Recommendations for the Governor's Water Resilience Portfolio

The following recommendations were authored by California water experts, representing dozens of environmental organizations in California.

Each of the individual recommendations below were submitted at different times over a span of four weeks to Nancy Vogel, Director of the Governor's Water Resilient Portfolio.

Collectively, the environmental organizations who have authored and endorsed the following recommendations formed One Water Network (OWN). One Water Network's mission is to: *achieve a resilient and sustainable water future for California by prioritizing solutions that elevate and connect human and environmental rights to water*.

One Water Network looks forward to working with the Governor Newsom Administration to implementing a Portfolio of actions that ensure a resilient California water future, especially in the face of the climate crisis.

Sincerely,

One Water Network

Coordinating Group:

- ***Toby Briggs,*** *Friends of the River*
- ***Eric Wesselman,*** *Friends of the River*
- ***Jon Rosenfield,*** *San Francisco Baykeeper*
- ***Mariah Looney,*** *Restore the Delta*
- ***Martha Davis***
- ***Ashley Overhouse,*** *South Yuba River Citizens League*

1 WATER RIGHTS FOR THE ENVIRONMENT

By Deirdre Des Jardins (ddj@cah2oresearch.com) and Lowell Ashbaugh with input from others

During the 2012-2016 drought, the State Water Resources Control Board temporarily suspended at least 35 minimum instream flow standards.[1] The Department of Fish and Wildlife reported that there had been 783 fish rescues in 52 different watersheds, comprising 51 species, and more than 264,000 fish.[2] Six hundred wild McCloud River redband trout were captured and held in nine holding tanks in the Shasta River fish hatchery until stream conditions improved. [3] This was crisis management.

In reviewing the effects of the 2012-2016 drought, Lund et. al. noted that "many of California's aquatic ecosystems remain chronically starved for habitat and water in all years," and that as a result, "native species enter droughts with diminished and geographically limited populations, only to encounter greater stresses during drought."[4] In the Delta, critically endangered Delta smelt may have gone functionally extinct from relaxation of minimum Delta flow standards.

Unless we do a better job of keeping water in our rivers and streams, California's native species *will not survive* climate change. We therefore propose the following reforms to ensure adequate instream flows.

1. Launch a major new initiative for the Water Board to set long-needed comprehensive instream flow standards statewide.
2. Require explicit analysis of the constitutional principles of reasonable use and the Public Trust Doctrine in state water management decisions. Make those principles the foundation of the Bay-Delta Water Quality Control Plan Update.
3. Determine instream flow needs before consideration of petitions for major new diversions.
4. Create mechanisms for public funding for alternative water supplies where needed to mitigate impacts of reduced diversions to maintain instream flows.
5. Provide dedicated funding to support and expand the Water Board's core water rights and water quality actions.

1. Comprehensive instream flow standards.

During the 1976-77 drought, Governor Brown created a Commission to Review California Water Rights Law. The blue-ribbon panel was charged with reviewing the Water Code in light of the drought and Article X, Section 2 of the California Constitution on "Reasonable Use" of water. The Commission's

[1] Hanak, E., J. Mount, C. Chappelle, J. Lund, J. Medellín-Azuara, P. Moyle, and N. Seavy. *What if California's drought continues?* PPIC Water Policy Center, 2015. Available at https://www.ppic.org/publication/what-if-californias-drought-continues/.

[2] Lehr, S. Chief, Fisheries Branch, Department of Fish and Wildlife, *2014-2015 Drought Response*. Briefing to PSFMC, 8-21-2015. Available at http://www.psmfc.org/wp-content/uploads/2015/09/8-PSMFC-Drought-Briefing-8-21-2015_compressed.pdf.

[3] Moyle, P. *McCloud River Redband Trout*, CalTrout, 2017. Available at http://caltrout.org/wp-content/uploads/2017/05/MCCLOUD_RIVER_REDBAND-final.pdf.

[4] Lund, J. Medellin-Azuara, J., Durand, J., Stone, K. "Lessons from California's 2012–2016 Drought" 2018. J. Water Resour. Plann. Manage., 2018, 144(10): 04018067.

1978 Final Report[5] recommended increased protection for instream flows, and providing for better management of groundwater.[6] The groundwater recommendations were ahead of their time and were not implemented for decades. For instream flows, the Commission proposed:

1. That comprehensive instream flow standards be set on a stream-by-stream basis by the State Water Resources Control Board and that the Board comply with these standards in its administrative and adjudicatory decision making; that instream flow standards be expressed in terms of certain quantities or flows of water which are required to be present at certain points along the stream at certain times of the year to protect fishery, wildlife, recreational, aesthetic, scenic and other beneficial instream uses; and

2. That compliance programs be developed where it is determined that the limitations on administrative actions imposed by the instream flow standards are inadequate to secure the beneficial instream uses of water envisioned by the standards. (p. 129.)

For aquatic ecosystems to survive, the Water Board *must* implement the protections for instream flows called for in the Commission's 1978 Final Report. Although legislation has mandated the determination of instream flows, doing so has been delayed for decades.

In 1982, the legislature passed a law requiring the Department of Fish and Wildlife to "identify and list those streams and watercourses throughout the State for which minimum flow levels needed to be established in order to assure the continued viability" of stream-dependent fish and wildlife. DFW was then required to prepare proposed "streamflow requirements" for each stream not later than July 1,1989 (Pub. Res. Code §§ 10001-2.) DFW did not even transmit the identification list to the Water Board until 2008. The transmittal identified 20 priority streams and was accompanied by obsolete and incomplete streamflow studies done over the previous 20 years.[7] DFW has since proposed only two actual "streamflow requirements" for the identified streams, for the Big Sur River and Butte Creek.[8]

In 2014, Action 4 of Governor Brown's California Water Action Plan mandated that the State Water Resources Control Board and the Department of Fish and Wildlife develop "defensible, cost-effective, and time-sensitive approaches to establish instream flows using sound science and a transparent public

[5] Governor's Commission to Review California Water Rights Law, Final Report, December 1978. Available at https://digitalcommons.law.ggu.edu/cgi/viewcontent.cgi?referer=https://www.google.com/&httpsredir=1&article=1425&context=caldocs_agencies.

[6] *National Audubon Society v. Superior Court*, 658 P.2d 709, 726 (Cal. 1983.)

[7] California Department of Fish and Wildlife, "Flow Recommendations to the State Water Resources Control Board." Available at https://www.waterboards.ca.gov/waterrights/water_issues/programs/instream_recommendations/docs/dfw_ifr.pdf.

[8] Department of Fish and Wildlife (CDFW) Instream Flow Recommendations: CDFW Instream Flow Program. Available at https://www.waterboards.ca.gov/waterrights/water_issues/programs/instream_recommendations/index.html.

process."[9] However, the action was not even begun until after the drought ended, likely due to agency resource limitations. The chosen streams include:[10]

Shasta River, tributary to the Klamath River
South Fork Eel River, tributary to the Eel River
Mark West Creek, tributary to the Russian River
Mill Creek, tributary to the Sacramento River
Ventura River

The Water Portfolio should accelerate and greatly expand this effort. The Water Board must have the resources and the mandate to determine instream flows necessary to protect the public trust. Timelines should also be set. In 2010, pursuant to the 2009 Delta Reform Act (Wat. Code § 85087), the Water Board sent a report to the legislature estimating that comprehensively determining instream flows for 100 priority streams outside the Delta and its watersheds would cost $107 million.[11] The Water Board has been collaboratively developing analytical tools for assessing instream flow needs that may reduce the costs.[12] The Governor should ensure that the next budget contains sufficient funds for the Water Board to begin a major initiative to comprehensively determine, within the next eight years, instream flows and/or other water quality criteria necessary to protect public trust and fish and wildlife beneficial uses in these priority streams.

2. Reasonable Use and the Public Trust Doctrine.

In 1983, the California Supreme Court found that "[t]he state has an affirmative duty to take the public trust into account in the planning and allocation of water resources, and to protect public trust uses whenever feasible." (*National Audubon Society v. Superior Court* (1983) 33 Cal.3d 319, 446.)

In the 2009 Delta Reform Act (Wat. Code § 85023) the legislature mandated that "The longstanding constitutional principle of reasonable use and the Public Trust Doctrine shall be the foundation of state water management policy and are particularly important and applicable to the Delta."[13] We urge the Governor to issue an Executive Order requiring that state agencies explicitly consider and address this statute in decisions on water management.

The constitutional principle of reasonable use and the Public Trust Doctrine must be the foundation of the Water Board's comprehensive update of the Bay-Delta Water Quality Control

[9] California Water Action Plan, p. 12. Available at https://www.waterboards.ca.gov/waterrights/water_issues/programs/instream_flows/cwap_enhancing/docs/cwap_final.pdf.
[10] California Water Action Plan – Enhance Water Flows in Stream Systems Statewide. Available at https://www.waterboards.ca.gov/waterrights/water_issues/programs/instream_flows/cwap_enhancing/#heading .
[11] State Water Resources Control Board, Instream Flow Studies for the Protection of Public Trust Resources: A Prioritized Schedule and Estimate of Costs , December 2010. Available at https://www.waterboards.ca.gov/waterrights/water_issues/programs/instream_recommendations/docs/draftreport110210.pdf.
[12] California Water Quality Monitoring Council, California Environmental Flows Workgroup webpage. Available at https://mywaterquality.ca.gov/monitoring_council/environmental_flows_workgroup/index.html.
[13] Ibid.

Plan. The Bay-Delta Water Quality Control Plan Update (and any voluntary settlement agreements) must be based on an independent, peer-reviewed scientific analysis demonstrating a high likelihood that the required biological outcomes (doubling salmonid populations, restoring populations of other species to healthy levels, etc.) will be achieved.

3. Determine instream flow needs before consideration of petitions for major new diversions.

In 2014, the legislature finally passed the Sustainable Groundwater Management Act. Many Groundwater Sustainability Plans rely on increased surface water diversions. The Water Board is currently granting temporary permits for groundwater replenishment without CEQA review. Large new permanent diversion rights should be granted only after planning and allocation of water for the environment.

With respect to the administration's proposed single tunnel, the legislature mandated in the 2009 Delta Reform Act that the Water Board determine "appropriate Delta flow criteria" for inclusion in any "change in point of diversion of the State Water Project or Central Valley Project" in the South Delta (Wat Code § 85086(c)(2.))[14] For the twin tunnels project, the Department of Water Resources proposed that the Water Board adopt no new Delta flow criteria, and instead rely on the federal Endangered Species Act for operational criteria to protect fish and wildlife. It is now clear that such reliance is unwise. For the single tunnel project, the legislature's intent that the state exercise its public trust responsibilities through the Water Board should be followed.

4. Public funding for alternative water supplies.

The 1978 Recommendations of the Governor's Program to Review Water Rights also addressed the need for reduced diversions:

> Compliance programs would be promulgated, following a public hearing, for streams where it appeared to the Board that compliance with the standards would require existing water uses under claim of right to be affected. The programs would include any physical solutions as may be required to avoid or mitigate the impact of compliance with the standards on existing uses.

We propose that the Water Portfolio include programs to ameliorate the impacts of reduced diversions of surface water to maintain instream flows. Funding should be provided for the Water Board to work with water agencies to assess the need for alternative water sources to meet agricultural, municipal, and industrial needs while maintaining instream flows. Where appropriate, mechanisms should be implemented to link public funding for agricultural and urban water conservation/recycling/reuse to priority instream flow standards.[15] Replacement of surface water diversions would be eligible for public funding after a sustainability analysis by the SWRCB.[16]

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[14] See https://mavensnotebook.com/dpg/Water_Code_Part_2.html.

[15] Sustainability, both of water uses and water supplies, should be a primary consideration in provision of public funds for alternative supplies. This will be discussed in a later submission.

[16] Sustainability, both of water uses and water supplies, should be a primary consideration in provision of public funds for alternative supplies. This will be discussed in a later submission.

5. Support the Water Board's core water rights and water quality missions.

In reviewing the 2012-2016 drought, Lund et. al. recommended that the state "determine water availability and water rights and use quantities, and create transparent and coherent water balance and information systems."[17] With the Water Board's increased workload due to climate change, the legislature must ensure that the Water Board has sufficient staff and funding for its core water rights and water quality missions.[18] We recommend the following:

- Provide dedicated funding for the Water Rights Division to develop comprehensive online information systems on water rights and water use by watershed, and better projections of water availability in watersheds during droughts.
- Provide general fund funding for the Water Rights Division for extra staff positions for processing water right applications and for water rights enforcement against unpermitted diversions.
- Provide sufficient funding for the Water Board to process applications for Clean Water Act Section 401 certifications in a timely manner.
- Provide funding for the Water Board to study Harmful Algal Blooms and to develop comprehensive and coordinated regional responses.
- Provide funding for accelerated implementation of TMDLs by the State Water Resources Control Board and Regional Boards.

[17] Lund. et. al. "Lessons from California's 2012–2016 Drought." Op. cit.

[18] In 2003, all General Fund funding for the Water Board's core water rights program was eliminated, shifting it to fees. The Legislative Analyst's Office noted that this would increase the backlog of water rights applications. See https://lao.ca.gov/analysis_2003/resources/res_19_3940_anl03.htm.

2 Adopt and Implement a Decision-Making Framework for Prioritizing Actions in the California Water Resilience Portfolio

By Gary Bobker (Bobker@bay.org), Jon Rosenfeld (jon@baykeeper.org), and Eric Wesselman (eric@friendsoftheriver.org)

Executive Order N-10-19 established two overarching goals for developing a new water resilience portfolio for the State of California: clean, dependable water supplies and healthy watersheds. In order to ensure that these goals are met effectively and efficiently, the Governor should adopt and implement a framework that translates these broad goals into clear and measurable targets and that screens and prioritizes projects and actions by their ability to achieve sustainability rapidly and cost-effectively. We don't have the time or money for an "all of the above" approach and neither would such an approach serve the overarching goals identified in the EO, so precedence should go to actions that:

- Increase equitable access to safe and affordable clean drinking water
- Diversify our water supply sources
- Restore degraded aquatic ecosystems that provide water supply and water quality benefits
- Reduce reliance on inter-basin water exports and other sources most vulnerable to climate disruption
- Reduce urban and agricultural demand for water

1. Targets—Develop and adopt clear and measurable targets for achieving goals and assuring benefits from portfolio implementation.

The first step in attaining the EO's identified goals is to articulate them in specific terms that will answer the question: *How will we know when we've succeeded?* Such targets serve to provide a scale for the challenges the Water Portfolio will address; this information is essential for planners to develop water management solutions of an appropriate size. Mono Lake is an example where clear targets led to multiple benefits including restoration of streams, improved regional planning, improved data, and no water rights disputes. In that case, the Water Board ordered that the Lake level was to achieve certain targets before the Los Angeles Department of Water and Power could take more water.

A. Clean, dependable water supplies.

Necessary targets that must be articulated include:

- Extent of coverage and timeline for extension of drinking water access to underserved communities.
- Durability and resilience of drinking water supply system to systemic threats such as climate change, earthquakes, wildfires, terrorism, etc.
- Timing and amount of imported vs. local water supplies.
    - Define reduced dependence on imported water
    - Define water supply reliability

- increased reliance on reliable local supplies including efficiency targets

B. Healthy watersheds.

Necessary targets that must be articulated include:

- Fish and wildlife viability and desired production of public fisheries.[19]
- Necessary improvements in quantity, timing, and quality of river flows that are tied to fish and wildlife population viability and vibrant fisheries.[20]
- Necessary expansion in acreage, connectivity and quality of aquatic and semi-aquatic habitats (e.g., floodplains, tidal marshes, and sierra meadows) tied to fish and wildlife population viability and vibrant fisheries.

2. Prioritization—Set priorities for selecting portfolio actions to achieve the goals and targets.

The second step in the decision-making framework is to evaluate portfolio elements based on:

- the likelihood that they can help to attain targets at the scale identified above (this includes an evaluation of uncertainty that the element will function as intended – e.g., that anticipated water savings will result in the right time and place)
- their cost
- the speed with which they will contribute to solutions.

A. Clean, dependable water supplies.

Appropriate priorities include:

- Actions that benefit economically disadvantaged communities and communities at highest public health risk. In Sativa, for example, the benefits will accrue not only to the community that is served, but to the overall management of the groundwater in LA County. If a local agency is engaged in the equivalent of circuit riding, then the effort becomes more cost-effective.
- Actions that reduce vulnerability to climate change and other disruptions by:
  - Managing demand by improving efficiency and creating alternative supplies within

[19] For example, in the case of protecting anadromous fishes, these targets have been partially completed by the Anadromous Fish Restoration Program, a cooperative program between federal and California agencies established under the Central Valley Project Improvement Act. In addition, the State Water Resources Control Board has begun to identify biological goals and targets for the Bay-Delta ecosystem via its 2010 public trust flow criteria report.

[20] In 2010, the State Water Board provided the California Legislature with a report on the river flows into, through, and out of the Sacramento-San Joaquin Delta that would be necessary (barring other improvements) to protect the public trust. While this report was not decisional or binding, it forms a solid foundation for decision-making and planning that informs policy-makers of the scope of the problems associated with current Central Valley Water management practices and the scale of solutions necessary to address those problems.

the area of use. This includes ensuring that small communities have the ability and resources to plan for drought and invest in water conservation measures.
- Improving the conjunctive use of surface and groundwater within the area of use.
- Improving the storage and conveyance of water within or in close proximity to the area of use.

B. Healthy watersheds.

Appropriate priorities include:

- Actions that benefit sensitive species (at highest risk of extinction or population decline) and habitats (i.e., habitat types currently restricted to small, isolated patches).
- Actions that restore natural timing and function of ecosystem processes (e.g., fish migration, sediment transport, and invasive species/toxic algae repression).
- Actions that utilize natural infrastructure to provide water management benefits (e.g., wetlands and floodplains).

C. Additional Prioritization Factors.

The following factors may be useful for weighting or timing implementation of Water Portfolio elements, provided that they first address the priorities identified in A or B above.

- Multiple benefit projects that address more than one Portfolio goal (integrated, synergistic, and/or complementary).
- Actions/projects that reduce energy footprint of water management actions.
- Actions with flexible elements that allow learning for improved management and that limit the potential for stranded assets.

3. Conduct a thorough inventory of demand and supply options.

In order to optimize efficiency of Water Portfolio actions, the State must understand actual water supplies and realistic water demands to a far greater extent than it does currently. For example, it is widely-agreed that California's tracking of water supply and use data is inadequate to effectively manage the resource and that public access to these data are almost completely lacking. Furthermore, the state's reliance on water purveyors to estimate their future water demands and current use is unacceptable as it creates perverse incentives. California must enter the 21st century with regard to what and how water supply/use data are collected, and how those data are disseminated to public-policy makers and the general public.
Actions necessary to improve public access to high quality water supply and use data include:

- Improve the state's water use monitoring by implementing actions to gather statewide aerial data and other information and provide this data in a form that is multi-layered and available to the public in real-time.
- Establish targets for water supply efficiency in all sectors (outdoor, indoor, industrial, for example) as a basis for accurately gauging future demand. The State simply cannot rely on water districts, each of whom has an interest in maximizing estimates of future demand, to provide realistic estimates of future water needs that Portfolio prioritization will require. This is being done within DWR now.

- Estimate potential demand that can be satisfied by Portfolio actions; these estimates will need to be regionally specific and incorporate a time element (i.e., when will the Portfolio-generated supply become available relative to increases in demand?).
- Inventory actions (projects, programs and policies) to meet or manage demand.
- Quantify or consider net costs and benefits of each action.

4. Integration.

Finally, the Water Portfolio Decision-Making Framework should implement an integrated approach to Portfolio actions, and where possible, link these to watersheds. This means evaluating suites projects, not projects in isolation; identifying and establishing management linkages between portfolio elements and targets.

A. Suites of Projects.

- Evaluate linkages between projects, including potential synergies and conflicts (e.g., effect of demand reduction, impact of wastewater reuse on flow levels in receiving waters; effect of groundwater recharge on in-stream flows in the short term (potential conflict) and in the long-term (potential synergy); competition for targeted water resources, etc.).
- Identify and promote suites of projects to be developed and implemented as integrated/coordinated/complementary packages.

B. Establish management linkages between portfolio actions and targets.

- Project terms and conditions should be designed to secure intended benefits (i.e., attainment of portfolio targets) established through relevant regulatory permitting processes.
- Project terms and conditions should be designed to secure intended benefits by establishing funding eligibility requirements.
- Establish Portfolio targets as state requirements by legislative or executive action.

C. Improve the state's ability to implement a systems approach by ensuring adequate resources for project evaluation and permitting.

3 Agricultural Land Use Diversification to Reduce Water Demand, Increase Local Self-Reliance, and Improve Climate Resilience

By Barbara Barrigan-Parrilla (barbara@restorethedelta.org) and Jon Rosenfeld (jon@baykeeper.org)

Intelligent policies that encourage agricultural land use diversification can reduce water use, improve water supply outcomes for human communities and public trust environmental benefits, increase local self-reliance, and ensure that California's agriculture industry continues to produce nutritious and affordable food supplies for Americans. We propose:

1. Incentivizing land retirement of ~300,000 drainage impaired lands in the Central Valley Project's San Luis unit (Westlands Water District) and incentivizing conversion to dry farming of crops on an additional 50,000 acres of land in this area.[21]
2. Subsidizing retirement of nearly 50,000 acres of drainage impaired land in the Tulare Lake Basin and committing funds necessary to understand the cost and benefits of needed salt pond remediation in this area
3. Investment in alternative crops and wetlands restoration in the Sacramento-San Joaquin Delta in order to capitalize on multiple benefits associated with encouraging soil carbon sequestration in this area.

1. Introduction.

California faces new and extreme pressure on its water supplies. The recent drought was the most severe of the last 1200 years. Such conditions heighten the need to balance water use and tradeoffs in allocation between agriculture, urban uses, and the environment. California agriculture, which is 2% of the state's economy (roughly $47 billion per year), makes up 12.5% of total agriculture production for the entire nation. Consequently, while California's agricultural output clearly serves the health and well-being of Americans, it is not one of California's leading economic drivers. Yet, agriculture uses 80% of the state's developed water supply.

Agricultural land use diversification can be described in two ways: 1) repurposing agriculture lands for environmental or economic uses; and 2) changing cropping patterns and planting decisions so as to continue producing commodities while reducing and/or increasing flexibility of water use. Opportunities exist in three key agricultural areas within California to begin implementation of a land use diversification program that can create water supply benefits with improved environmental outcomes, while keeping the agricultural sector productive and profitable. Specifically, the potential benefits of agricultural land use diversification are well documented and ripe for implementation in the Sacramento-San Joaquin Delta, San Luis Delta Mendota Unit, and the Tulare Lake region.

[21] Incentives for this and all land retirement initiatives would be tied to guarantees that water currently used in these areas is dedicated to protection of the public trust (i.e., not exported) and improving access to clean drinking water for underserved communities. Also, in the short term, land retirement incentives can include subsidies to restore soil organic matter (carbon farming; See OWN Carbon Farming proposal).

2. San Luis Delta Mendota Water Authority Land Diversification Proposal.

1. Provide state funding to incentivize retirement of the remaining ~300,000 acres of drainage impaired lands in the Westlands Water District. Estimated costs for purchase and retirement of these chronically impaired farmlands range from $740-790 million (in 2015 dollars).
2. Provide incentives to transition an additional 50,000 acres of Westlands acreage to dry farming crops (e.g., of industrial hemp), with funding tied to guarantees that this acreage will not use imported water in the driest 70% of years. however, incentivizing transition to dry land farming would require significantly less investment.

Westlands Water District, part of the Central Valley Project's San Luis unit, was intended to rely on groundwater storage with supplemental water supplies provided by Delta exports when "excess" water was available in the Delta. Westlands' contract with the US Bureau of Reclamation for 1,100,000 acre-feet of water deliveries through the Central Valley Project has never been fully met and Westlands claims the need for 1,400,000 acre-feet of water annually, because water is not available even in high water years to meet their contract limit.[22] With declining surface water supplies due to climate change, agricultural producers in this area will need to rely even more heavily on groundwater supplies, use existing supplies more efficiently, and/or scale back operations, during times of drought. For example, in 2014 Westlands fallowed 206,915 acres or 36% of all its lands.

Much of the land in the San Luis Delta Mendota Water Authority area is unsuitable for irrigated agriculture because the soils leach high levels of salts, selenium, and boron, along with other trace elements. When these lands are irrigated, leached salts either poison crops (when there is not proper drainage) or the drainage effluent can poison fish and wildlife in waterbodies that receive the drainage. These problems were first documented almost 30 years ago in a 1990 report by the San Joaquin Valley Drainage Program. Presently, potential Federal legislation includes a drainage settlement that would not guarantee that these lands will have proper drainage and will not remove them from irrigated agricultural production.

In 2015, ECONorthwest, the Pacific Northwest's largest and most respected independent economic consulting firm, produced a report entitled *Estimated Costs to Retire Drainage Impaired Lands in the San Luis Unit*. Based on ECONorthwest's analysis 279,000 acres to 299,000 acres are drainage impaired lands ready for land retirement. Similarly, the preferred alternative of the Bush Administration's Final EIS regarding San Luis Unit Drainage alternatives (the "In-Valley/Drainage-Impaired Area Land Retirement Alternative")[23] would have retired 308,000 acres of drainage impaired lands in the San Luis unit (10,000 of which were federally owned, the rest being privately owned).

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[22] https://www.sjcl.edu/images/stories/sjalr/volumes/V13N1C2.pdf. The Struggle for Water: How One Irrigation District Seeks Water Supplies: San Joaquin Agricultural Law Review: page 68.

[23] See Table "ES-5 Present Worth of Federal Project Costs" of the Final EIS's executive Summary, here: https://www.usbr.gov/mp/nepa/includes/documentShow.php?Doc_ID=2226. All documents that were part of that EIS are available here: https://www.usbr.gov/mp/nepa/nepa_project_details.php?Project_ID=61. Record of Decision available here: https://www.usbr.gov/mp/nepa/includes/documentShow.php?Doc_ID=2598.

ECONorthwest's report[24] estimated total costs for retiring these drainage impaired lands ranged between $540 million and $1 billion. Retiring these drainage impaired lands would:

- allow for approximately 15% to 20% of exported Delta water to remain in the estuary (assuming that the related water rights were retired), where it could support estuarine fish and wildlife while simultaneously reducing impacts to the SWP;
- allow for some of the saved water to be shared with small westside farming communities that experience unreliable drinking water supplies;
- increase reliability for other water users, including the remaining Westlands acreage that would not be retired.

A breakdown of land retirement costs from the report is summarized below.

> Using the estimated acreage of drainage impaired lands remaining in the San Luis Unit and a range of land costs paid by previous retirement programs, we estimate that retirement of the remaining impaired lands would cost between $740 million and $793 million, on average.

Table 1. Summary of Cost Estimates[25]

Land Categories		Acreages
Total Area of San Luis Unit		730,000
Total Drainage-impaired Lands		379,000
Lands Already Retired		80,000 to 100,000
Lands Remaining to be Retired		279,000 to 299,000
Cost Range	**Land Prices**	**Total Cost Estimates ($M, 2015$)**
Lower Bound	$1,937	$540 to $579
Average	$2,651	$740 to $793
Upper Bound	$3,440	$960 to $1,029

[24] https://s3-us-west-2.amazonaws.com/econw-publications/2015-San-Luis-Unit-Land-Retirement.pdf.
[25] See also tables in the Final EIS from the Bush Administration re: costs.

Additionally, the 300,000 plus acres of land that are not drainage impaired within the San Luis Delta Mendota Water Authority are in areas where increased temperatures and limited water supplies are expected under climate change.

Fortunately, opportunities exist for growers in this region to remain profitable, or even increase profits, post land retirement. While retired lands may be suitable for solar farming and winter grain production, industrial hemp can be grown in the lands that are not retired. We propose that the State incentivize conversion of 50,000 acres to industrial hemp (or other dry farmed crop) in this area as a means of further reducing reliance on the Delta for exported water and maintaining a robust agricultural economy. Growers should be incentivized to dry farm hemp during dry periods and to irrigate only when water supplies are available, as was the original intent for water supplies when Westlands Water District was created. Such incentives should be available for 4 years in order to facilitate agricultural land use diversification.

Industrial hemp is widely recognized as a relatively drought tolerant crop. Various agricultural research sites indicate a range of 12-25 inches of rain to grow an acre of industrial hemp (1-2 acre feet of water), while almonds require 3 acre feet per acre of water for one acre of mature trees. Thus, 50,000 acres of almonds would require 150,000 acre feet of water vs. 50,000 to 100,000 acre feet of water for 50,000 of industrial hemp. However, during dry periods, hemp produces about 400 pounds of seeds per acre compared to 1100 pounds of seeds per acre when irrigated.

Diversifying Westlands' acreage to include industrial hemp would not only maintain, but likely increase, agricultural profitability in this area. Revenues per acre of hemp for CBD oil have reached $90,000 in 2018 with costs per acre at $400 to $1200.[26] If 50,000 acres of almonds were converted in the San Luis unit to planting industrial hemp, revenues could reach as high as $4.5 billion, whereas 50,000 acres of almonds would generate $250,000,000 of revenue.[27] According to Arizona Project Wet[28], part of the University of Arizona:

> Some farms have reported revenue of $90,000 per acre for hemp used to manufacture CBD oils. Compare that to $600 an acre for alfalfa or $700 per acre of corn. Even high water use almonds generate only $5,000 per acre….
> There are other reasons for farmers to have high hopes for hemp. It's a simple crop to grow and it has an abundance of uses. Some sources report 25,000 different products can be created from the plant. The 2016 U.S. market for hemp products was estimated at $688 million which included foods, textiles, supplements, industrial applications, personal care products as well as CBD oils.

Finally, because Industrial Hemp lends itself to a host of manufacturing and industrial applications, new job opportunities would become available for farmworkers who have not been able to find employment in farm fields that have been converted to highly mechanized nut tree farming.

3. Restoration of Tulare Lake Basin.

[26] https://arizonawet.arizona.edu/content/could-farming-hemp-save-water. We calculated revenue based on Arizona Wet's revenue per acre of $90,000 for hemp vs. $5000 for almonds.
[27] NO CITE (originally footnote 7).
[28] https://arizonawet.arizona.edu/content/could-farming-hemp-save-water.

Proposal: Provide $130 million in funding necessary to retire salt-impaired farmland in the Tulare Basin. Conduct environmental analyses to determine costs and environmental and social benefits of remediating existing drainage ponds that poison migratory birds.
Today, in the Tulare Lake Basin, the Water Education Foundation cites, "Drainage water from about 44,046 acres of farmland is contained and evaporated from eight basins encompassing 4,740 acres of evaporation ponds." Recent studies indicate that birds wintering in the evaporation ponds are being subjected to selenium poisoning, much in the same way that birds were harmed at Kesterson thirty years ago.

As no other water resources exist for Tulare Lake Basin, land retirement would be permanent for the nearly 50,000 acres of farm acreage and basins. Using the median land retirement rate for the San Luis Delta Mendota drainage impaired lands, it would cost approximately $130 million for the state to buy out these lands. Environmental groups in that part of California claimed the cost of restoration of the Tulare Lake Basin at $1 billion in 2009. Economic analyses should be funded that would ascertain how many jobs could be created by such a large-scale restoration project and from a related tourist economy, in addition to groundwater recharge and environmental benefits; several sources peg water conservation-related job gains at 12-18 for every $1 million of public investment spent, versus large scale water infrastructure projects that result in 8-10 jobs for every $1 million of investment.

4. Delta Land Diversification.

Proposal: Invest studies required to explore the potential for expanding carbon farming in the Sacramento-San Joaquin Delta to a scale that it can contribute significantly to attaining multiple benefits for the Delta and water supply reliability elsewhere in the state.

Diversification of land use with the Sacramento-San Joaquin Delta can achieve several objectives. In this area, soil subsidence (resulting from current and past farming practices that oxidized peat-rich soils) has caused massive subsidence of agricultural lands, making them vulnerable to levee failure such as may occur under sea level rise. Thus, in addition to the many benefits of carbon sequestration (*see also*, OWN Carbon Farming proposal), significant carbon farming in the Delta could contribute to restored island elevations and thus limit the impacts of future levee failures. Mitigating the effects of levee failures provides a significant benefit to water districts that rely on the Delta for their water supply.

We propose expanding (1) broad scale tule planting and (2) conversion of some central Delta farmlands to rice farming. Both tule planting and rice production offer carbon sequestration benefits, and offer opportunities to build back land mass to reverse subsidence in Delta islands and improve soils, resulting in increased resilience in the face of flooding related to storms, high river flows, and sea level rise. Tule planting, especially on the waterside of levees and rim islands, provides opportunity for improved fish habitat, while rice planting provides ideal habitat to support waterfowl. (Tule, however, is not a water saving crop; wetlands require more water than many crops, and without adequate flow can exacerbate the methylation of Mercury).

Delta Tule planting -- The Delta Conservancy has brought forward a plan to restore wetlands through large scale tule restoration projects. As part of the Delta Conservancy's 2017-22 Strategic Plan, the Conservancy seeks to "promote multi-benefit Delta working landscapes," and "fund and implement high priority projects that increase Delta ecosystem viability through sustaining critical habitat…." The

implementation of this strategy includes a Delta Carbon Management program implementing a partnership,

> "working public and private landowners and project developers to develop pilot projects to verify greenhouse gas emission reduction credits. This will allow them to realize revenue by trading credits on the voluntary carbon market. If the voluntary protocol can be demonstrated, the California Air Resources Board will consider adopting the protocol under the Cap-and-Trade compliance market, thereby doubling the value of the credits which further incentivizes change. Additionally, staff has begun to develop a coalition of interested organizations to develop appropriate messages and strategies to realize additional funding to support a program that can incentivize landscape scale land-use changes that will stop ongoing subsidence and resulting emissions."

Delta Rice Farming -- California's Department of Water Resources has conducted a managed wetland carbon sequestration effort in the Delta since 1997 on Twitchell Island[29]; information gained through this program can now be applied to agricultural lands in the Delta or verified across different soils and land uses (row crops, orchards, vineyards, rice, etc). Recently, this information has been applied to quantify the greenhouse gas emissions and economic implications of different scenarios of crop and wetland mosaics on the 3,700-ha (= 9143 acres) Staten Island in the central Delta[30]; findings indicate that diversification of agricultural practices, including adding rice cultivation and wetland restoration to Staten Island land use practices, could reduce greenhouse gas emissions from agriculture by ~30% (a net reduction equal to eliminating 22,000 tons of CO_2 emissions per year) while farm profits *increased* by 12%. More aggressive restoration scenarios (i.e., those that increased the proportion of the island committed to wetland restoration) resulted in decreased agricultural revenue but could reduce greenhouse gas emissions by almost twice as much as the scenario that maximized farm revenue. Deverel et al. (2017) concluded that "...conversion to a mosaic of wetlands and crops including rice could substantially reduce overall GHG emissions of cultivated lands in the Delta without greatly affecting profitability."

Existing initiatives related to Delta Ag Land Diversification -- The Delta Carbon Management Program is budgeted at $3 to $5 million dollars for 2019 for the development of projects with interested Delta landowners. While $3 to $5 million may be an adequate amount for on the ground tests of tule planting and conversion of corn and other row crops to rice farming on a very small scale, it is certainly not enough to implement a large-enough conversion of 50,000 to 100,000 acres of farmland to rice and tule production. If test trials show the positive results that are anticipated, funding needs should be identified and extrapolated from test trials, and dedicated funding for program expansion should become of Water Portfolio planning. Whereas rice fields are maintained by farmers after initial investments for conversion, tule plantings need continued maintenance so as to be clear of invasive species. Habitat maintenance needs must be built into the budget as well. The state can decide to pay area farmers to grow and maintain wetland areas, or fund part of the California Conservation Corps to

[29] Windham-Myers, L., B. Bergamaschi, F. Anderson, S. Knox, R. Miller and Fujii, R. (2018). Potential for negative emissions of greenhouse gases (CO2, CH4 and N2O) through coastal peatland re-establishment: Novel insights from high frequency flux data at meter and kilometer scales To cite this article: Lisamarie Windham-Myers et al 2018 Environ. Res. Lett. 13 045005.

[30] Deverel S., P. Jacobs, C. Lucero, S. Dore, and T. R. Kelsey. (2017). Implications for Greenhouse Gas Emission Reductions and Economics of a Changing Agricultural Mosaic in the Sacramento–San Joaquin Delta. San Francisco Estuary and Watershed Sciences 15(3) Article 2 https://doi.org/10.15447/sfews.2017v15iss3art2.

handle tule maintenance. We understand that local Delta farm leaders estimate the conversion of existing row crops to rice to cost approximately $1000 per acre.

4 IMPROVE WATER MANAGEMENT AND EFFICIENCY IN AGRICULTURE

By Eric Wesselman (eric@friendsofhteriver.org)[31]

The Water Resilience Portfolio should support improved water management and efficiency in agriculture with a portion of conserved water dedicated to meeting instream flow needs. Efficient irrigation methods, improved farming practices, infrastructure improvements, water-use monitoring technologies and information management tools can dramatically decrease water demand while maintaining agricultural productivity. This should be coupled with expansion of the state's Healthy Soils Program (see OWN Carbon Farming recommendation).

Innovative agricultural water management paired with watershed restoration provides multiple benefits including:

- greenhouse gas reductions
- targeted and strategic groundwater recharge
- reduced demand for irrigation water
- increased local water resiliency
- reduced polluted runoff
- river and watershed health and resiliency

To realize these benefits, the Portfolio should call for:

1. Expanding the State Water Efficiency and Enhancement Program (SWEEP) to meet a goal of reducing demand for irrigation water by 1 MAF by 2030 to help meet instream flow standards and the state's climate goals.
2. Upgrading water delivery systems to facilitate greater deployment of efficient irrigation technologies and practices.

1. Background.

As of 2010, 43 percent of irrigated cropland in California was still being flood irrigated.[32] Conversion to drip and micro irrigation has the potential to save 5.6 to 6.6 million acre-feet of water annually in California, but the groundwater recharge benefits of flood irrigation need to be considered.[33] While flood irrigation can help recharge groundwater, this is not uniformly true. Recharge benefits of flood irrigation depend on soil type and the characteristics and condition of the underlying aquifer. Flood irrigation can also lead to groundwater contamination from fertilizers, pesticides and naturally occurring contaminants.

[31] For additional information, please contact Cannon Michael, Bowles Farming Company, Inc. at 209-769-6777 or cannong@bfarm.com or Karen Buhr, Executive Director, California Association of Resource Conservation Districts at (916) 524-2100 or karen-buhr@carcd.org.
[32] Tindula, G., Orang, M., and Snyder, R. (2013)."Survey of Irrigation Methods in California in 2010." J. Irrig. Drain Eng., 139(3), 233–238.
[33] Natural Resources Defense Council, Pacific Institute, 2014, 'The Untapped Potential of California's Water Supply.'

Old-fashioned water delivery systems present a significant barrier to water use efficiency on agriculture because many are not compatible with modern irrigation approaches and technologies. Retrofits are needed to accelerate demand reduction for irrigation water and reduce water losses from evaporation, spillage, and seepage. Spills alone can account for up to 20 percent of a water district's total water use. Retrofits need to maintain the ability to flood irrigate for crop and soil health and targeted groundwater recharge.

The State Water Efficiency and Enhancement Program (SWEEP) provides financial assistance in the form of grants to implement irrigation systems that reduce greenhouse gases and save water on California agricultural operations. SWEEP was established by the emergency drought legislation passed in 2014 and is implemented by the CA Department of Food and Agriculture. SWEEP provides financial support for several irrigation upgrades including soil moisture monitoring, drip systems, switching to low pressure irrigation systems, pump retrofits, variable frequency drives and installation of renewable energy to reduce on-farm water use and energy. In less than five years the program has awarded $62.7 million for 614 projects covering over 114,000 acres and leveraged more than $40.8 million in matching funds from awardees. These projects have reduced CO2 emissions by 75,368 metric tons and saved over 101,050 acre-feet of water per year.[34] Comparatively, a water project like Temperance Flat Dam would cost at least $2.6 billion and yield 70,000 acre-feet per year on average.[35] SWEEP should be improved and significantly scaled up as a cost-effective and multi-benefit water resilience approach.

2. Specific Proposals.

1. **Expanding and Enhancing the State Water Efficiency and Enhancement Program (SWEEP) at CDFA.**
    a. Set goal and provide funding ($650m) to improve irrigation systems and practices on 1,000,000 acres by 2030 to help meet instream flow standards and the state's climate goals by reducing CO2 emissions by 736,490 metric tons and saving 1 million acre-feet of water.
    b. Leverage and supplement the capacity of agencies and organizations that have a successful record of providing technical and financial assistance to growers that is critical to maximizing the benefits of CDFA's Healthy Soils Program and SWEEP (Resource Conservation Districts (RCDs), UC Cooperative Extension (UCCE), and non-profit organizations). This should include baseline funding for RCDs to provide greater on-the-ground technical assistance and training needed to ensure successful installation, implementation, operation and maintenance of funded projects.
    c. Amend funding eligibility and guidelines to ensure efficient use of funds by:
        i. Tightening rules and oversight to avoid double dipping from other programs and overestimation of costs.
        ii. Providing set rates and figures to grantees for reimbursable irrigation upgrades and soil improvements as the Natural Resource Conservation Service does.
        iii. Prioritizing funding for growers with demonstrated financial need and in disadvantaged communities.
        iv. Amend match requirement to increase grower participation by reducing it and/or spreading it out over time, and waiving it for grantees with demonstrated financial need.

[34] CDFA: https://www.cdfa.ca.gov/oefi/sweep/.
[35] USJRBSI DEIS, p. 2-92, table 2-9.

d. Include funding for before and after evaluations to provide comparative data and increase effective implementation of projects and use of irrigation systems.
e. Ensure the program provides sufficient funding for the deployment of water-use monitoring technologies and information management tools.
f. Identify, replicate and support successful cost-sharing programs between irrigation districts and their growers with matching state funds and explore cost-share opportunities with urban water agencies.

2. **Upgrade water delivery systems to facilitate greater efficiency (50 percent of irrigation systems in the Central Valley by 2030 and 90 percent statewide by 2050). To do this DWR should**:
    a. Modify the current list of required efficiency practices to incorporate specific standards of water delivery service and a specific timeframe.
    b. Ensure that irrigation districts measure the amount of water delivered to their customers and charge their customers at least in part based on the volume of water delivered as required by the Water Conservation Act of 2009.
    c. Oversee retrofit program for projects that allow for 24-hour arranged demand delivery, water service through pressurized or low-volume compatible delivery systems, and the ability to deliver water for flood irrigation to recharge groundwater and other benefits.
    d. Identify funding through water bond proceeds, AB32 auction proceeds, a minimum investment requirement, or cost-share programs and partnerships with irrigation districts and urban water agencies.

5 EXPAND THE STATE'S LAND-BASED CARBON SEQUESTRATION PROGRAM IN THE AGRICULTURAL SECTOR AND DEVELOP SIMILAR PROGRAMS IN THE MUNICIPAL/RESIDENTIAL SECTOR

By Jon Rosenfeld (jon@baykeeper.org)

1. Introduction.

Increase California's investment in carbon sequestration on agricultural lands (e.g., California's Healthy Soils Program/Initiative) and expand these efforts to include municipal/residential landscapes. In addition to its role in mitigating greenhouse gas emissions, increasing soil organic matter (e.g., by sequestering carbon dioxide) has multiple benefits, including:

- increased soil water storage and local aquifer recharge,
- reduced irrigation demand and increased local self-reliance for water,
- decreased erosion and reduction in the potential transport of fertilizers and pesticides into local waterways, and
- empowerment of homeowners, individual farmers, and municipalities to participate in climate change mitigation and development of sustainable water use practices.

Specifically, we propose:

1. Investing $90 million per year to expand the state's existing program of incentives, education, and technical assistance to increase soil organic matter on crop and pasture lands to cover an additional 1,000,000 acres per year of California agricultural land; experts indicate this level of investment is warranted, timely[36,37] and will help put the state on track to achieve carbon neutrality of its agricultural sector by 2045;
2. Integrating this approach into agricultural land diversification initiatives, including by promoting alternative cropping strategies in the Sacramento-San Joaquin Delta and land fallowing initiatives in the western San Joaquin Valley and Tulare Lake Basin (*see also*; OWN Agricultural Land Diversification proposal);
3. Matching $20 million dollars of existing local and regional funding to leverage local economic incentives in order to convert an additional 200,000 conventional residential landscapes to water-wise/carbon sequestering landscapes and increasing support to municipal green infrastructure programs by $10 million with a goal of reducing irrigation demands on 100,000 acres of municipal landscapes, within 4 years;
4. Investing $2.5 million in research and demonstration projects in municipal/residential areas throughout California that will both educate the public about the benefits of naturalized landscaping and urban forestry and develop greater region-specific data on the water savings, carbon sequestration, native biodiversity and water quality benefits of alternative landscaping.

[36] IPCC, 2018: Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways. World Meteorological Organization, Geneva, Switzerland. https://www.ipcc.ch/sr15/chapter/spm/.
[37] Sanderman et al. PNAS 2017;114:36:9575-9580.

To achieve these targets, the Governor's Water Portfolio will need to leverage and supplement the capacity of those agencies and organizations that have a successful record of providing technical and financial assistance to agricultural producers for planning and implementation of conservation practices (National Resource Conservation Service (NRCS), Resource Conservation Districts (RCDs), UC Cooperative Extension (UCCE), and nonprofit organizations).

2. Description.

Enhancing storage of organic carbon in soils has multiple significant benefits. Increasing soil organic matter promotes a healthy soil ecosystem that can increase plant photosynthesis, and associated carbon sequestration, on an ongoing basis.[38] In addition to showing great promise as a climate change mitigation and resilience strategy[39,40] increasing carbon stored in soils increases their capacity to hold water, thus reducing climatic water stress[41] and the need for water to irrigate crops or urban landscapes. One California farmer who has employed carbon farming techniques through an existing state program reports: "[*My almond] trees, they don't stress as much, because they hold the moisture a lot longer.*"[42]

According to modeling done for the California Natural Resources Agency, increasing soil organic matter in all working lands in California would lead to massive increases in soil moisture storage; specifically:

> *"Increases in total soil organic matter of 3% increased the soil water holding capacity by up to 4.7 million acre-feet across all working lands in California, with hydrologic benefits greatest in locations with enough precipitation to fill increases in soil storage capacity. The benefits of increasing soil organic matter included a reduction of climate change impacts to hydrologic variables in comparison to no-action soil management."*[43]

The largest benefits in saved water supply occurred in the perimeter locations of the Central Valley, where precipitation is highest.

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[38] Ryals and Silver. (2013). Effects of organic matter amendments on net primary productivity and greenhouse gas emissions in annual grasslands. *Ecological Applications*, 23, 120821140338006. Available at https://www.energy.ca.gov/sites/default/files/2019-07/Agriculture_CCCA4-CNRA-2018-006.pdf.

[39] If just 6% of grassland soil across California is treated with compost, the carbon sequestered would offset about 25% of the state's agricultural emissions, the equivalent of removing nearly 2 million cars from the road. Myer and Silver, 2018, in Flint et al. (2018). CCCA4-CNRA-2018-006.

[40] Marin Carbon Project research shows that, "sequestration of just one metric ton of carbon per hectare on half the rangeland area in California would offset 42 million metric tons of CO2, an amount equivalent to the annual greenhouse gas emissions from energy use for all commercial and residential sectors in California." Available at https://www.carboncycle.org/carbon-farming/.

[41] Flint et al. (2018). Increasing soil organic carbon to mitigate greenhouse gases and increase climate resiliency for California. A report for California's fourth climate assessment change assessment. CCCA4-CNRA-2018-006. https://www.energy.ca.gov/sites/default/files/2019-07/Agriculture_CCCA4-CNRA-2018-006.pdf.

[42] Sommer, Lauren. California's Latest Weapon Against Climate Change Is Low-Tech Farm Soil. KQED public radio. May 2, 2019. https://www.npr.org/2019/05/02/718736830/californias-latest-weapon-against-climate-change-is-low-tech-farm-soil.

[43] Flint et al. (2018).

In addition, increasing soil organic matter levels reduces the potential for pesticides and fertilizers to leach into groundwater[44,45] or run off to adjacent surface waters, while also reducing the need for these costly applications.

3. Expanding Existing Carbon Farming Efforts and Developing New Initiatives.

Agricultural Sector[46] -- The existing California Healthy Soils Program [SB 1350] has engaged a variety of farming systems and crops across the state's agricultural sector and should now be expanded dramatically. Since 2016, the Healthy Soils Program has promoted farming practices that remove carbon dioxide from the atmosphere by increasing organic carbon storage in soils and vegetation on agricultural land. In 2017, the program received $7.5 million from the California Climate Investments program (cap-and-trade). For 2018, 194 projects were selected totaling approximately $8.7 million in grants funded through the Greenhouse Gas Reduction Fund. In addition, the federal NRCS has for many years promoted practices to maintain and restore healthy soils through their portfolio of conservation practices. However, the acreage reached by these early efforts pales before the acreage that must be engaged in order to attain the goal of a carbon-neutral agricultural sector.

The time is now for California to capitalize on its initial investment and fully commit to carbon farming and other land-based carbon sequestration strategies by expanding the existing program to engage 1 million new acres per year. Such an effort will require investment of at least $50 million/year to incentivize farmers and ranchers to implement carbon farming practices and an additional $40 million/year will be needed to enable CA's Resource Conservation Districts and UC Cooperative Extension to provide essential support functions including education, technical support, planning and permitting, as well as implementation and monitoring of on-farm projects deploying carbon sequestration practices. This investment in technologies that are known to reduce net release of greenhouse gases and improve local self-reliance for irrigation water would engage 50 percent of agricultural acres by 2030 and 95 percent by 2045 with on-farm technical assistance, demonstration projects, and incentives. Furthermore, this massive effort will require large amounts of compost inputs -- the State should seek to eliminate barriers to on-farm composting and increase the supply of commercial compost available for agricultural uses to at least 30 metric tons by 2045.

In addition to expanding the footprint of the Healthy Soils Program, we propose increasing the number and diversity of agricultural landscapes in which this program operates. For example, targeted investment of funds to incorporate the efforts of the Carbon Farming Network[47] and others in the

[44] Curell, Christina. Michigan State University Extension. (2011). Soil organic matter can decrease leaching potential of pesticides.
https://www.canr.msu.edu/news/soil_organic_matter_can_decrease_leaching_potential_of_pesticides
[45] Islam, R. and R. Reeder. (2014). No-till and conservation agriculture in the United States: An example from the David Brandt farm, Carroll, Ohio. International Soil and Water Conservation and research. International Soil and Water Conservation Research 2(1): 97-107. Available at https://www.sciencedirect.com/science/article/pii/S2095633915300174.
[46] For more information on expanding Carbon Farming in the agricultural sector contact: Mr. Torri Estrada, Executive Director, Carbon Cycle Institute; testrada@carboncycle.org; (707) 992 5009.
[47] Convened by the Carbon Cycle Institute in 2016, the Carbon Farming Network consists of RCDs, non-profits, and land trusts across California that work with landowners to develop and implement carbon farm plans and activities. https://www.carboncycle.org/strategic-partners/carbon-farming-network/.

Sacramento-San Joaquin Delta, would produce multiple environmental benefits. In the Delta, current and past farming practices that oxidized peat-rich soils have caused subsidence of agricultural lands, making them vulnerable to levee failure, which is increasingly likely under recent sea level rise scenarios.[48] In addition to the many benefits of carbon sequestration, carbon farming in the Delta could contribute to restored island elevations that would limit the impacts of future levee failures[49,50] and reduce seepage impacts to farmland from adjacent Delta channels. California's Department of Water Resources has conducted a managed wetland carbon sequestration effort in the Delta since 1997 on Twitchell Island[51]; information gained through this program can now be applied to agricultural lands in the Delta and verified across different soils and land uses (row crops, orchards, vineyards, rice, etc.). Information gained from the Twitchell Island project and other carbon sequestration experiments was recently applied to quantify the greenhouse gas emissions and economic implications of different scenarios of crop and wetland mosaics on the 3,700-ha Staten Island in the central Delta.[52] In this modeling analysis, diversification of agricultural practices, including adding rice cultivation and wetland restoration to Staten Island land use practices, reduces greenhouse gas emissions from agriculture by ~30% (a net reduction equal to eliminating 22,000 tons of CO_2 emissions per year[53]) while farm profits *increased* by 12%. More aggressive restoration scenarios (i.e., those that increased the proportion of the island committed to wetland restoration) reduced agricultural revenue but limited greenhouse gas emissions by almost twice as much as the scenario that maximized farm revenue. The researchers concluded that "*…conversion to a mosaic of wetlands and crops including rice could substantially reduce overall GHG emissions of cultivated lands in the Delta without greatly affecting profitability*."[54]

Expansion of the state's carbon farming program should also be incorporated into the process of fallowing marginal farmland. Increasing soil organic matter on degraded soils or on lands that are unsuited to agriculture (e.g., as a result of climate change or naturally high levels of toxic minerals) can sequester carbon and vastly improve local water storage capacity and aquifer recharge potential. Subsidies to land owners directed through the California Healthy Soils Program can be part of the financial packages associated with land retirement -- easing the transition from active farming and maximizing societal benefits of agricultural diversification.

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[48] Oliver. (2019). How rising sea levels could impact Delta, Sacramento Valley. UC Davis John Muir Institute of the Environment. https://johnmuir.ucdavis.edu/2019/03/25/how-rising-sea-levels-could-impact-delta-sacramento-valley/.

[49] Merrill et al, (2010). Greenhouse Gas Reduction and Environmental Benefits in the Sacramento-San Joaquin Delta: Advancing Carbon Capture Wetland Farms and Exploring Potential for Low Carbon Agriculture. http://www.stillwatersci.com/resources/2010merrilletal_deltacarbon.pdf.

[50] https://www.watereducation.org/sites/main/files/file-attachments/brock--combined_4-30-14.pdf.

[51] Windham-Myers, L., B. Bergamaschi, F. Anderson, S. Knox, R. Miller and Fujii, R. (2018). Potential for negative emissions of greenhouse gases (CO2, CH4 and N2O) through coastal peatland re-establishment: Novel insights from high frequency flux data at meter and kilometer scales Environ. Res. Lett. 13 045005.

[52] Deverel S., P. Jacobs, C. Lucero, S. Dore, and T. R. Kelsey. (2017). Implications for Greenhouse Gas Emission Reductions and Economics of a Changing Agricultural Mosaic in the Sacramento–San Joaquin Delta. San Francisco Estuary and Watershed Sciences 15(3) Article 2 https://doi.org/10.15447/sfews.2017v15iss3art2.

[53] For comparison's sake, if an average car emits ~4.6 metric tons of CO2/year (https://www.epa.gov/greenvehicles/greenhouse-gas-emissions-typical-passenger-vehicle) then agricultural diversification on Staten Island alone, at a level that increases farm profits, could remove the equivalent of 4,800 cars worth of CO2 emissions each year.

[54] Deverel et al. (2017).

Municipal/Residential Sector[55] -- The State should leverage existing local incentive-based programs that encourage conversion of landscapes to water-wise alternatives with a goal of increasing residential lawn conversions to water-wise and climate-smart landscaping for 200,000 homes over the next four years. Many municipalities across the state already offer rebates and other savings associated with conversion from conventional yards and irrigation systems to modern alternatives.[56] State matching of existing local and regional rebates should be targeted both at increasing the current annual total of landscape conversions (i.e., making local and regional rebate program funds go further) and, in particular, increasing the rate of adoption in disadvantaged communities (i.e., by increasing the economic incentive per applicant). In addition, the State should provide $10 million in grants to municipalities seeking to reduce irrigation of municipal landscapes, including through techniques that improve soil organic matter, with a goal of engaging 100,000 acres of municipal lands in carbon and water saving soil management practices within four years.

In the municipal/residential sector, demonstration programs are needed in order to communicate the benefits and techniques of converting residential and municipal lawns and golf courses to landscaping that sequesters carbon, reduces water demand, and reduces non-point source pollution related to fertilizer and pesticide runoff. ReScape California is pursuing one such demonstration project and has established a Climate Change Consortium that will pair scientific research organizations with municipalities and local groups to measure and monitor results of alternative landscapes over a four year period. The results of this monitoring will inform best practices for managing alternative landscapes in the municipal/residential sector. These demonstration landscapes will cover a combined total area of over 1500 acres; results will be monitored over a 4-year period. All demonstration landscapes in this effort will include a carbon sequestration calculator, water savings tools, and a rating system[57] that captures the environmental benefits of each landscape conversion and scores them for compliance with state and local regulations and sustainability. The landscapes themselves and all connected information, including real-time monitoring and data reporting on water savings, carbon sequestration, and habitat improvement, will be publicly accessible. The first demonstration will pair the East Bay Municipal Utility District with the Eden affordable housing project and the Oakland Housing Authority. The focus of this demonstration will be water savings, adherence to water budgets, stormwater health and carbon sequestration. Demonstration projects of this sort should be implemented across the state in order to educate the public about the benefits of naturalized landscaping and develop greater regionally specific data on the water savings, carbon sequestration, and water quality benefits of alternative landscaping.

4. Appendix: Benefits of Increasing Soil Organic Matter Content.

Compared to proposed geoengineering fixes for rising levels of greenhouse gases, storing carbon in soil engages the natural process of photosynthesis to transfer carbon dioxide from the atmosphere to the soil as soil organic carbon using time-tested, low technology methods. For example, increasing soil

[55] For more information on expanding alternative landscaping in the Municipal/Residential sector contact: Ms. Milena Fiore, Executive Director, ReScape California, milena@rescapeca.org, (415) 766 2021.
[56] See partial listing of existing residential programs here: https://rescapeca.org/resources/for-communities/rebates-for-communities/.
[57] The ReScape California Rated Landscape Program (https://rescapeca.org/about-us/), rates landscapes. With a possible 200 points in 14 areas including stormwater and site drainage, soil health, carbon held in materials, hydrozone planting, planned planting, turf in recreational areas only, low volume irrigation systems installed with weather or soil moisture-based controls, mulch and compost on-site production. 81 sites have been rated as sustainable to date. https://rescapeca.org/rated-landscape-projects/.

organic matter can be accomplished by application of organic soil amendments (particularly compost), allowing cover crops and crop residues to decompose *en situ*; targeted grazing by livestock, and limiting oxidation of existing soil organic matter (e.g., by reducing or eliminating soil tillage).

The benefits of carbon farming practices vary in relation to climate, soil type, and land use. In addition to its numerous environmental benefits, carbon sequestration in soils offers many economic benefits as well. Carbon farming practices can lead to substantial cost savings through decreased input costs (e.g., reduced water, pesticide, and fertilizer use) and can increase crop productivity.[58]

1. **Land Use – Agriculture.**

Water Saving Benefits -- Water savings and soil moisture retention related to increased soil organic matter are impressive. NRCS states that every 1% increase in soil organic matter has the potential to store an additional 25,000 gallons of water per acre.[59] According to analyses conducted for the California Natural Resources Agency:

> *"Increased soil organic matter can be achieved in multiple ways to increase soil water-holding capacity, forage and crop yields, increase baseflows and aquifer recharge, reduce flooding and erosion, increase carbon sequestration, and reduce climate-related water deficits, therefore developing hydrologic resilience to climate change while simultaneously reducing atmospheric greenhouse gases. Prioritized investment in California's working landscapes will yield multiple ecosystem service benefits by targeting conservation and management actions on grasslands in locations or counties that can gain the most benefit."*[60]

Carbon Storage Benefits -- Several studies demonstrate the potential of carbon farming practices to increase sequestration of carbon dioxide. For example, simply spreading compost over grazed grasslands in Marin and Yuba Counties led to a sequestration rate of 1 metric tons of CO_2/acre/year. Scaled to 25% of California's grasslands, the carbon dioxide stored by this approach would be 21 million metric tons.[61] Although sequestration varies with location, a study done sponsored by the California Natural Resources Agency showed that adding compost to grasslands increased soil organic carbon across all sites by 1.1% to 2.5%.[62] It is estimated that compost applications to just 6% of California rangelands could result in storage of 8.4–8.7 million metric tons of CO_2 equivalents at maximum sequestration, 15 years after a single compost amendment.[63]

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[58] According to studies sponsored by the California Natural Resources Agency, "in the Salinas Valley, California, researchers studied the effects of using municipal compost on intensive vegetable production systems. They found that application of compost increased lettuce and broccoli yields in three different trials, resulting in increased financial returns of US$1,732 per acre for plots treated with minimum tillage and compost compared to control plots that did not receive compost (Jackson et al., 2004)" In Flint et al. (2018).

[59] Emerson, W.W. 1995. Water retention, organic carbon and soil texture. Australian J. Soil Res. 33: 241-251.

[60] Ibid. at p. iv.

[61] Block. (2017). From Waste to Wonder: Using Compost to Restore Carbon to Soil. University of California. http://climatechampions.ucop.edu/2017/04/06/whendee-silver-compost-to-restore-carbon-to-soil/.

[62] Flint et al. (2018). Increasing soil organic carbon to mitigate greenhouse gases and increase climate resiliency for California. A report for California's fourth climate assessment change assessment. CCCA4-CNRA-2018-006 Available at https://www.energy.ca.gov/sites/default/files/2019-07/Agriculture_CCCA4-CNRA-2018-006.pdf.

[63] Ibid.

Water Quality Benefits -- Increased organic matter in the soil also contributes to overall soil and plant health and pest resistance, reducing the need for chemical applications. Increasing soil organic matter improves soil structure and can reduce the need for pesticide and fertilizer applications. Healthy soils also decrease erosion and sediment loads and the overall capacity of soils to filter contaminants (salt, nutrients, etc.).

2. Land Use -- Municipal/Residential.

Water Saving Benefits -- Lawns are the largest "crop" in North America and watering residential lawns is the primary reason that most residential water use occurs outside of the home. Many municipalities[64] now offer rebates to encourage replacement of grass turf with plants and landscaping treatments that require less irrigation. Practices that increase soil health and carbon sequestration also increase the soil's water holding capacity, which can lead to substantial reduction in the municipal/residential landscape irrigation demand. Municipal and regional rebates for installation of low-water use landscapes have become common across the southwestern United States. A case study in Santa Monica showed that native gardens use 77% less water than traditional gardens[65] and the US EPA estimates that California native plants can reduce the average homeowners water consumption by 60%.[66] ReScape California-rated gardens use 10%–50% less water than conventional landscapes.[67]

Carbon Storage Benefits -- Whereas the water savings associated with alternative landscaping are sizeable and well-established, the carbon sequestration capacity of alternative landscaping requires additional documentation; carbon sequestration rates are likely to vary based on geography, soils, type of landscaping, and other variables. Nevertheless, preliminary research indicates that the potential for increasing soil carbon storage in municipal/residential landscape is substantial.[68] The State should expand efforts to increase carbon sequestration in the urban ecosystem by increasing the green acreage of cities and increasing both the living biomass and soil organic matter in these areas.[69] Carbon farming principles and techniques can be employed in residential and municipal landscapes, including parks, road corridors, and public or private golf courses, cemeteries, and schoolyards.

Water Quality Benefits -- Increasing soil organic matter through carbon sequestration practices is likely to reduce the need for pesticides and fertilizers. Overapplication of pesticides and fertilizers is a common problem in the residential/municipal yard care context; these products easily run off into municipal storm drains and contaminate local and regional water sources.[70] Foregoing pesticide

[64] Major Western cities pay residents to rip out their lawns to save water. Why isn't Denver? H2O Radio. https://www.coloradoindependent.com/2019/07/18/rebate-turf-replacement-water-conservation/.
[65] The Case for Sustainable Landscapes. (2009). American Society of Landscape Architects. https://landscapeforlife.org/wp-content/uploads/2017/09/The-Case-for-Sustainable-Landscapes-Brochure.pdf.
[66] https://saveourwater.com/using-california-native-plants/.
[67] https://rescapeca.org/rated-landscapes/.
[68] US Forest Service. Climate Change Resources Center; eco-smart landscape. https://www.fs.usda.gov/ccrc/tools/ecosmart-landscapes.
[69] Lal, R. (2012). Towards greening of urban landscape. Chapter 19 in: Lal and Augustin (eds.), Carbon Sequestration in Urban Ecosystems, 373. DOI 10.1007/978-94-007-2366-5_19.
[70] ReScape reports 85–95% weed suppression without toxic chemicals and 70–80% reduction in runoff from high-quality naturalized landscapes as compared to conventional landscapes. *See* https://rescapeca.org/rated-landscapes/.

applications increases the soil's biodiversity, which helps residential soils sequester even higher levels of organic carbon.

Additional Benefits -- Engaging homeowners in conversion of traditional lawns to more naturalized landscapes empowers individuals to make a contribution to climate change mitigation as well as regional water sustainability.

6 Realigning Hydropower and Watershed Portfolios in a Changing Energy Landscape

By Dave Steindorf (dave@americanwhitewater.org), Chris Shutes (blancapaloma@msn.com), Ashley Overhouse (ashley@yubariver.org), Redgie Collins (rcollins@caltrout.org) and Eric Wesselman (eric@friendsoftheriver.org)

1. Realigning California's Aging Hydropower.

Mandates for renewable and carbon-free electricity in California and changes in energy markets have made several hydropower projects in California uneconomic and obsolete. Hydropower projects that cannot respond to hourly changes in power demand are competing with wind and solar energy resources that are newer, cheaper, and much smaller in geographic footprint. Hydropower project owners are thus selling or decommissioning some projects already, with many more to come.

The Pacific Gas and Electric Company's (PG&E) recent bankruptcy has amplified this trend as the utility is under great pressure to maximize assets by selling low-value hydropower projects. This major shift creates risks and opportunities. These dynamic shifts provide a phenomenal opportunity to "realign" California's aging hydropower projects. We recommend that the Governor include in his Water Resilience Portfolio a policy to remove or reconfigure non-economic hydroelectric projects on rivers that have high ecosystem and community value in California. Such removal or reconfiguration will help to modernize California's energy portfolio in the age of renewables.

2. Relevance to Water Resilience Portfolio.

a. <u>Prioritize multi-benefit approaches that meet multiple needs at once.</u>
Realigning hydropower projects to their current and future public benefits is a multi-benefit approach. In the past hydropower revenues alone had to carry the other project benefits. The change in energy market conditions has made that business model untenable. Benefits provided to fisheries, water supply and recreation could be lost if projects are sold based upon the hydropower value model. Valuing and sharing costs among all of the project beneficiaries will create durable solutions for these watersheds.

b. <u>Encourage regional approaches among water users sharing watersheds.</u>
Many hydropower projects have inter-basin water transfers that are important for each affected watershed, for both fisheries and water supply.

c. <u>Strengthen partnerships with local, federal and tribal governments, water agencies and irrigation districts, and other stakeholders.</u>
Most of these relationships currently exist, but they are organized under the umbrella of the FERC hydropower license. Realignment can strengthen these relationships by securing the benefits desired by each of these groups.

3. Benefits and Impact.

Realigning hydropower will leverage the dramatic and inevitable shift in California's energy portfolio to remove or reconfigure non-economic hydroelectric projects on rivers that have high ecosystem and community value. The river restoration potential and water supply protection are substantial. Objectives include:

- Increased instream flows
- Fish passage to reconnect spawning habitat to the main stem of river systems
- Improved recreational opportunities
- Restored river channel habitat
- Restoring to good condition, upgrading, and maintaining water and power infrastructure that remains in service

In addition, preserving important associated water supply would have local economic benefits and enable flexibility in other parts of California's water system. Water from non-economic hydropower projects is at risk because of the uncertainty of their potential sale or decommissioning.
High priority projects for Realigning Hydro include:

- Decommission the Battle Creek Hydroelectric Project. This would return the full natural flow to Battle Creek, restoring an annual average of 42,000 acre-feet to the river and optimizing about 42 river miles of salmon and steelhead spawning, rearing and migration habitat. It would also protect the water supply to the Coleman Fish Hatchery, the most productive in the Sacramento Valley.
- Partially decommission and upgrade or reconfigure the DeSabla – Centerville Project. Protect about 40,000 acre-feet of agricultural water supply for Butte County annually, including import of about 30,000 acre-feet of cold water in summer and fall to Butte Creek to support the largest spring-run salmon population in California.
- Partially decommission and re-operate the Potter Valley Project. Restore access to 100-200 miles of salmon and steelhead habitat in the upper Eel River. Protect 50,000 to 70,000 acre-feet of water supply for Mendocino, Sonoma, and Marin counties.

4. Policy Actions.

California should make realigning hydropower an explicit priority policy initiative. As the first step in implementing the policy, the state should direct and fund the California Energy Commission (CEC) to produce a report that assesses:

- The annual economics (net income) of each hydropower project in California and identifies hydropower projects that operate at a net loss.
- The status of hydropower infrastructure and projects with significant aging and safety issues.
- For each project that operates at a net loss, the CEC should quantify other project values such as fisheries, consumptive water use, recreation, and local economic benefits that the project provides.
- Innovative solutions to address uneconomic hydro and aging infrastructure challenges, both on

a macro level and on an individual project basis.

- The state should direct the CEC to develop and review the report with support of an independent stakeholder advisory group of public and private participants, including the California Hydropower Reform Coalition (CHRC). The report should develop recommendations and propose solutions for realigning hydropower projects now operating at a loss. Solutions should emphasize multiple project benefits and should give priority to viable funding options, significant restoration benefits, improved safety, water supply benefits, and local economies.

The state should then create a stakeholder process to determine the long-term disposition of these non-economic projects that aligns with the report recommendations described above. This process would seek to protect and enhance the multiple benefits from these projects, including fishery protection, water supply, and recreation.

5. Cost.

The three uneconomic hydro projects we cite as examples above are costly for California in a number of ways.

The three projects are costing PG&E's ratepayers more than $15 million per year. Additionally, these projects exclusively produce baseload power, which is increasingly creating surplus of power at certain times in California power markets. This negatively impacts all other power producers in the state in the form of negative power pricing. There are also substantial indirect costs to the state and a number of third-party organizations.

The cost to decommission the Battle Creek Project is likely $100 million. The cost to partially decommission and to upgrade or reconfigure the DeSabla – Centerville Project is likely $50-100 million.

The cost to partially decommission and re-operate the Potter Valley Project is likely $200-400 million (the higher cost would include a yet-to-be-decided removal of Scott Dam and Pillsbury Reservoir). Finally, because the future of these projects is uncertain, the other resource values associated with these projects are at risk; water supply, fisheries, and recreation.

As an initial point of discussion, we recommend that existing operator PG&E, which seeks to end its ownership of these projects, contribute the equivalent of ten years of its operating losses to the realignment process.

6. Timeframe.

The long-term outcomes for the three projects described can be secured in four years. Actual implementation may take longer. Some benefits may be realized immediately by protecting water supplies for fisheries and consumptive water uses. PG&E's bankruptcy has made existing O&M on these projects tenuous.
These are not the only hydropower projects in California that are facing uncertain futures because of changing economic conditions. Creating a process with the projects highlighted above will provide a template for realigning other non-economic power projects.

7. Similar Case Studies.

The Hydropower Reform Coalition (HRC) has been involved in dozens of hydropower project decommissionings and dam removals across the country. Some of these have been confined primarily to removal of project features, dams, powerhouses, etc., while others have required significant efforts to protect affected resources

The Klamath Dam removal process is a specific example where the HRC and other stakeholders are protecting public trust resources by removing the project dams and allowing these fish to return to their historic habitats. At the same time, the process is also protecting consumptive water needs for agriculture in the Klamath Basin and protecting the recreation economy. Stakeholder engagement has been the key to success.

7 PRINCIPLES FOR STATE INVESTMENT IN CLIMATE ADAPTATION

By Deirdre Des Jardins (ddj@cah2oresearch.com) with input from the OWN team

For climate adaptation, the first priority of the state must be increasing resiliency of the existing built environment, and protecting vulnerable populations from catastrophic effects of climate change. Catastrophic climate change effects include severe droughts, river flooding, heat waves, fires, and inundation from sea level rise.[71]

The state must also invest in increasing resiliency of ecosystems in the face of climate change.[72]

- We must recognize that demand for funding for climate adaptation measures will exceed availability.
- We must ensure that the best available, independent science is used to evaluate proposed state investments in climate change adaptation, to ensure that those investments truly increase climate resiliency.
- We must develop clear, objective goals and priorities for state investment in climate adaptation, as well as criteria for evaluation of proposed projects. Clear and measurable targets must be set for Water Portfolio investments.[73]

1. Water Supply.

State water supply investments should prioritize public benefits such as increasing ecosystem resilience, and avoid subsidizing the cost of water, which indirectly subsidizes unsustainable patterns of use. State subsidies for water supply for disadvantaged communities should be targeted specifically at those communities.

Targeted funding should also be provided to reduce reliance on aquatic ecosystems and aquifers by investing in urban and agricultural conservation and efficiency and alternative water supplies.[74]

The state should evaluate current patterns of land use, including agricultural use, and ensure that state policies encourage uses that are sustainable and adaptive to climate change.[75]

2. Ecosystems.

For aquatic ecosystems to survive in the face of climate change and demand for new diversions, the state must ensure that there are adequately protective instream flow criteria. Quantifiable goals and deadlines should be set.[76]

[71] See OWN's recommendations on Climate Change – Flooding.
[72] See OWN's recommendations on Integrating SGMA investments with planning for land retirement and evaluating flood resilience projects for habitat and recharge benefits.
[73] See OWN's recommendations on Evaluating / Vetting (Adopt and Implement a Decision-Making Framework for Prioritizing Actions in the California Water Resilience Portfolio.)
[74] See OWN's recommendations on Water Rights for the Environment and Evaluating / Vetting.
[75] See OWN's recommendations on Agricultural Diversification.
[76] See OWNS's recommendations on Water Rights for the Environment and Evaluating / Vetting.

The state must prioritize climate adaptation measures that increase sustainability in the use of surface water and reduce impacts on aquatic ecosystems.[77]

For inundation due to sea level rise and river flooding, the state should prioritize pro-adaptive approaches which utilize natural infrastructure, where feasible.

3. Mitigation.

The Water Portfolio should address mitigation of greenhouse gas emissions as well as climate adaptation.[78]

[77] See OWN's recommendations on Efficiency in Agriculture, Urban Water Use Efficiency, Urban Wastewater Recycling, Water Recycling and Greywater, and Innovative Water Technology.
[78] See OWN's recommendations on Carbon Sequestration and Realigning Hydropower and Watershed Portfolios in a Changing Energy Landscape.

8 URBAN WATER USE EFFICIENCY

By Eric Wesselman (eric@friendsoftheriver.org)

Further advances in urban water use efficiency and conservation can reduce water demand, protect aquatic habitats, conserve energy, and reduce water pollution. Several actions can support these advances. Below are four of our priorities. Reduced water demand should be quantified and tied to meeting instream flow needs.

1. Ensure effective implementation of SB 606 and AB 1668.

A. Process.

1. **Agency Coordination** – The legislation directs the State Water Board to adopt water use standards and DWR to complete studies to inform the development of those standards. As of now, the timeline for DWR for completing the water use studies conflicts with the State Board's timeline for completing its CEQA process. To avoid unnecessary delays, it is imperative that the State Board and DWR closely coordinate on development of the studies and share the data in a timely manner so that appropriate follow up assessments can be conducted. For example, it appears that the State Board only received some of the details from the first aerial imaging studies when one of the water agencies involved in the study released the data at a public conference. As of May 20th, the full data sets had not been shared between the two agencies.
2. **Working Groups** – The structure of the workgroups prevents adequate participation by the NGO community and business representatives. One issue is that NGOs do not have enough staff resources to fully engage on each of the eight proposed workgroups. In addition, the CII performance measures are split among several workgroups that also include discussions of little importance to the business community. All elements of the CII performance measures should be combined into one working group to help get engagement from the business community.
3. **Public Input** - DWR has been advancing the landscape area measurement pilots without adequate stakeholder input. DWR has held one technical workgroup meeting to share the decisions they had made. Stakeholders from water agencies and NGOs expressed concern about the lack of input on these decisions. DWR promised to seek further input before moving forward with the next phases but has failed to do so.

B. Technical Issues – Landscape Area Measurement / Outdoor Water Standard.

1. **Definition of "Irrigable"**
   a. The legislation included the term "irrigable" for use in establishing the landscape area and ultimately outdoor water use. This term is not defined in the legislation or other statute. DWR staff has adopted a definition of "irrigable" area with little to substantiate its decision and has adjusted it several times to get a result DWR staff think is appropriate.

   b. DWR's current definition of "irrigable" area includes areas that are not currently irrigated but might be irrigated in the future. Based on the available data, this definition results in an outdoor water use objective far greater than actual outdoor water use. If instead "irrigable" area was defined as the area currently irrigated, the data show that the water use objective is much closer to actual water use. Moreover, it is much easier to estimate the area currently irrigated from the aerial imagery. Regular updates of aerial data could address concerns around the impact of future irrigated areas not captured in the initial landscape area measurement.
   c. DWR should simply define "irrigable" as "the area currently irrigated" and provide updated information in regular intervals to capture changes.

2. **Exclusion of Non-Single-Family Residential Landscapes**
   a. DWR has proposed only including single-family residences in its landscape area measurements, thereby excluding CII landscapes (including those with a dedicated landscape meter), some multi-family residences, and areas in residential areas not captured in individual parcels (e.g., parkways and common areas). This excludes significant areas of landscape that were intended to be part of the water use objective. These areas should be included in the landscape area measurements.
3. **Evapotranspiration (ET)**
   a. The outdoor water use objective will be determined by multiplying evapotranspiration (ET) by an adjustment factor and the landscape area (i.e., ET x ET adjustment factor x landscape Area).
   b. Reference ET provides an indication of plant water requirements, which can be met by rainfall or supplemental irrigation. Effective ET subtracts precipitation from the reference ET and represents the amount of supplemental water needed. We recommend that DWR share data about the impact of using reference and effective ET on the outdoor objective and use the number that (1) most closely reflects efficient water usage and (2) acknowledges that landscapes should not be irrigated when it rains.
4. **Aerial Imagery Should Be Used for Multiple Purposes**
   a. The aerial imagery being used to determine landscape area could be used for other purposes. For example, academic institutions and local governments are already working with aerial data to look at water quality issues, impact of land use on water demand, and locations for stormwater capture projects. Other agencies, such as the CPUC and CEC, might also have a need for the data. Using these data for multiple purposes would help to share the costs to collect and process the data among agencies. It may also allow for more regular updates of the data.
5. **Data Should be Made Readily Available**
   a. DWR staff has stated they intend to make the aerial imagery and landscape area measurement data available for a short period of time (i.e., 60 days). Per California's goals for data transparency under AB 1755, these data should be publicly available in perpetuity.

2. Enforce plumbing replacement deadlines in existing law.

SB 407 (2009), requires all inefficient plumbing fixtures in pre-1994 residential and commercial buildings in California to be removed and replaced by January 1, 2017, and January 1, 2019,

respectively. The Alliance for Water Efficiency calculates that there are likely up to 4 million inefficient toilets remaining in California homes. Replacing those toilets could produce 90,000 acre-feet per year for 20 years – a total of 1.8 million acre-feet – at a cost of $330 per acre-foot. Enforcement of SB 407 falls to building code officials in cases of buildings undergoing major renovations and additions. For all other existing buildings, enforcement responsibility is shared by cities, counties, and local water suppliers.

Few, if any, water suppliers or local governments have set out enforcement strategies to meet the plumbing replacement requirements of SB 407. In order to ensure that the water-saving goals of SB 407 are met, we recommend the following:

- Make plumbing replacement a statewide priority: DWR should include SB 407 implementation as a statewide priority in DWR's Integrated Regional Water Management (IRWM) Grant Program Guidelines.
- Develop and fund local compliance strategies: Each newly submitted IRWM Plan should be required to contain a compliance strategy of locally selected incentives and regulations sufficient to achieve SB 407's plumbing replacement requirements.
- Direct water suppliers to take the lead: SWRCB should adopt regulations directing water suppliers to require certification of inefficient fixture removal when a new customer seeks water service for a pre-1994 building, and to assist low-income property owners in removing and replacing inefficient fixtures.
- Fund a toilet retrofit program for low-income residents. The State should fund a targeted statewide toilet retrofit program for low-income customers, affordable housing units, and disadvantaged communities.
- Designate continued use of inefficient plumbing fixtures as wasteful and unreasonable use of water: In light of the widespread availability of water-efficient plumbing fixtures at reasonable costs, the SWRCB should make a finding that the continued use of inefficient plumbing fixtures in pre-1994 residential and commercial buildings after January 1, 2020 constitutes waste and unreasonable use of water.

3. Strengthen building and plumbing codes.

New or strengthened provisions for water efficiency should be added to the California Plumbing Code, as well as to the California Energy Commission's Title 24 building standards and Title 20 appliance standards. Stronger requirements for hot water piping can reduce the waste of energy and water when showers and faucets are left to run until water is hot enough to use. Appliance and equipment standards should be established or strengthened for faucets, urinals, commercial dishwashers, car washes, and landscape system components, among others.

4. Provide financial and regulatory support to speed the transition to efficient home appliances, especially clothes washers.

Clothes washers on the market today use significantly less water and energy than older clothes washers. Accelerating the transition to high-efficiency clothes washers would result in immediate water and energy savings and help households to reduce water consumption during the drought. Utility rebates ($35 to $75) are currently being offered by energy utilities throughout the state. In some areas, water utilities offer additional incentives, but these often times require a separate

application. The CPUC should encourage all regulated utilities to expand their marketing and promotion of clothes washer rebates, and to better integrate these incentives with similar programs offered by water suppliers in their respective service territories. The CPUC should also target energy savings from cold water conservation programs. The State Board should adopt parallel requirements for publicly-owned water suppliers. This initiative should be complemented with expanded appliance recycling programs to ensure that old, inefficient clothes washers are permanently removed from service and cannot be refurbished or resold.

9 WASTEWATER RECYCLING AND ONSITE REUSE

By Eric Wesselman (eric@friendsoftheriver.org)

Potable and onsite water reuse are significantly under tapped sources for water supply in California. The Water Resilience Portfolio should take advantage of this sustainable water supply by:

- Setting statewide standards to increase recycling of treated wastewater for potable and onsite water reuse.
- Increase funding and prioritization for direct and indirect potable reuse and recycling projects through the State Revolving Loan Fund (not purple pipe).
- Create a favorable regulatory setting by:
  - Adopting regulations for direct potable reuse by the mandated deadline of 2023.
  - Creating a model water reuse ordinance as the state did for landscape water.
  - Establishing design requirements for municipal stormwater retention for water quality and supply.

By 2050, this proposal would yield more than 2 MAF/year, on top of other urban water efficiency measures. At least half of this water should be dedicated to meeting instream flow needs.

1. Multiple benefits of water recycling and reuse.

With today's technologies water recycling and reuse can:

- safely and sustainably increase water supply
- reduce water pollution
- increase local self-reliance for water
- reduce energy use and GHG emissions
- provide water for wetlands and riparian habitats
- decrease the diversion of water from sensitive ecosystems
- support economic development by leveraging innovative technologies

2. Water Recycling.

California's wastewater has historically been treated solely as waste: used once, treated, and then disposed of through offshore dumping. As a result, approximately 400 billion gallons of treated water are discarded into the ocean or California estuaries annually (1.2 million acre-feet/year).[79] Instead, this water should be recycled and used for beneficial purposes such as agricultural and landscape irrigation, industrial processes, toilet flushing, replenishing groundwater basins and surface water augmentation. Recognizing the potential, the State of Florida will prohibit ocean discharges from wastewater treatment plants in South Florida after 2025 – finding that "the discharge of domestic wastewater though ocean outfalls wastes valuable water supplies that should be reclaimed for beneficial purposes."[80] California can and must follow suit.

[79] https://www.nrdc.org/experts/drevet-hunt/local-water-reliability-act-fortifies-coastal-water-supplies.
[80] Fl. Ann. Stat., Title XXIX, §§ 403.089(9), (9)(c)(2).

3. Site Specific Water Reuse.

More than 4 million acre-feet (MAF) of potable water—10 percent of water used by people in California—is used to irrigate landscapes in urban areas.[81] Site specific water reuse should provide a much greater share of this supply while landscape conversion and other efficiency efforts reduce overall demand for outdoor irrigation. Reusing water reduces the use of potable water for irrigation and/or indoor use. Examples of water that can be reused onsite include graywater from laundry, shower, and lavatory discharge, rainwater, stormwater, blackwater, condensate and foundation drainage. In addition to providing water for irrigation, onsite water reuse can be used for toilet flushing, commercial processes and cooling towers.

4. Governance.

In 2014, all authority and responsibility for the state's drinking water programs, including the recycled water program, were transferred from the Department of Public Health to SWRCB (Health and Safety Code §1116271).

Residential graywater systems are regulated by the Department of Housing and Community Development (HCD) which creates building standards for the construction, installation, and alteration of graywater systems for indoor and outdoor uses.

5. Challenges.

Despite the benefits, California has persistently failed to meet recycling targets and goals, which were first set in 1977, and again in 1991, 2003, and 2009 (Figure 1). This is mainly due to a lack of financial incentives and regulatory drivers to invest in recycling where historical water rights are secure. For example, the Bay Area has not invested significantly in water recycling compared to Southern California, because water rights in this region are fairly strong. Even where significant investments in water recycling have been made, such as southern California, much more can be done to limit the discharge of treated and untreated wastewater.

Other obstacles to expansion of water recycling include limited access to low-interest SRF funds, where recycling proposals far outstrip available funding, as well as regulatory uncertainty surrounding State Water Board support for potable reuse.

Onsite water reuse exists largely as a cottage industry that suffers from a regulatory patchwork of municipal standards and unfamiliar regulators at the municipal level. There is also a need to reduce the number of non-compliant graywater systems by making legal compliance more easily achievable, provide guidance for avoiding potentially unhealthful conditions, and provide an alternative way to relieve stress on private sewage disposal systems by diverting graywater.

[81] https://pacinst.org/wp-content/uploads/2014/06/ca-water-urban.pdf.

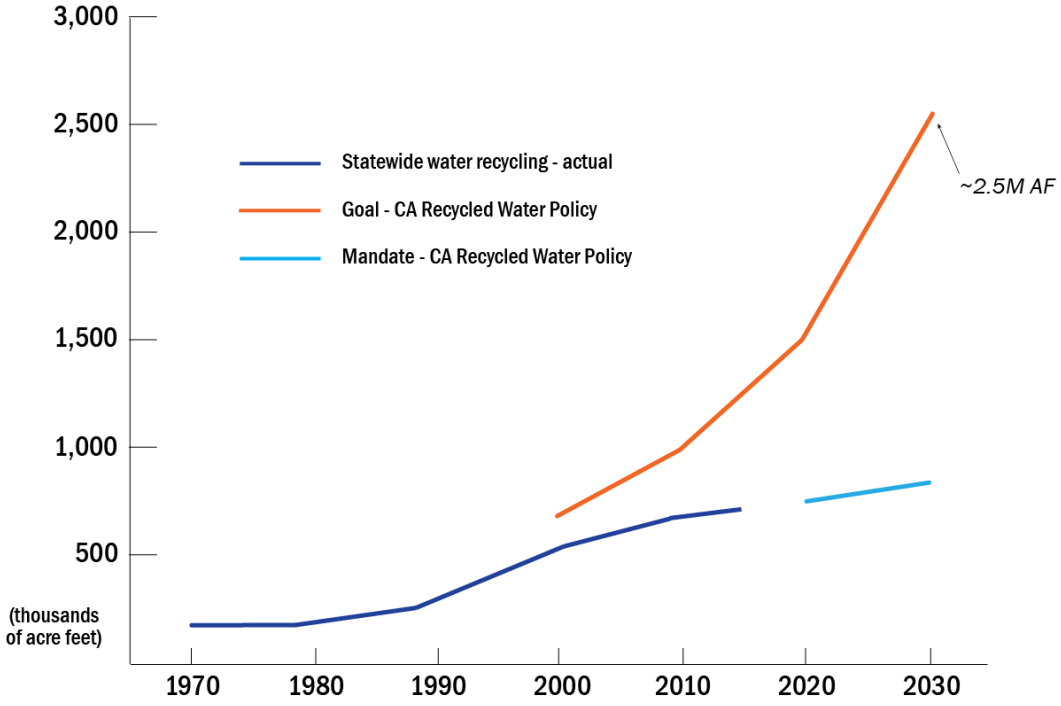


Figure 1. California's 2009 Recycled Water Policy Goals versus actual recycling rates.

6. Proposal.

Governor Newsom's Water Resilience Portfolio should increase the state's reliance on local water recycling and reuse and dedicate a portion of conserved water from natural sources to meeting instream flow needs.

1. Wastewater Recycling.

a. Set a statutory standard that wastewater treatment facilities reduce the volume of treated wastewater discharged into the ocean by 50% by 2025, 75% by 2035, and 100% by 2040; and prohibit new or expanded ocean outfalls immediately.
b. Require feasibility studies by non-importing water suppliers, to evaluate opportunities and benefits of using recycled water for agriculture or potable use, compared to any beneficial uses supported by the discharge of treated wastewater to non-marine receiving waters.
c. Supplement the State Revolving Fund (SRF), address the backlog of SRF funding, and accelerate the implementation of potable reuse projects languishing in the planning phase.
d. Ensure the State Water Resources Control Board is adequately resourced to put regulations for direct potable reuse in place by the mandated deadline of 2023.

2. Onsite and Neighborhood-Scale Reuse.

a. Set a statutory standard for municipalities and/or urban water agencies that 30% of urban residential, commercial, and institutional landscapes be irrigated with non-potable or recycled water by 2030, 40% by 2040, and 50% by 2050.
b. Update the state's definition of graywater to allow for the reuse of kitchen sink water.

- State should rewrite the definitions of graywater to separate "dark graywater" from "graywater" Amend Section 17922.12 of the Health and Safety Code.
- State legislation to define “dark graywater” so that it includes untreated wastewater from kitchen sinks or dishwashers that has not been contaminated by any toilet discharge, has not been affected by infectious, contaminated, or unhealthy bodily wastes, and does not present a threat from contamination by unhealthful processing, manufacturing, or operating wastes.
- Require HCD, at its next triennial building standards rulemaking cycle, to develop and submit for approval building standards for the construction, installation, and alteration of dark graywater systems for indoor and outdoor uses.

c. SWRCB conduct a statewide water audit and onsite water reuse feasibility study for state-owned buildings and update to water-sense standards so the state leads by example (see City of Los Angeles water efficiency ordinance).
d. Improve and expand MWELO to encourages onsite reuse of rainwater and graywater.
   - Require all state-owned properties to comply with MWELO by 2035 (exceptions for sports fields, and high-use grass areas in parks, etc.)
   - MWELO requirements in place for all front yards landscapes, regardless of size of yard, by 2040 to make a significant culture shift in landscaping and prevent the overspray onto sidewalks
   - Amend 23 CCR § 492.13 on Irrigation Efficiency to state “new technologies that can demonstrate higher irrigation efficiencies are allowed provided the applicant attaches 3rd party independent data showing irrigation efficiency (IE) for that new technology.” Currently, to determine Estimated Total Water Use, average irrigation efficiency is assumed to be 0.75 for overhead spray devices and 0.81 for drip system devices. Having only two choices drip or overhead spray kills innovations that could save California water. It provides an unintended disincentive to innovate since any new technology will be lumped into one of those two groups and suffer the same efficiency number.
e. Develop a model ordinance for onsite water reuse—The Governor or the State Legislature direct the SWRCB, Department of Housing and Community Development (HCD), the Building Standards Commission, local agencies, and NGO stakeholders to draft a set of model local water reuse ordinances for new and existing construction which would provide a consistent policy baseline in the same way as the Model Water Efficiency Landscape Ordinance. A model graywater ordinance for new construction should draw from related existing ordinances from the San Francisco Public Utilities Commission, City of Los Angeles, and City of Tucson’s Ordinances 10579 and 11089 to:
   - Streamline the permitting process by requiring a single point of contact for customers/developers to obtain graywater related permits from the authority having jurisdiction and require local jurisdictions to provide information about graywater reuse through the building department or water agency.
   - Require or create model ordinance for dual-plumbing in new single-family homes to collect graywater separately from blackwater (“graywater ready”), based on design guidelines from the Decentralized Water Policy Council's model ordinance.
   - Incentivize and/or require blackwater reuse in new commercial and large multi-family residences.
   - Require separate water meters for outdoor water use and submetering for multi-family and commercial tenant space

- Requiring smart hot water design that limits the volume of water delivered to any fixture to 0.6 gallons before hot water arrives.
- Statewide water audits for state-owned large buildings (modeled after city of Los Angeles ordinance)
- Require Landscape water audits to be conducted on large properties to encourage irrigation and landscape improvements)

f. Stormwater—The SWRCB should:

- Establish requirements for municipal stormwater retention for water quality and supply that reaffirms municipalities' legal obligation to achieve water quality standards and TMDLs. Municipalities should retain 100% of non-stormwater runoff; retain where feasible the runoff produced by rainfall up to and including runoff from the 85th percentile, 24-hour storm event for each watershed management area, and treat any additional runoff not retained to that level. Where identified as feasible, particularly in areas of the state with strong groundwater recharge potential, the State Board should require retention of the 90th or 95th percentile, 24-hour rain event.
- Incentivize front yard rain gardens to manage stormwater and create landscapes that don't require irrigation once established.

3. **Overlapping**—State budgeting for SWRCB to conduct a public education and outreach program to build awareness that water recycling and onsite reuse can provide a safe, reliable, and sustainable water supply for California. The program should provide resources and materials for consumers and installers and include a training component for local officials in planning and permitting offices.

7. Conclusion.

Wastewater recycling and onsite water reuse present an opportunity for urban communities to secure local water sources for a growing population and an expanding economy. As the Governor considers a suite of efforts to address California's water crisis, this proposal represents a critical step in securing a water source long recognized as essential to statewide sustainability.

10 CLIMATE CHANGE: FLOODING AND ADAPTIVE MANAGEMENT OF RESERVOIRS

By Deirdre Des Jardin (ddj@cah2oresearch.com) and Ron Stork (rstork@friendosftheriver.org)

Climate change will bring increased frequency of flooding to the Central Valley. This will have a major impact on the efficacy and sometimes survivability of existing flood control infrastructure. To manage and mitigate such risks, major investments will need to be made.
One Water Network recommends the Water Portfolio prioritize addressing "water stress" on vulnerable communities in California. The US Water Alliance defines "water stress" as including impacts of flooding and sea level rise as well as inadequate access to drinking water and wastewater services, and water pollution.[82]

1. Background: Increased Flood Flows in the Central Valley.

Climate modeling shows that the biggest changes in flood flows will be in the San Joaquin River basin and tributaries including the Tulare Lake Basin, which currently discharges Kings River floodwaters into the San Joaquin River. The reason is that the headwaters of the San Joaquin River and Tulare Lake basins are at high elevation, and runoff in most watersheds is currently dominated by snow accumulation and snowmelt. Above 10,000 feet, large storms with rainfall have rarely occurred in the winter months.
Climate change models for the 2017 Central Valley Flood Protection Plan Update[83] showed 10-20% increase in 200-year flood flows in the Sacramento Valley in the near term (2011-2040), and 35-50% by 2041-2070. (See figures below.) Increases in inflows in the Sacramento basin are smaller.
The Central Valley Flood Protection Plan (CVFPP) modeling does not include changes in atmospheric rivers. Modeling by NASA's Jet Propulsion Laboratory (JPL) projects that atmospheric rivers will be about 25% longer and 25% wider in the future.[84] Daniel Swain has estimated that there is a greater than 50% chance of an ArcStorm-like event by 2060. [85] (The ArcStorm is a USGG-developed hypothetical 1862-like storm applied statewide.)

[82] US Water Alliance, *An Equitable Water Future: A National Briefing Paper*. Available at https://kresge.org/sites/default/files/library/equitable-water-future-us-water-alliance.pdf.
[83] Draft Central Valley Flood Protection Plan -- Climate Change Analysis Technical Memorandum. March 2017. Available at http://cvfpb.ca.gov/wp-content/uploads/2018/03/Draft-Central-Valley-Flood-Protection-Plan-Climate-Change-Analysis-Technical-Memorandum.pdf.
[84] Espinoza, V., D. E. Waliser, B. Guan, D. Lavers and F. M. Ralph (2018). "Global Analysis of Climate Change Projection Effects on Atmospheric Rivers." Geophysical Research Letters 45: 10.1029/2017GL076968. Available at https://agupubs.onlinelibrary.wiley.com/doi/abs/10.1029/2017GL076968.
[85] Swain, D.L., Langenbrunner, Neelin, J.D. & Hall, A.,"Increasing precipitation volatility in twenty-first-century California," *Nature Climate Change v. 8*, p. 427–433 (2018) Available at https://www.nature.com/articles/s41558-018-0140-y.epdf.

Climate Change Analysis – Phase IIB

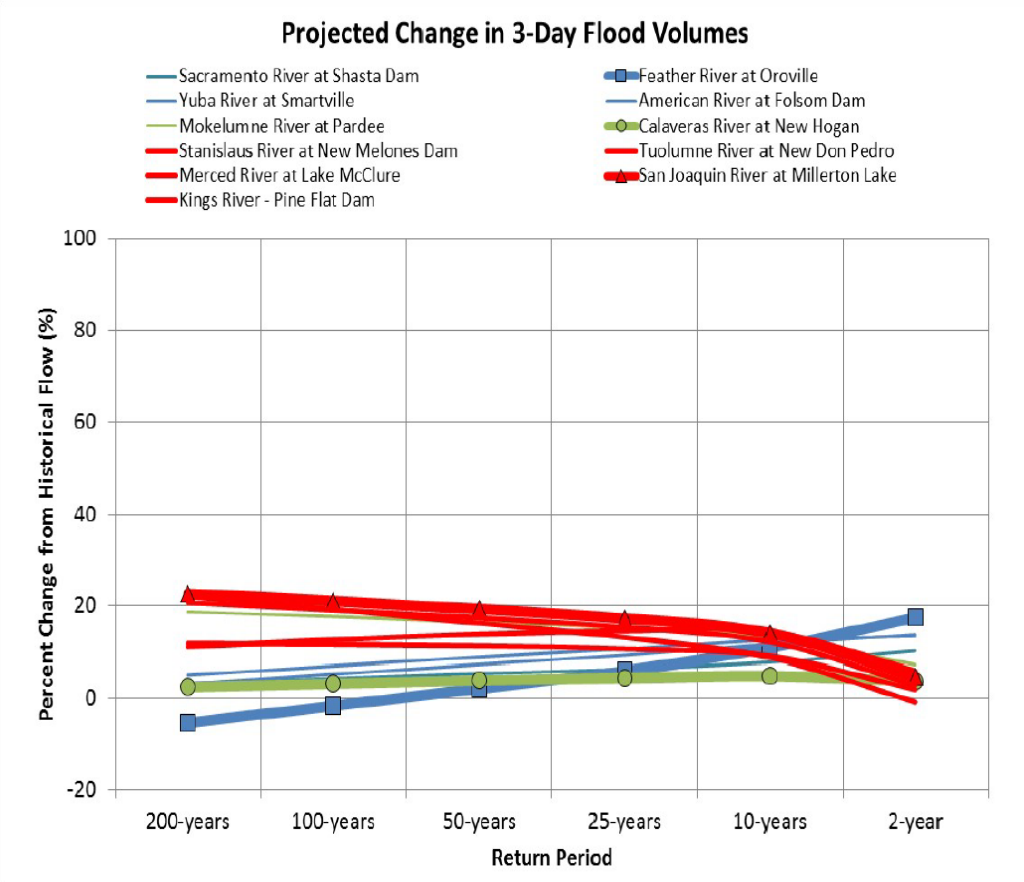


Figure 37. Changes in 3-day Flood Magnitudes with Different Return Periods under the 2011-2040 (2025) Climate Change Scenario

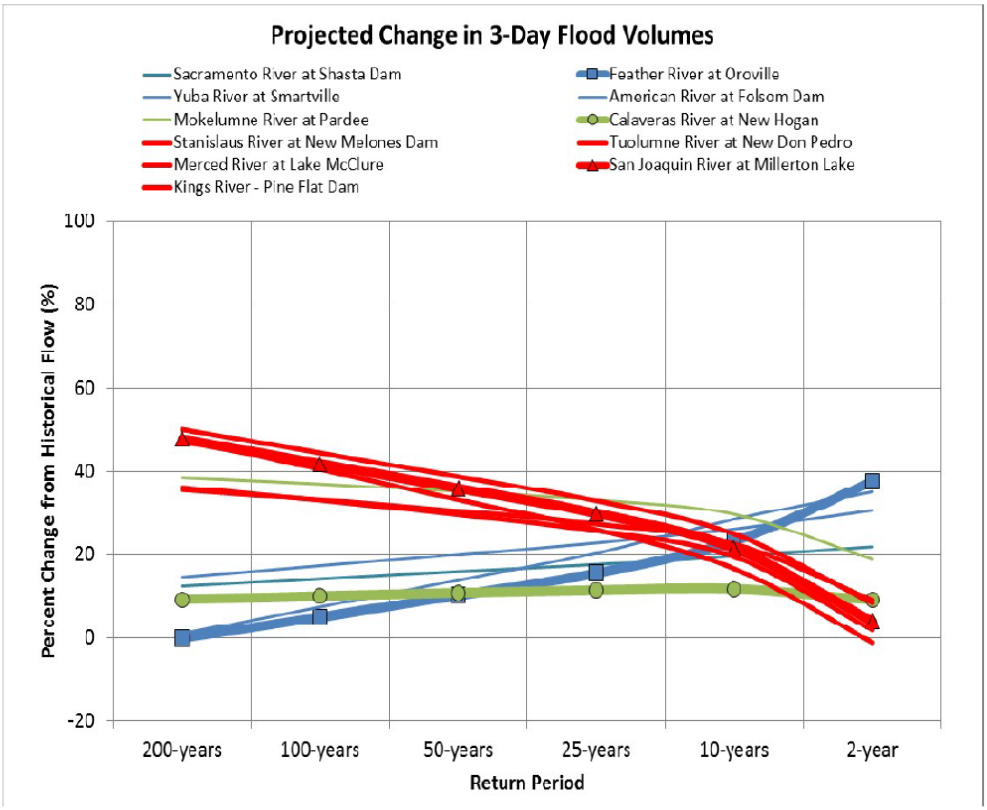


Figure 38. Changes in 3-day Flood Magnitudes with Different Return Periods under the 2041-2070 (2055) Climate Change Scenario

2. Recommendations for Adaptation.

Increased flood flows will pose significant risks, particularly in the San Joaquin Valley. The risks extend to both rim dams around the Valley and ill-prepared downstream floodplains. We recommend re-evaluation of spillway-design-flood inflows and outflows and release capacity for all existing Division of Safety of Dams (DSOD) jurisdictional dams in California in light of new climate change modeling, prioritized by risk of loss of human life and infrastructure. Legislation and funding should be provided for the Division of Safety of Dams to conduct dam safety reviews for revised extreme flood inflow estimates and to make orders resulting in necessary spillway capacity and other safety improvements.
Increased and more frequent flood flows also require re-evaluation of the design flood used for reservoir-based flood management, as well as the size of downstream floodways, from the headwaters to floodplain storage areas and to the ocean. For each watershed, there must be a comprehensive evaluation of measures needed to right-size future flood management. These measures may include revised reservoir regulation manuals, increased effective flood reservations, floodplain buffering, increased low-level dam outlet-work capacity, improved floodplain management and floodplain-infrastructure resilience, and improvements to downstream physical and natural infrastructure.
To avoid unacceptable flood impacts, funding for maintenance and improvements of existing flood control infrastructure must be greatly increased. An interagency work group estimated a shortfall of

$100 million a year for long-term funds for operations, maintenance, repair and rehabilitation of State Plan of Flood Control Levees. The estimate did not include addressing deferred repair, rehabilitation and replacement needs, which were estimated to cost another $38-47 million annually. [86] Nor did the estimate include needed upgrades to withstand increased flood flows due to climate change.
Non-project levees in the City of Stockton and the Sacramento-San Joaquin Delta also need upgrades to deal with sea level rise and increased flood flows.[87] Stockton is the 13th largest city in the state of California and has significant known flood risks.[88]
California must not continue to defer protection of vulnerable communities in the state from flooding. With climate change, the consequences could be catastrophic.

3. Adaptive Reservoir Operations.

With a warming climate, more precipitation is falling as rain rather than snow. This may require increased reservoir flood reservations to maintain acceptable levels of downstream flood control. Forecast-Informed Reservoir Operations (FIRO) allow existing reservoirs to store more water than would otherwise be achievable. This is achieved by conditional encroachment into flood reservation space in reservoirs based on short term weather forecasts. FIRO is being actively studied, and has quite recently been implemented at Folsom Dam, which had its effective flood reservation increased in 1995-96. Because Folsom had increased spillway capacity, it has allowed a new flood management manual with more flexible operations. These operations must only be considered for dams which have sufficient release capacity and downstream floodway and floodplain capacity to rapidly recover flood reservation space. We recommend that suitable candidates be evaluated for implementing FIRO *after* flood reservation requirements have been "trued-up" for expected increased inflows due to climate change. We also recommend fully funding the Integrated Forecast and Reservoir Management (INFORM) system as a systemwide risk-informed management tool. INFORM was developed by the Hydrologic Research Center in San Diego in coordination with the Department of Water Resources. INFORM projects a set of likely inflows to major reservoirs in the Sacramento Valley from NWS forecasts and develops risk-based tradeoffs for the management of the system.[89] While long-term forecasts have been implemented, short- and medium-term forecasts, which are essential for basin-wide management of flood flows, still need to be implemented. The integrated forecasting system also needs to be extended to the San Joaquin Valley.

[86] Department of Water Resources, Draft Technical Memorandum: Flood System Long-Term Operations, Maintenance, Repair, Rehabilitation, and Replacement Cost Evaluation, January 2017. Available at https://water.ca.gov/LegacyFiles/cvfmp/docs/OMRRR_TM_Jan_2017.pdf.
[87] Restore the Delta, Climate Equity and Seismic Resilience for the San Francisco Bay-Delta Estuary, August 2019. Available at https://www.restorethedelta.org/wp-content/uploads/RTD_Climate_Equity_Report_2019_Final.pdf.
[88] U.S. Army Corps of Engineers, Lower San Joaquin River Feasiblity Study, July 2018. Available at https://www.spk.usace.army.mil/lower_sj_river/.
[89] For more information on INFORM, see https://www.hrcwater.org/projects/project-2/.

11 INTEGRATE SGMA INVESTMENTS WITH PLANNING FOR LAND RETIREMENT AND EVALUATE FLOOD RESILIENCE PROJECTS FOR HABITAT AND RECHARGE BENEFITS

By Fran Spivy-Weber (frances.weber@gmail.com),Tom Biglione (ftbiglione@gmail.com), Deirdre Des Jardin (ddj@cah2oresearch.com), and Ron Stork (rstork@friendoftheriver.org) with input from others.

1. Brief description.[90]

Integrate SGMA investments with planning for retirement of degraded lands in the San Joaquin Valley and Tulare Lake Basin. Where land is going out of production due to drainage impairment and soil salinization, major new investments in storage and conveyance for groundwater recharge make little sense. On the San Joaquin River, some flood resilience projects could enhance habitat for wildlife and provide recharge benefits by restoring floodplains.

2. Relevance to Executive Order.

This proposal is a multi-benefit approach, considering natural processes and climate change. The focus is regional.

3. Positive Transformative Impacts.

Planning for land retirement in the San Joaquin and the Tulare Lake Basin will reduce impacts of increased demand on surface waters due to SGMA and provide for upland habitat restoration for endangered species. It will also allow the state to address environmental justice issues created by land fallowing.

By evaluating multi-benefit projects on the San Joaquin River, the projects can be tested for their ability to achieve multiple purposes— increased habitat through increased flows and more complexity from broadened waterways, more flood protection, seasonal wetlands, and reduced cost to build and maintain new engineered flood levees, as well as recharge of aquifers. The Tulare Lake bottom and its immediate upland areas also provide opportunities for integrating local and regional flood protection with surface supplies and groundwater recharge, combined with expansion of seasonal and permanent wetland habitat.

4. Background.

On the west side of the San Joaquin Valley and in the Tulare Lake Basin, a UCANR study of remote sensing data from 2007 to 2013 found that 955,000 acres of land is now moderately to extremely

[90] For additional resources, *see* USDA Salinity Laboratory, The Nature Conservancy, Luke Wang at CSU Fresno, Gary Bobker, Jeff Mount at the PPIC, Paula Landis, Region 5 of the Water Boards. A good book for appreciating this area is *The Dreamt Land* by Mark Arax.

saline.[91] The State Department of Land Conservation also has reported that 276,000 acres of land were fallowed in the San Joaquin Valley between 2006 and 2012 (net change.).[92] There has been no assessment of the locations and causes of the land fallowing, or if there has been transfer of surface water used for irrigation.

On the east side of the San Joaquin Valley, the 2017 Central Valley Flood Protection Plan Update has identified 12 sites for small scale levee setbacks and floodplain storage (see map on next page).[93] Pilot implementation of some of these small scale projects can test the ability to integrate purposes—recharge of aquifers, increased habitat through increased flows and more complexity from broadened waterways, more flood protection, seasonal wetlands, and reduced cost to build and maintain new engineered flood levees.

5. Mechanisms.

1. **Land fallowing and habitat restoration**. Funding should be provided for the Department of Conservation to assess current farmland mapping data for changes in farmland status, and to correlate farmland mapping data with remote sensing of soil salinity. The Department of Fish and Wildlife should be funded to work with NGO and local stakeholders to identify opportunities to acquire blocks of fallowed land for upland habitat restoration.[94] Funding should also be provided for the Water Board to develop mapping of serial and long term water transfers in the Central Valley and better information for evaluating cumulative environmental and socioeconomic impacts.

2. **Natural flood resilience and recharge.** Funding should be provided for the Department of Water Resources and the Central Valley Flood Protection Board to refine and further develop the San Joaquin Valley Basinwide Feasibility Study. (See One Water Network's recommendations on climate change and flooding.) Once priority projects for flood management are identified, an interagency Task Force could work with stakeholders to evaluate additional benefits from natural infrastructure projects – including the levee setback and bypass projects in the 2017 CVFPP update.

6. Costs.

One Water Network supports allocation of costs by project purposes: flood control, habitat enhancement, and recharge. The cost of purchasing easements will depend on the value of the

[91] Scudiero E, Corwin D, Anderson R, Yemoto K, Clary W, Wang Z, Skaggs T. 2017. "Remote sensing is a viable tool for mapping soil salinity in agricultural lands." Calif Agr 71(4):231-238. Available at http://calag.ucanr.edu/Archive/?article=ca.2017a0009.

[92] California Department of Conservation, Farmland Conversion Reports. The last report used data from 2010-2012. See https://www.conservation.ca.gov/dlrp/fmmp/Pages/Farmland%20Conversion%20Reports.aspx.

[93] California Department of Water Resources, Central Valley Flood Protection Plan, 2017 Update. Available at http://cvfpb.ca.gov/cvfpp/.

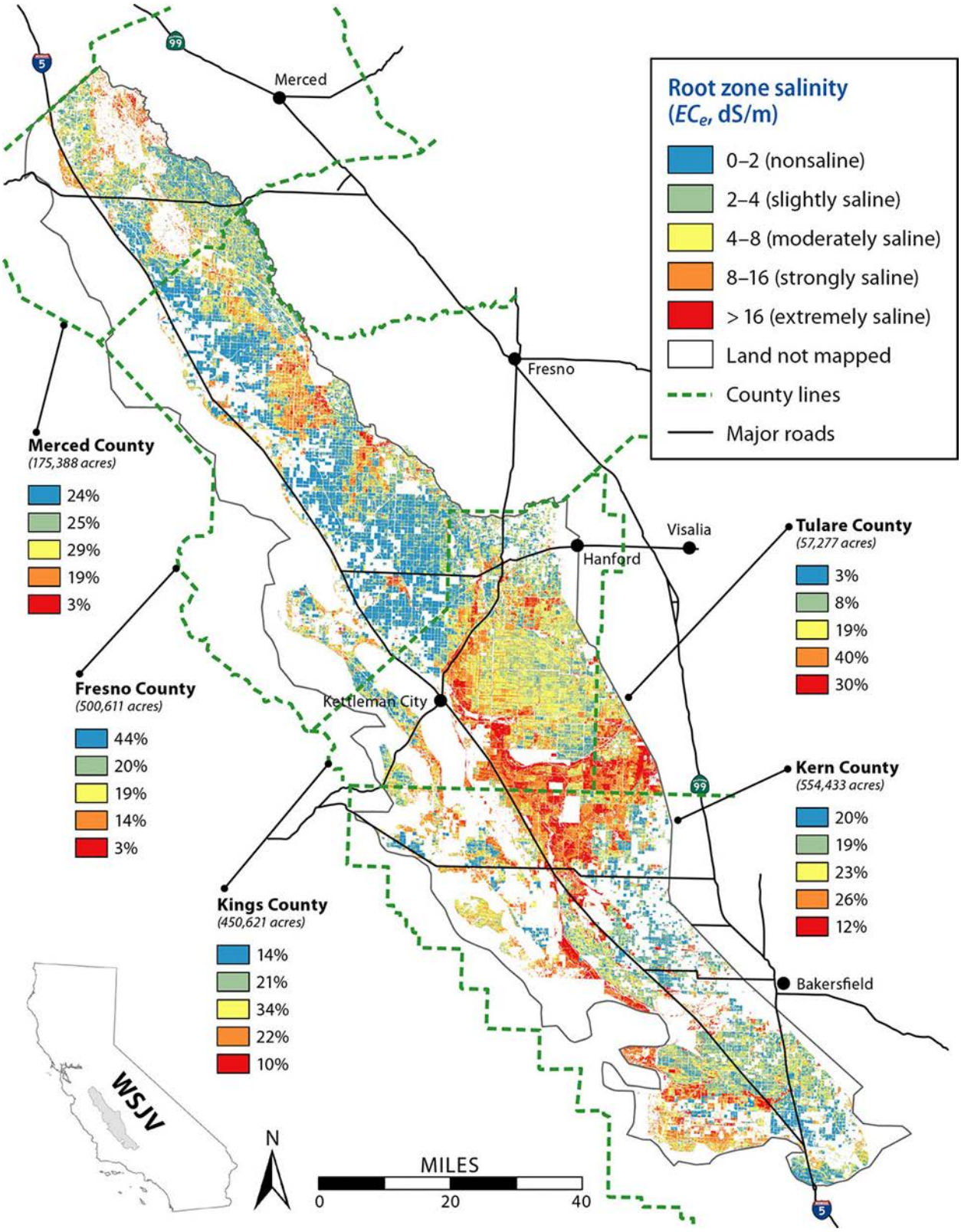
[94] The Nature Conservancy has identified 2.5 million acres of land suitable for strategic retirement. See Butterfield, H.S., R. Kelsey, A. Hart, T. Biswas, M. Kramer, D. Cameron, L. Crane, and E. Brand. 2017. Identification of potentially suitable habitat for strategic land retirement and restoration in the San Joaquin Desert. The Nature Conservancy, San Francisco, California. 25 pages. Available at https://www.scienceforconservation.org/assets/downloads/SLR-Habitat_-2017-lo.pdf.

farmland. Incentives to farmers may increase the number of areas available but incentives may also increase the cost.

7. Timeframe.

In four years, the Department of Land Conservation can update farmland mapping and the State Water Resources Control Board can develop maps of long term water transfers. The Department of Fish and Wildlife can identify opportunities to acquire blocks of land for upland habitat restoration. The Central Valley Flood Protection Board and the Department of Water Resources refine and further develop the San Joaquin Valley Basinwide Feasibility Study and the Task Force can evaluate benefits from natural infrastructure projects. Pilot projects can be identified.

In eight years, blocks of retired farmland can be acquired and restored and San Joaquin River pilot projects can be near completion.



Map of SJV soil salinity. Source: USDA Salinity Laboratory, see Scudiero et. al. (2017.)

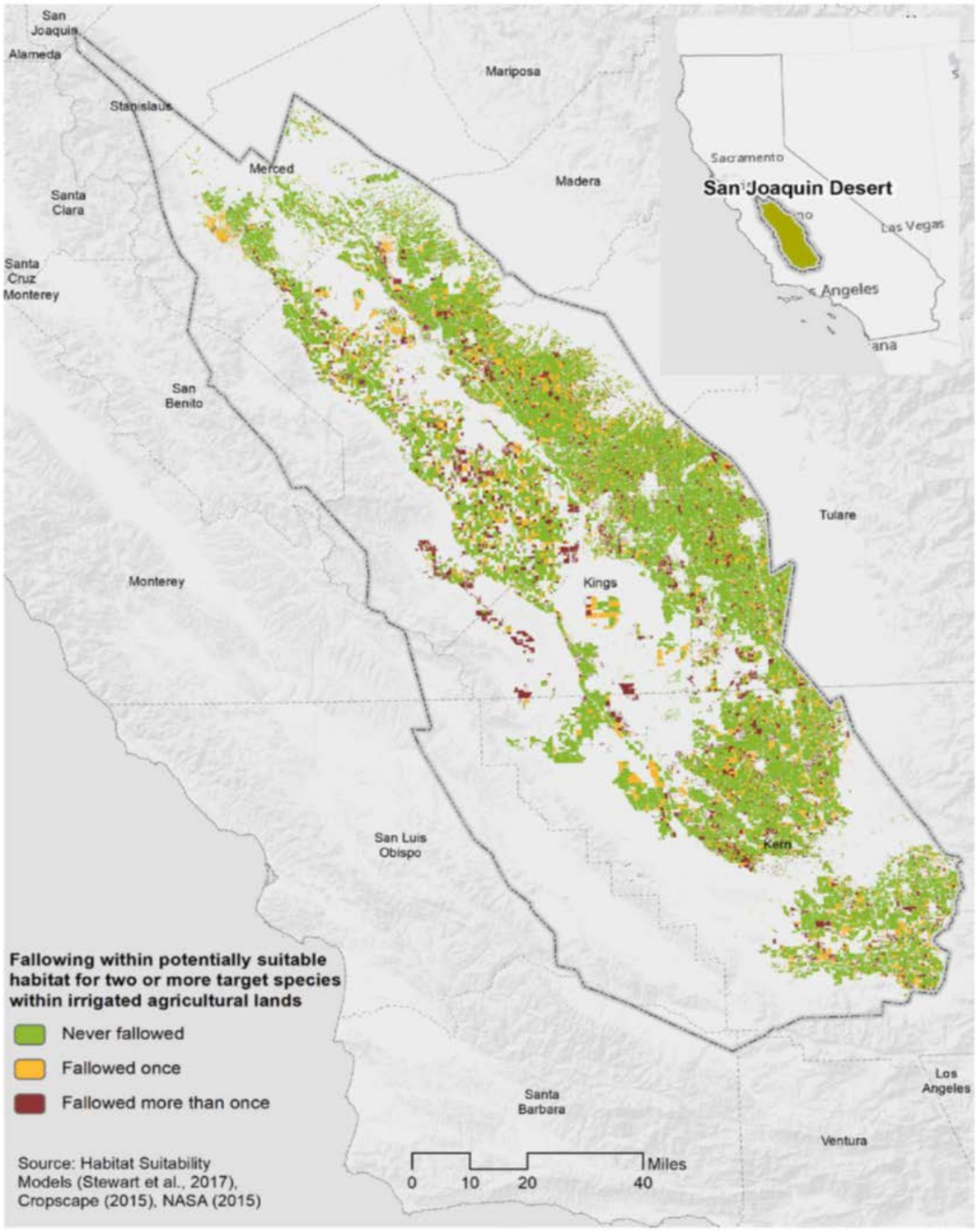
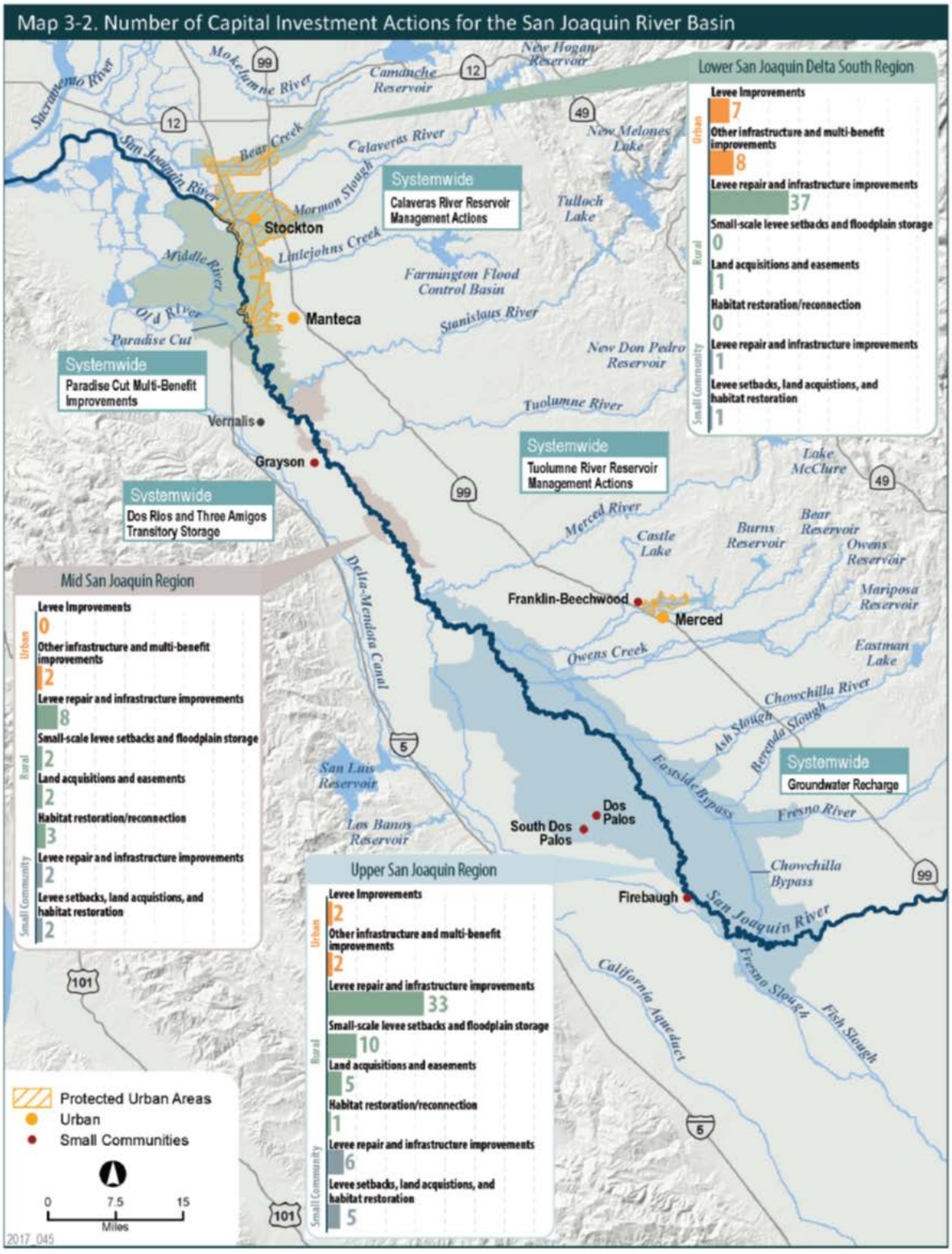


Figure 6. Fallowing within potentially suitable habitat for two or more target species within irrigated agricultural land. Fallowing data was available for 2011, 2013, 2014, 2015, 2016.

Map of SJV fallowed land suitable for habitat. Source: Nature Conservancy, Butterfield et. al. (2017.)



Map of potential SJV flood investments. Source: 2017 CVFPP Update, p. 69.