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Earth's Future

Supporting Information for

Resilient California water portfolios require infrastructure investment partnerships that are viable for all partners

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Introduction

This Supporting Information contains five additional figures, S1-S5. Figure S1 and S2 support Sections 2.4 and 3.2 of the main text, respectively, while Figures S3-S5 support Section 3.4 of the main text.

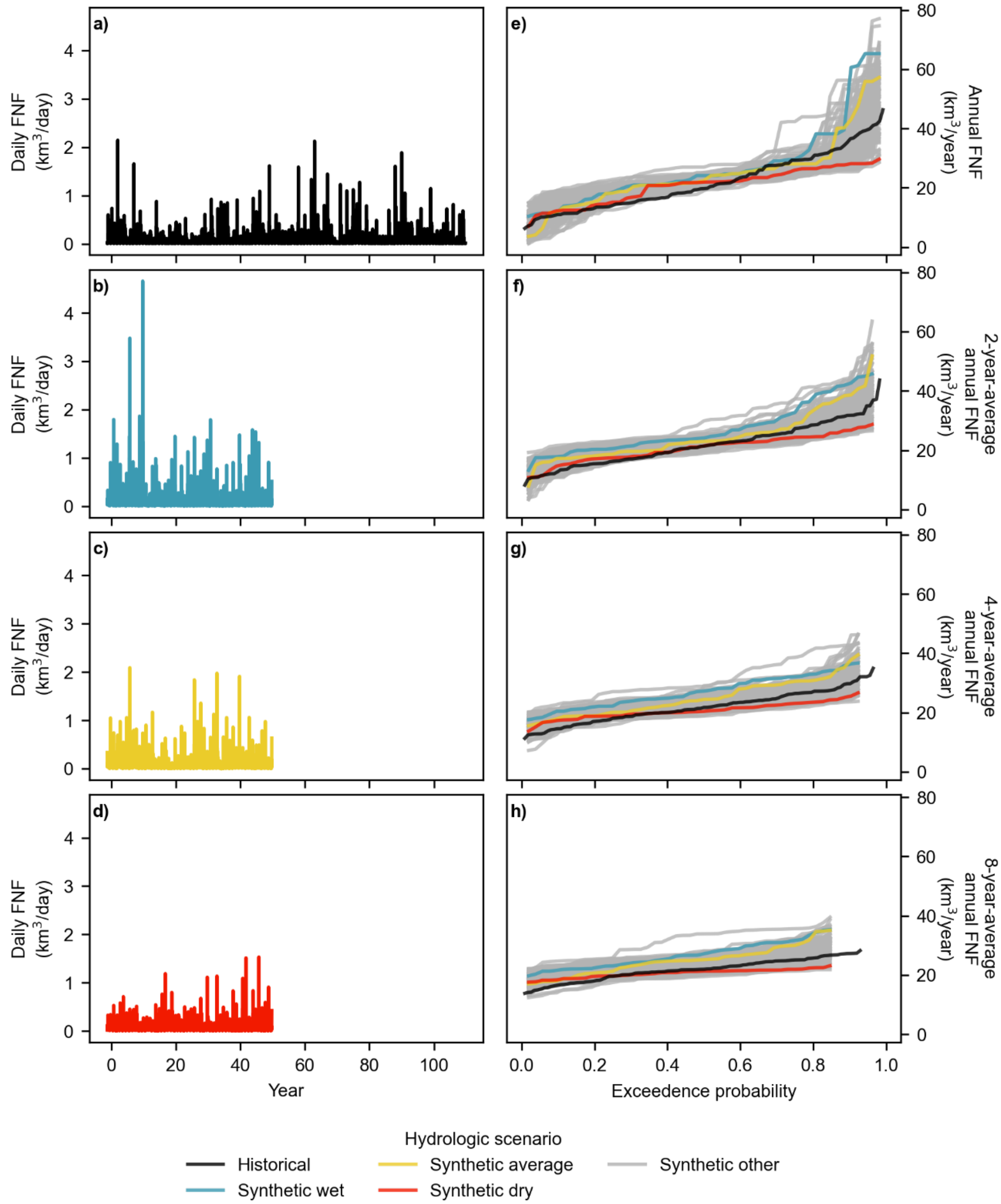

Figure S1. Comparison of synthetic and historical full natural flow (FNF) for the Sacramento River Basin. Panels (a-d) show the total full natural flows for the four major reservoirs of the Sacramento River Basin (Shasta, Oroville, New Bullards Bar, and Folsom), under the historical record and the wet, average, and dry synthetic scenarios. Panels (e-h) show the full natural flow duration curves for each time series over 1-, 2-, 4-, and 8-year periods.

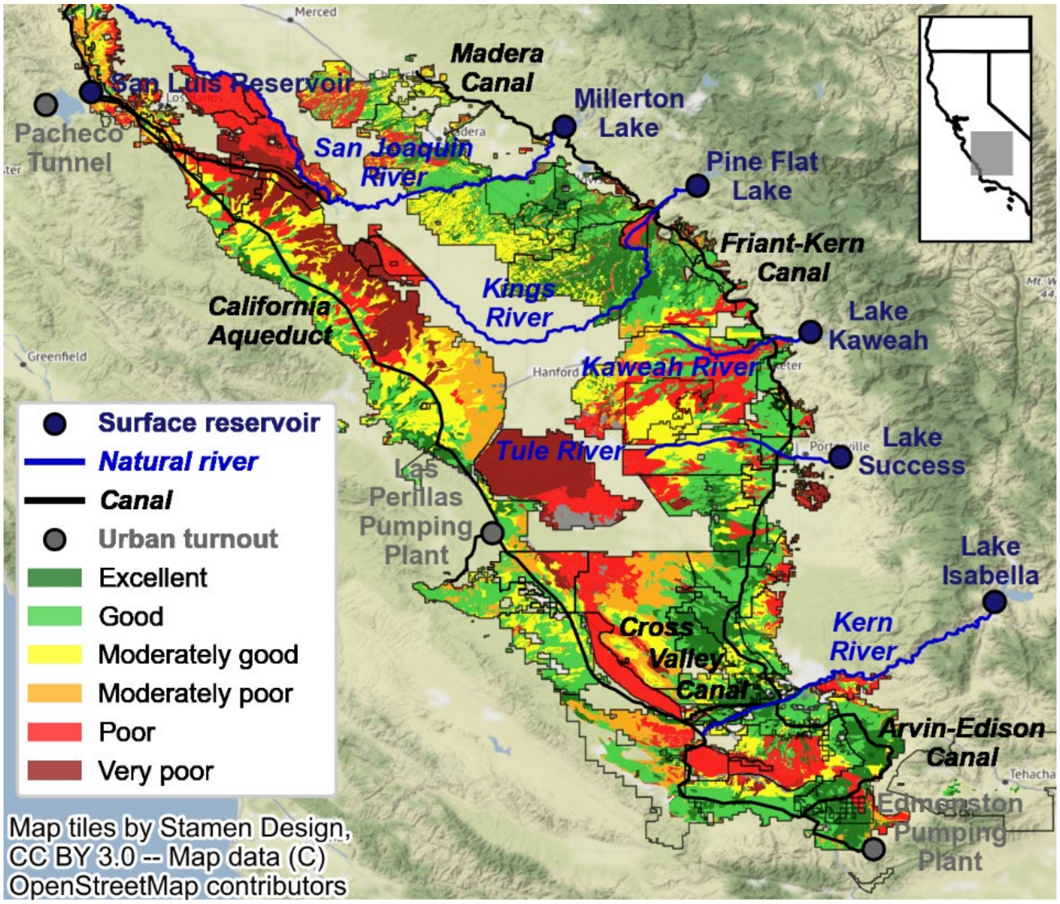

Figure S2. Soil suitability for groundwater recharge in the southern Central Valley. Five major reservoirs store runoff from the Sierra Nevada mountains in the east and release it into the region's major rivers, where much of the flow is withdrawn by water districts. Millerton Lake diverts San Joaquin River water into the Madera Canal and Friant-Kern Canal as part of the Central Valley Project (CVP). The CVP and State Water Project also pump water from the Sacramento-San Joaquin Delta to San Luis Reservoir, where it is routed via a series of pumps and canals to water districts in the valley and urban districts along the coast. Water districts in the region are designated with thin black outlines, and their coloring represents the suitability of soils for groundwater recharge after accounting for deep tillage, according to the Soil Agricultural Groundwater Banking Index (O'Geen et al., 2015).

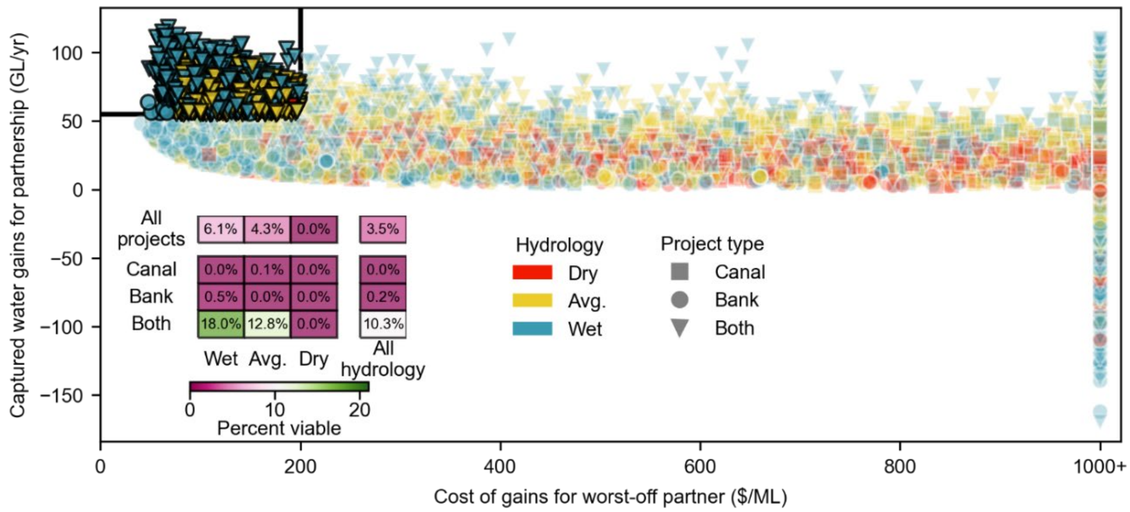

Figure S3. Viability of sampled infrastructure investment partnerships with additional constraint on partnership captured water gains. Each simulated partnership is plotted according to the cost of gains for the worst-off partner vs. the captured water gains for the partnership as a whole. The project type and hydrologic scenario used for each simulation are represented by marker type and color, respectively. Viable partnerships (those with costs <$200/ML ($247/AF) for the worst-off partner and captured water gains >55 GL/year (45 kAF/year) for the partnership)) are represented with black outlines and higher opacity. All costs over $1,000/ML ($1,233/AF) are consolidated into "1000+". Inset shows the viability of candidate partnership structures under each combination of capital project and hydrologic scenario, represented by color as well as the percentage printed in each square.

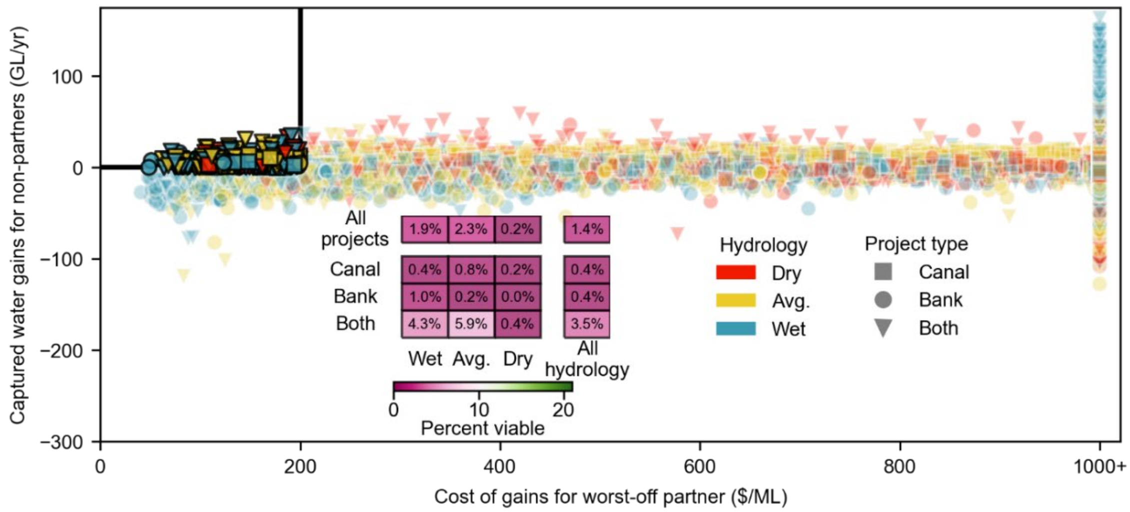

Figure S4. Viability of sampled infrastructure investment partnerships with additional constraint on captured water gains for non-partners. Each simulated partnership is plotted according to the cost of gains for the worst-off partner vs. the captured water gains for the partnership as a whole. The project type and hydrologic scenario used for each simulation are represented by marker type and color, respectively. Viable partnerships (those with costs <$200/ML ($247/AF) for the worst-off partner and captured water gains >0 GL/year across all non-partners in the region)) are represented with black outlines and higher opacity. All costs over $1,000/ML ($1,233/AF) are consolidated into “1000+”. Inset shows the viability of candidate partnership structures under each combination of capital project and hydrologic scenario, represented by color as well as the percentage printed in each square.

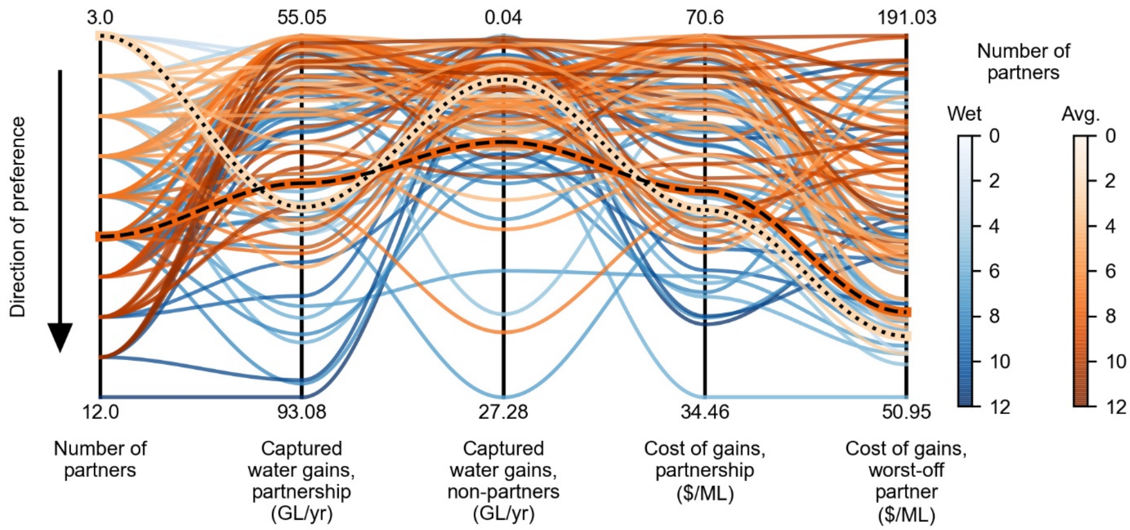

Figure S5. Performance of partnerships that meet multiple criteria. Each vertical axis represents a different performance metric. Each curve represents a simulated partnership, and its intersection with each vertical axis corresponds to its performance on that metric. Blue and orange curves correspond to the wet and average hydrologic scenarios, respectively, and color shading represents the number of partners. The Alt-3 and Alt-8 partnerships are shown in bold with dotted and dashed black emphases, respectively.

References

O'Geen, A. T., Saal, M. B. B., Dahlke, H., Doll, D., Elkins, R., Fulton, A., … Walkinshaw, M. (2015). Soil suitability index identifies potential areas for groundwater banking on agricultural lands. *California Agriculture*, *69*(2), 75–84. https://doi.org/10.3733/ca.v069n02p75