desert) will provide ample opportunities for this position. Further intersection with ANR Innovate has the potential to expand public-private partnerships in innovation, technology, and infrastructure investments. These interactions will facilitate identification and management of critical research questions to be addressed through collaborative research programs/projects and disseminate the key-findings at large scale throughout California and network of CE advisors, specialists, and faculties.

Network external to UC ANR: The CE Specialist is expected to leverage and expand on the network built by UC Merced scientists and faculties. This includes working with scientists from the California Department of Water Resources, Department of Food and Agriculture, Department of Conservation, California Energy Commission, U.S. Department of Agriculture Natural Resources Conservation Service (NRCS), the Nature Conservancy, and Environmental Defense Fund, Lawrence Livermore National Laboratory, National Laboratory of the Rockies, UC Alianza, and Agrovoltaicos sin Fronteras, as well as with private sector experts and stakeholders working on food-energy-water nexus plans and technologies. The candidate is also expected to collaborate and work closely with Turlock Irrigation District, Westlands Water District, and other relevant partners and authorities to address implementation requirements of the SGMA.

Support: UC Merced CEE is a strategic and ideal location for this position where the incoming hire can leverage ongoing efforts and establish a successful research and extension program. UC Merced's Experimental Smart Farm is in an early stage of growth and provides an unique opportunity for envisioning the future of food-energy-water research and demonstration. It also provides cross-disciplinary integration with faculties from across the school of engineering. Additionally, UC Merced's proximity to Kearney and Westside Research and Extension Centers will be an asset for this position to implement extension activities in collaboration with CE advisors and specialists at the Center. Dedicated office space will be provided at UC Merced, with access to shared computational and cyberinfrastructure resources (high-performance computing, cloud allocations) appropriate for the position. Dedicated wet-lab space is not required for this position, but analytical needs will be met through VISTA and CEE shared resources. Transportation can be provided through VISTA and UC Merced fleet services. Additional computational needs (e.g., software licenses, cloud/HPC access, web tools, data-storage support, and field instrumentation) will be provided by UC Merced VISTA and AES. Administrative support will be provided by the UC Merced Department of Civil & Environmental Engineering. While the successful candidate is expected to develop an extramurally funded research and extension program, funding for programmatic support is provided by ANR. Proposed CE specialist will also have access to WSREC which is equipped with research and extension facilities to conduct research including agrivoltaics intercropping, groundwater solar pumping, solar irrigation, etc. KREC research has a set of solar panel arrays that can be an advantage for this position as well. Both RECs are about 1.25 hours driving from UCM. Access to other RECs will be available based on programmatic and research needs.

Other support: The Specialist will be expected to develop a robust extramurally funded applied research and extension program. Likely sources include state (e.g., CalEPA, CalOES, CDFA, CEC, DOC, DWR, SGC) and federal (DOE, NOAA, NSF, USDA, USGS), and private foundations focused on agriculture, food, energy, and water resilience (e.g., Resources Legacy Fund, Packard Foundation, Walton Family Foundation, etc.). Additional funding sources are likely to include commodity boards, water agencies, utilities, and industry partners.