California WATER COMMISSION

Water Storage Investment Program Concept Paper Form

Please complete the questions below and return your completed concept paper by email to cwc@water.ca.gov by 5:00 p.m. on March 31, 2016. Completed concept papers should not exceed four pages.

Contact Information

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Agency/Organization Name: North Kern Water Storage District (NKWSD) , California Resources Corporation (CRC), and Lawrence Berkeley National Laboratory (LBNL)	
Agency Type (select one):	☒ Public Agency ☐ Nonprofit Organization ☐ Public Utility ☐ Tribe ☐ Mutual Water Company ☐ Local Joint Powers Authority ☒ Other: LBNL is assisting NKWSD in a full-scale groundwater storage demonstration project. CRC is a net producer of water and is supplying treated high grade reclaimed water to NKWSD. UC Davis and university of the Pacific will partner with LBNL. The final applicant will be NKWSD.

Project Information

Project Name: Sustainable Groundwater Banking Demonstration Project	
Project Type:	☐ CALFED Surface Storage ☒ Groundwater Storage ☐ Groundwater Contamination Prevention or Remediation ☒ Conjunctive Use ☐ Reservoir Reoperation ☐ Local Surface Storage ☐ Regional Surface Storage ☐Other:
Estimated Project Cost: $1,500,000	
Estimated WSIP Funding Request: $750,000	

Please describe your project, including location, water source, facilities, and operations:
Project Rational.

The Sustainable Groundwater Management Act (SGMA) requires water agencies to sustainably manage groundwater resources. One component of sustainable groundwater management is the deliberate, engineered replenishment of groundwater.

Many water agencies in the Central Valley of California are operating groundwater recharge projects facilitated by infiltration basins or "spreading fields" where water is applied to dedicated land areas for replenishment of local aquifers. Currently, groundwater replenishment is largely conducted on a site by site basis, with little coordination between projects, and few projects have been thoroughly validated as to their efficacy. There is growing interest in scaling up engineered groundwater replenishment to regulate and improve the management of water supplies that will incrementally improve groundwater conditions with respect to SGMA. It is calculated that engineered storage in groundwater aquifers has the potential to supplement or replace surface storage on a state-wide basis.

North Kern Water Storage District (NKWSD) and California Resources Corporation (CRC) will work with Lawrence Berkeley National Laboratory (LBNL) to validate, enhance, improve, and coordinate existing groundwater banking activities in the Kern Subbasin. Per DWR Bulletin 118 NKWSD is located in the Kern Subbasin of the Tulare Lake groundwater basin, in the northeastern portion of the Subbasin in an area generally defined by the drainage area comprising "Poso Creek". Other agricultural water providers in close proximity to Poso Creek include Cawelo Water District, Shafter-Wasco Irrigation District, Semitropic Water Storage District and Southern San Joaquin Municipal Utility District. These districts along with NKWSD and several other districts and entities are part of the Poso Creek Integrated Regional Water Management Plan (IRWMP). The Poso Creek IRWMP identifies projects and programs to improve regional water management and optimize the use of available water supplies. CRC is a net producer of water, some of which is treated to high quality and provided to the NKWSD. This water is available for use in recharge experiments. These proposed experiments would improve understanding of groundwater recharge in this important basin, allowing better control and recovery of recharged waters, and the beneficial use of reclaimed produced water.

The enactment of SGMA further heightens the importance of the Poso Creek programs and will likely result in the identification of additional projects focused on increasing regional groundwater banking capabilities. The districts in the Poso Creek region wish to work cooperatively with LBNL on technical studies to determine the best locations for potential additional recharge facilities. These projects would entail the development of additional facilities to increase groundwater recharge of available water supplies (replacing existing agricultural lands with recharge ponds would also provide benefits with respect to SGMA by incrementally reducing demands on the groundwater basin).

Reclaimed produced water has been blended for irrigation use as a proven best practice for decades under state-approved permits from certain oilfields in eastern Kern County. The proposed experiments would result in information in support of engineering to more fully take advantage of this plentiful source of reclaimed water to support agriculture, a key industry in a region that is economically challenged due to the drought. An analysis of current oilfield produced and disposed water volumes, produced water quality, and current beneficial reuse projects in Kern County suggests up to tens of thousands of additional acre-ft per annum of produced water with relatively low levels of salinity and other constituents could be reclaimed and possibly used for groundwater replenishment for irrigation and other non-potable applications. Currently, the majority of excess produced water is wasted.

Other sources of water for groundwater banking in the region include storm-flows and industrial waters from the many facilities that process local agricultural products. The opportunity exists to expand use of industrial wastewater for additional aquifer replenishment in the Central Valley if water quality objectives can be met. Storm-flows are already an important source of water for groundwater banking and a better understanding of infiltration processes will enable improved storm water capture.

Project Field Site(s)

NKWSD includes approximately 70,000 acres of highly productive farmland (approximately 85% of the District is planted to "permanent crops") located in the northeastern portion of the San Joaquin Valley in Kern County, north of the City of Bakersfield. NKWSD relies heavily on water supplies emanating from pre-1914 water rights on the Kern River and operates an extensive conjunctive use project to manage these highly variable supplies. NKWSD's project includes approximately 1,500 acres of dedicated recharge basins across five sites and 100 recovery wells. Additionally in the Poso Creek region both Cawelo Water District and Semitropic Water Storage District operate smaller scale direct recharge programs, and Shafter-Wasco Irrigation District has initiated a project to develop recharge facilities within its boundary. Additionally, in combination, the Poso Creek districts have access to water supplies and conveyances from local (Kern River and Poso Creek), state (State Water Project) and federal (Friant/Central Valley Project) systems that can be utilized for the study. These facilities will be available for the proposed project.

Project Proposed Scope of Work

In order for ground water infiltration to become true groundwater "banking" in the Central Valley, important scientific and technical questions need to be answered. How fast can the water be infiltrated into the aquifer? Where should the water be infiltrated? What changes in water quality will occur as the water infiltrates to and flows through the aquifer? Where and when can the groundwater be recovered? NKWSD, CRC and LBNL activities will address these questions and use improved technical understanding of groundwater banking to improve groundwater storage reliability.

This project will involve applying geophysical techniques, advanced water chemistry analysis, and biogeochemical modeling to provide definitive answers concerning the physical and chemical outcome of groundwater infiltration activities. The project will focus on the infiltration process in the vadose zone, using geophysical techniques such as seismic surface wave tomography (SWT), Interferometric Synthetic Aperture Radar (Insar), surface and borehole based electrical resistivity tomography (ERT), and streaming potential (SP) and magnetotelluric (MT) measurements to characterize infiltration and map subsurface features controlling groundwater infiltration. Water quality changes during infiltration and effects on groundwater quality will be examined using stable isotope analysis in addition to complete chemical characterization. Stable isotopes of nitrogen, hydrogen, and oxygen will be used to track sources of water and nitrate in both the vadose zone and groundwater and determine the effects on infiltration on groundwater quality. Biogeochemical modeling will be conducted using the TOUGH-React code. Modeling and measurements will be used to validate existing groundwater banking protocols and guide site selection for new infiltration areas.

This project will coordinate with and be connected to on-going and proposed regional characterization, mapping and modeling studies by the USGS, groundwater banking projects directed by UC Davis, and regional water management activities, including regional modeling, by the DWR and the State Board. The objective is to answer the basic technical questions described above so that sustainable groundwater banking activities can be expanded regionally and eventually statewide.

Per Water Code section 79753, the Commission may only fund the public benefits of water storage projects. Further, ecosystem improvements must make up 50% of the funded public benefits (Water Code section 79756(b)). What public benefits does your project provide? (select all that apply):

☒ Ecosystem Improvements ☒ Water Quality Improvements ☐ Flood Control
☐ Emergency Response ☐ Recreation

Please describe the magnitude of the public benefits and how the project will be operated to provide the public benefits:
Increased use of reclaimed produced water for groundwater replenishment will make more water available for agriculture, and allow some high quality water currently used for irrigation to be repurposed for domestic or environmental use. Currently available data suggest the opportunity for expanded use of reclaimed produced water in the Kern Subbasin could be equivalent to water usage by approximately a hundred thousand households.

Water Code section 79752 requires that funded projects provide measurable improvements to the Delta ecosystem or to the tributaries of the Delta. Please describe how your project provides ecosystem improvements in the Delta or tributaries to the Delta:
Current irrigated lands in the Poso Creek management area use water imported from the Delta via the State Water Project. This project will reduce Delta water demand by improved utilization of reclaimed water, storm flows, and winter flows. Large-scale groundwater banking, which will be enabled by the results of this project, will result in decreased demand for surface water diversions, especially during critical years when river ecosystem effects are most severe. These improvements will be documented.

Water Code sections 79755 and 79757 require the Commission to make a finding that a project will advance the long-term objectives of restoring ecological health and improving water management for beneficial uses in the Delta prior to allocating funding for a project. Please describe how your project could help advance the long-term objectives of restoring ecological health and improving water management for beneficial uses in the Delta:
Please see above. Long-term benefits analysis will be conducted by LBNL.

Please describe any other benefits provided by your project, such as water supply reliability benefits, and the potential beneficiaries:
Maximizing ground water banking of high grade industrial reclaimed water will not only provide a significant volume of "new water" into the California's water system but will also accelerate adoption of cost effective, leading edge water treatment technology in the state on a commercial scale and lead to development of regional infrastructure to accommodate the region's long-term water supply needs. Part of this regional infrastructure may include wetland ponds as part of the storm-flow capture and infiltration system.

Water infiltration could improve groundwater quality depending upon the quality of the source water and the fate and transport of its dissolved constituents during infiltration and percolation. For instance reclaimed produced water is typically lower in nitrates than regional groundwater. A major goal of the proposed research is optimizing benefits and reducing impacts of regional groundwater banking.

Increasing the use of local water sources for groundwater replenishment will reduce dry-year curtailments of water deliveries for irrigation, and consequently reduce fluctuations in food cost and increase food reliability.