

# WATER RESILIENT CALIFORNIA

Strategically siting groundwater recharge projects to benefit communities and ecosystems

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## 1 MOTIVATION

### Water in California

California depends on groundwater to meet agricultural, domestic, and industrial water needs, especially during drought years. Several decades of unsustainable extraction have caused a depletion of groundwater across California, especially in the southern portion of the semi-arid, intensely cultivated Central Valley. Due to climate change, drought conditions may worsen, and the annual availability of surface water from rain and snowmelt is expected to be increasingly variable.

### Sustainable Groundwater Management Act

The Sustainable Groundwater Management Act (SGMA) of 2014 requires regional managers in critically overdrafted basins to develop and implement plans by 2040 to halt and reverse unsustainable use of groundwater that is causing undesirable results.



### Why Groundwater Recharge?

Underground aquifers in California have tremendous storage capacity, at least 17 times the volume of surface water storage in the state according to estimates by the California Department of Water Resources. There is an opportunity to take advantage of this capacity to store large volumes of available surface water during wet years for sustainable withdrawal during dry years.

Managed aquifer recharge is one method that many Groundwater Sustainability Agencies plan to use to achieve their goals under the Sustainable Groundwater Management Act. Additionally, managed aquifer recharge can generate multiple benefits for communities and ecosystems, if located strategically.

## THE PROBLEM

Many groundwater managers throughout the Central Valley lack the information needed to inform strategic siting of groundwater recharge projects in a way that can achieve benefits for communities and ecosystems.

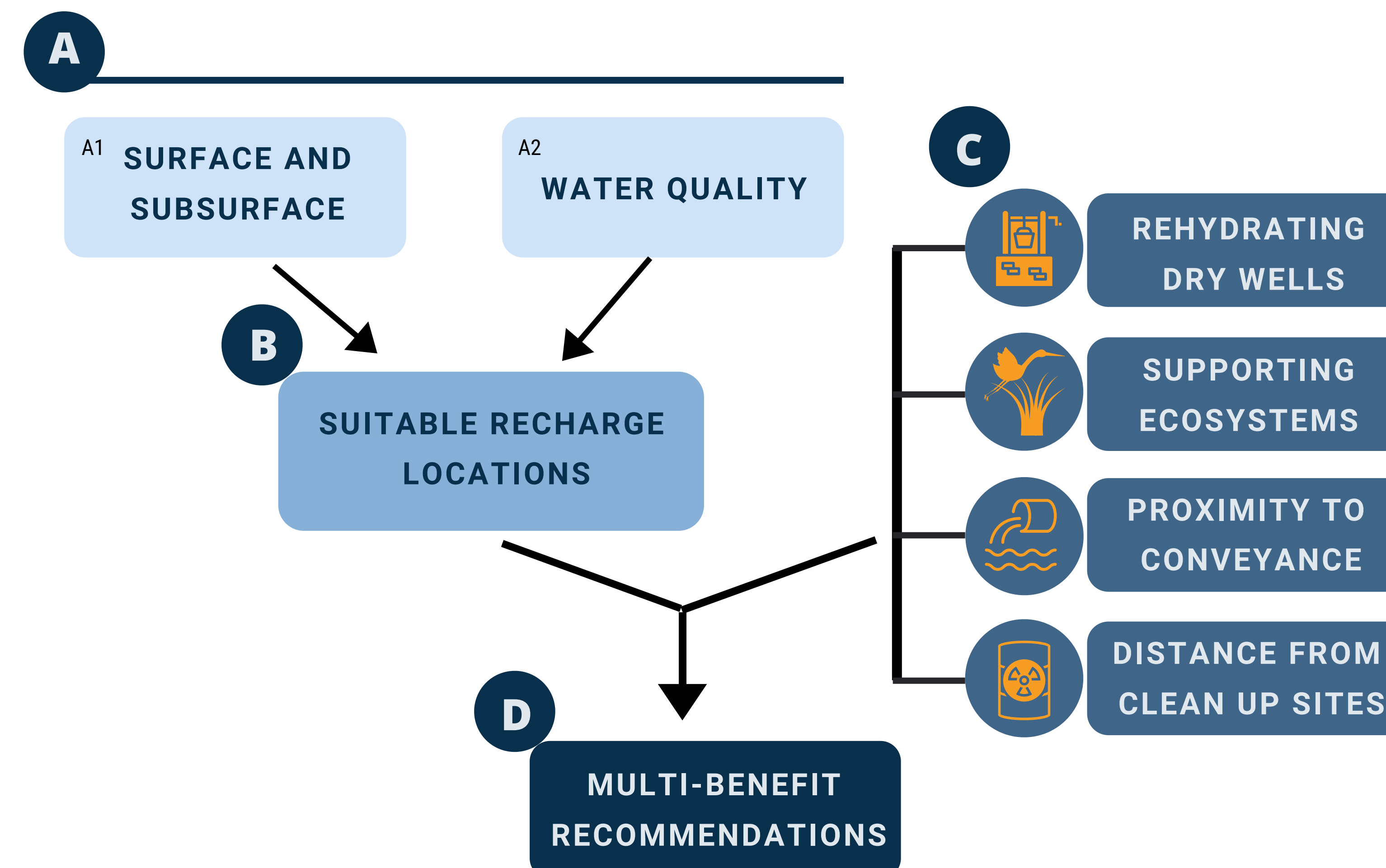
## 2 OUR APPROACH

We developed a customizable decision support tool to locate optimal sites for groundwater recharge projects in California's Central Valley that have the potential to produce benefits to communities and ecosystems while increasing local water resilience.

We created our tool in ArcMap Model Builder using publicly available datasets from government agencies and research institutions. The tool is transferable to any groundwater basin within the Central Valley, regardless of the level of locally specific data that has been collected. We designed the tool to allow the user to customize the output to reflect local priorities for groundwater recharge projects related to benefits or feasibility considerations.

Our tool can be applied to any basin within the Central Valley; we used the Madera Subbasin to test our tool on the groundwater basin scale.

## 3 DECISION SUPPORT TOOL CHARACTERISTICS



**A-1. Surface and Subsurface Conditions**  
Ranks locations on their relative ability to allow water at the land surface to reach the groundwater table based on physical properties such as topography, soil characteristics, and depth to groundwater.

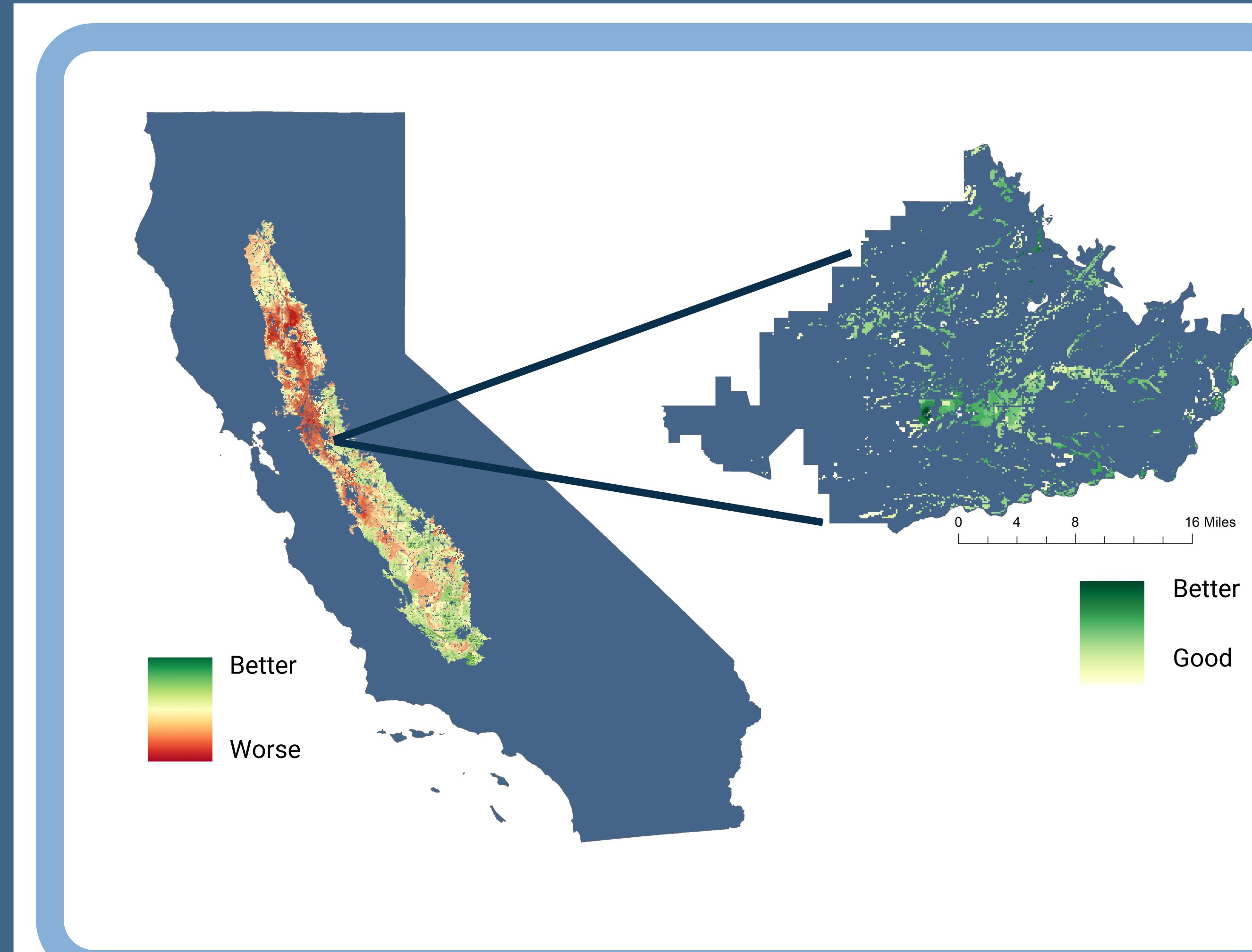
**A-2. Water Quality**  
Ranks locations on their relative likelihood of introducing new nitrogen contamination into groundwater. Nitrogen accumulation in soil is largely due to past land uses.

**B. Suitable Recharge Locations**  
A combination of surface and subsurface conditions and water quality identifying locations within a basin where clean water can most easily reach the groundwater table.

**C. Additional Considerations**  
Benefits and feasibility considerations users may be interested in considering when siting groundwater recharge projects. A user can specify how much priority is given to each of these considerations, and this customized weighting scheme changes the resulting multiple benefit recommendations.

**D. Multi-benefit Recommendations**  
Identifies preferred locations to site groundwater recharge projects within a basin based on the customized priorities a user sets for the additional considerations.

## 4 RESULTS FOR SITING GROUNDWATER RECHARGE PROJECTS



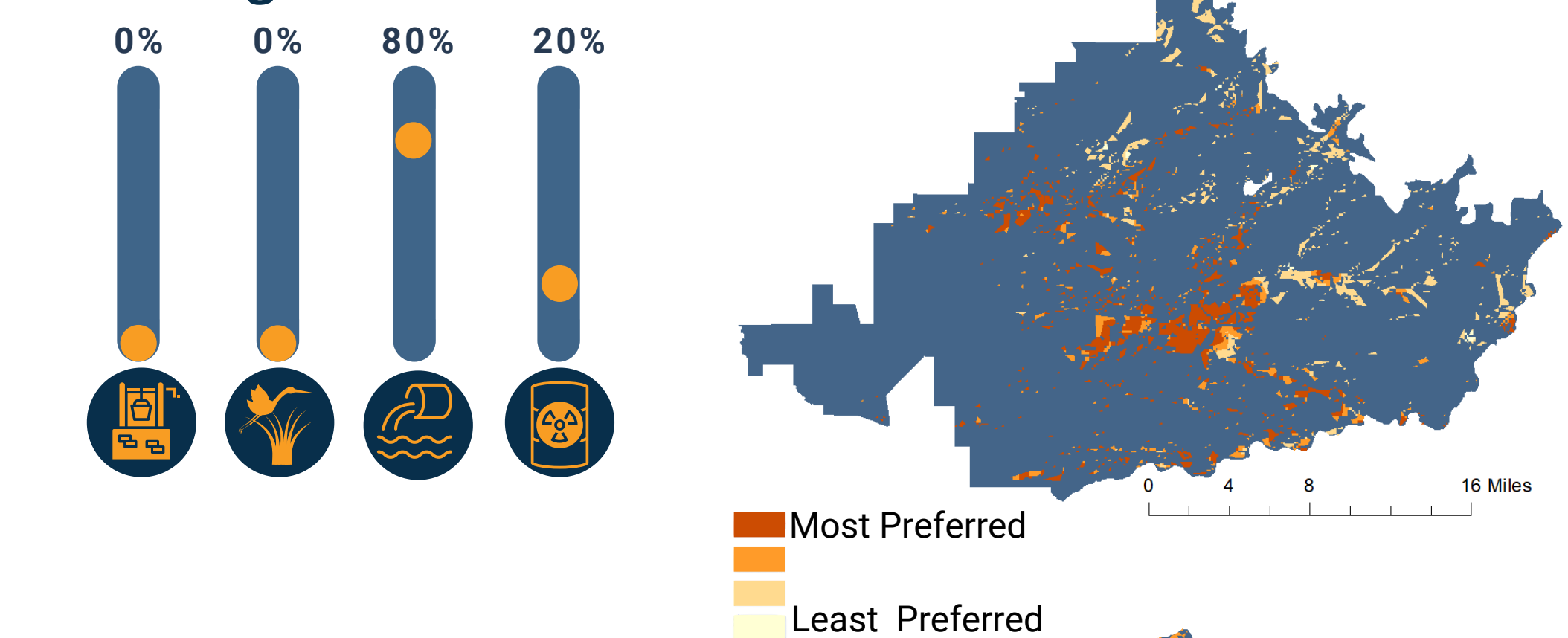
The maps to the left show ranked recharge locations for the Central Valley and suitable recharge locations in the Madera Subbasin. Suitable recharge locations identify areas where water can most easily reach underlying aquifers while minimizing the risk of introducing new nitrogen contamination.

Groundwater managers also have the option to generate customized multi-benefit recommendations within their basin's suitable recharge locations based on local needs and priorities. Managers can assign preference (0-100%) to each of the four additional considerations:

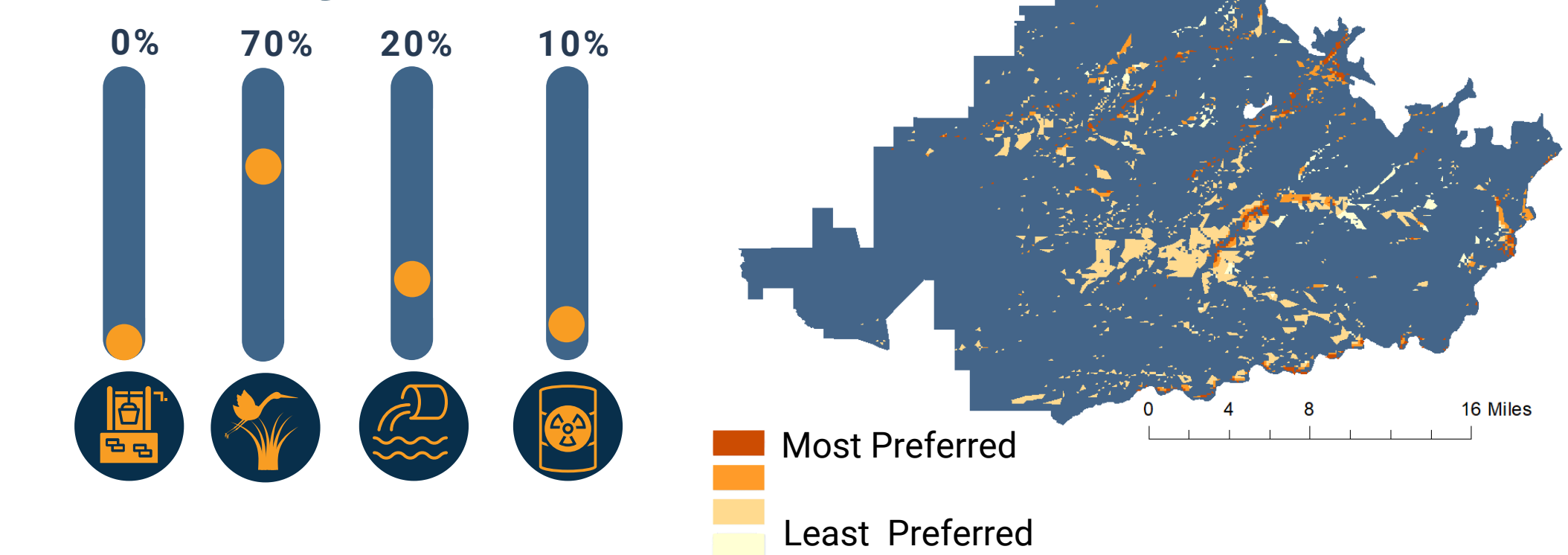
- Rehydrating domestic wells that have run dry
- Supporting groundwater dependent ecosystems
- Minimizing the need for new conveyance infrastructure
- Protecting water quality

The two maps to the right show how the most preferred locations to site recharge projects change based on hypothetical customized priorities. Both maps highlight the same areas shown in the suitable recharge locations map on the left. The preference ranking (orange to yellow) of these areas changes based on the specified priorities.

### The Engineer's Choice



### The Ecologist's Choice



## 5 MANAGMENT APPLICATIONS

The customizable outputs of our tool allow for a streamlined assessment of the most suitable areas to consider recharge within any groundwater basin in the Central Valley.

For example, the Madera Subbasin Groundwater Sustainability Plan identifies the need to construct 350 acres of dedicated groundwater recharge basins to reach sustainability by 2040.

The outputs of our tool help managers to:

- Narrow land area under consideration from 350,000 acres to the most suitable 28,000 acres
- Allow for exploration of other benefits to be gained, and basin specific prioritization based on community and stakeholder goals

Our decision support tool gives water managers the information that they need to consider how to best achieve multiple benefits of managed groundwater recharge projects.

As groundwater basins throughout California's Central Valley begin to implement projects to meet the goals of the Sustainable Groundwater Management Act, our analysis will help water managers plan for a more resilient water future.

## 6 LEARN MORE

If you are interested in learning more about our project, accessing references to the data we used, or receiving a copy of the decision support tool, please visit our website:

[waterresilience.wixsite.com/waterresilienceca](http://waterresilience.wixsite.com/waterresilienceca)

or email us: [gp-waterresilience@bren.ucsb.edu](mailto:gp-waterresilience@bren.ucsb.edu)

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