

Re-optimizing Water Management for Environmental Performance ?

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DIVIDING THE WATERS X

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Appropriative Rights

“All water within the State is the property of the people of the State, but the right to the use of water may be acquired by appropriation in the manner provided by law.”

(Calif. Water Code § 102)



What is the “manner provided by law?”

Physical Diversion or Control

Hence: **No instream appropriations**

(Fullerton v. SWRCB (1979) - DFG has no authority to appropriate water to protect fisheries; California Trout v. SWRCB (1979) (conservation organization similarly may not appropriate water for instream uses))

THE PAST



METHODS FOR REALLOCATING WATER FOR ENVIRONMENTAL NEEDS: The Tool Kit

- **Regulatory:**
 - FERC (re)licensing
 - ESA
 - Clean Water Act – Physical availability as a water quality parameter (PUD # 1 of Jefferson County v. DoE)
- **Property rights-based limitations on appropriations:**
 - Public Trust Doctrine
 - Reasonable Use Doctrine
- **Statutory reallocations:** e.g. CVPIA
- **Market transactions:**
 - Purchases / Transfers of Instream Flow Rights



THE PROBLEM:

- **These are all “Zero-Sum” Tools**
- **They freeze the status quo: protection rather than restoration**

The Future

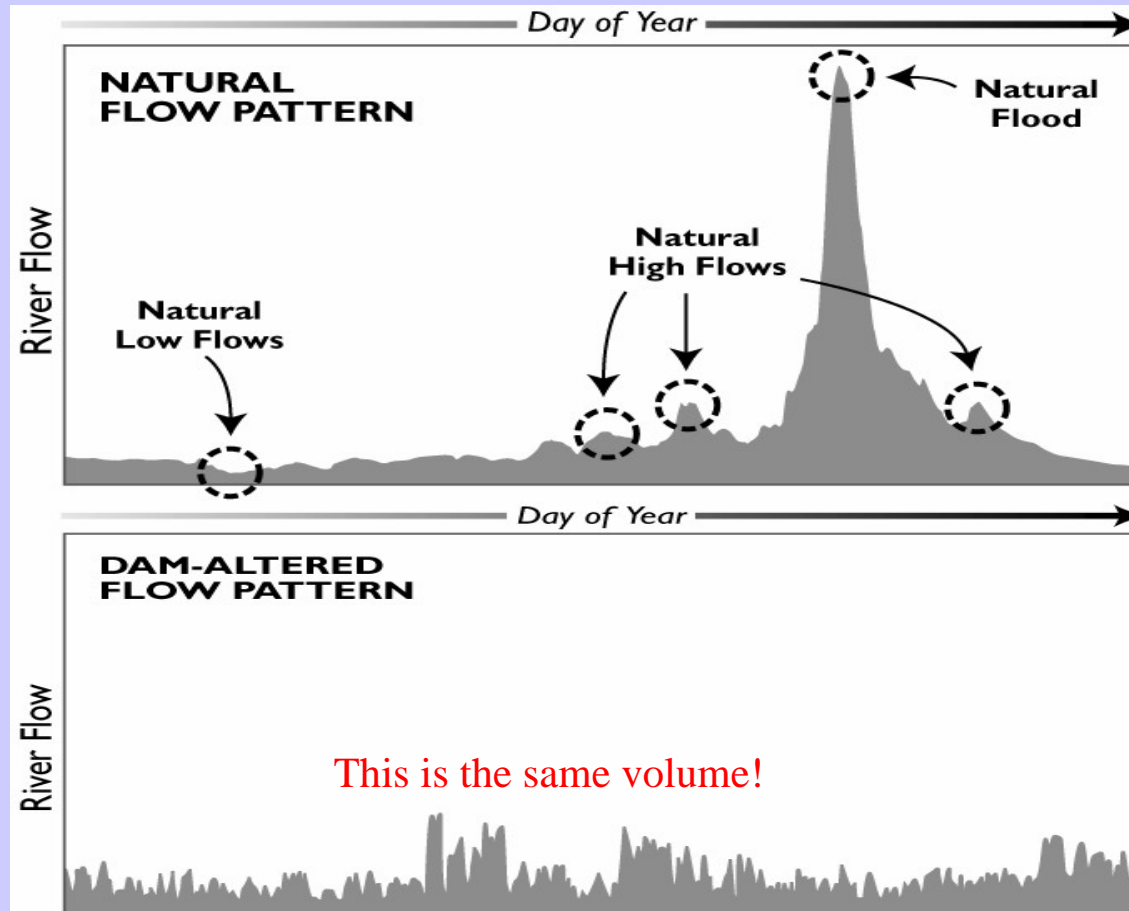


METHODS FOR "RE-OPTIMIZING" WATER MANAGEMENT FOR ENVIRONMENTAL PERFORMANCE

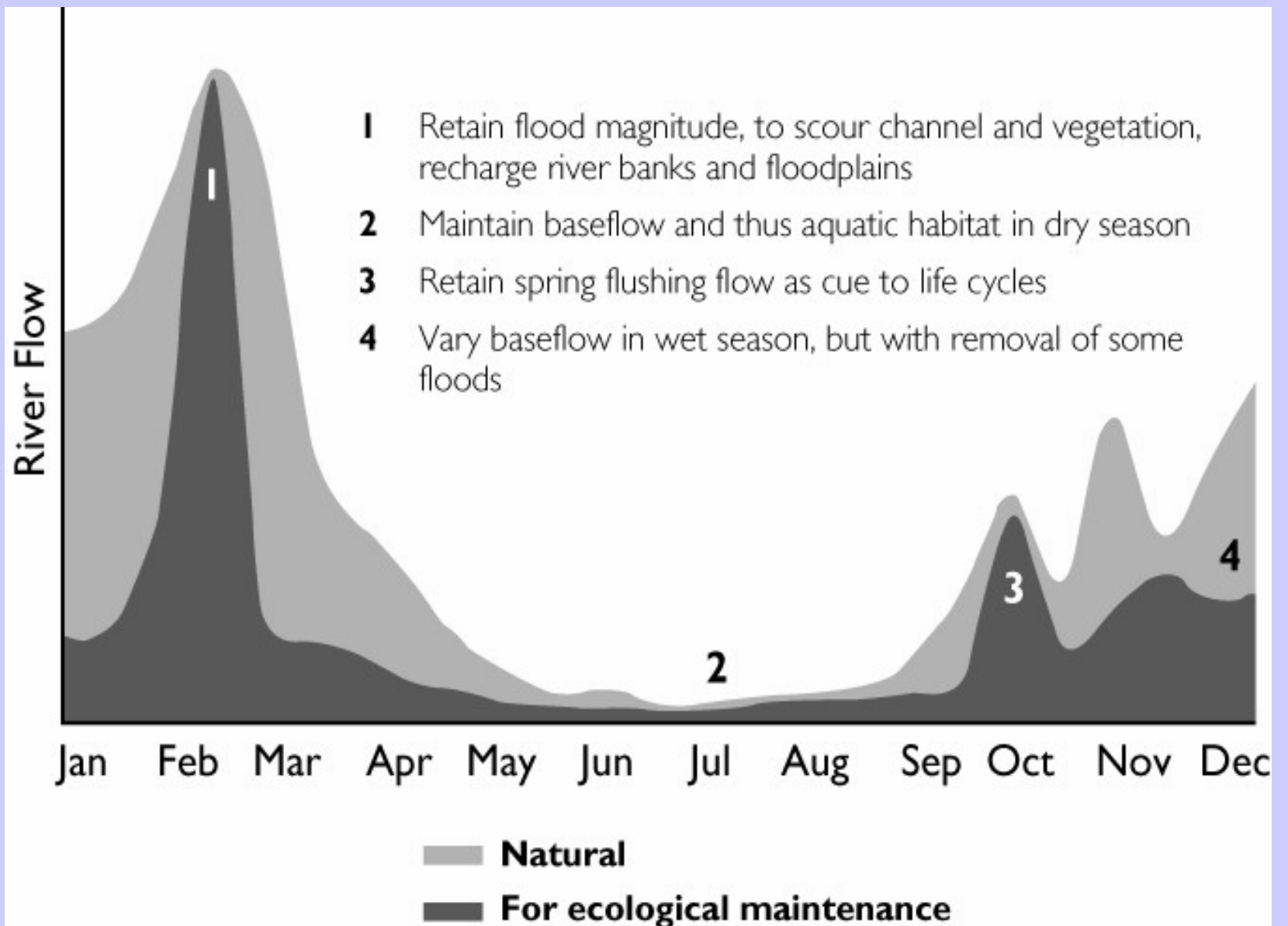
Dual-Objective Water Resource Management

- **No new water projects absent a substantial environmental restoration component**
- **New environmental restoration likely to be embedded within more comprehensive water augmentation schemes**

What is an Environmental Flow: moving from minimum flow to variable flow




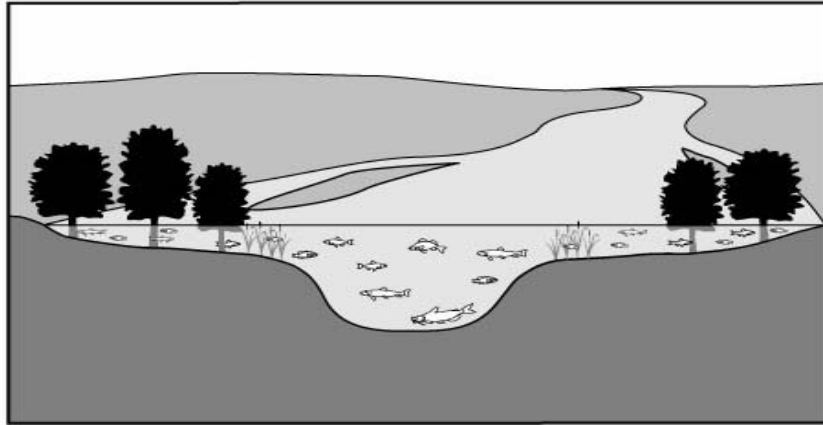
It's not just a matter of water volume...







Making Rivers Function Like Rivers Again: Impact of River Development on Floodplains

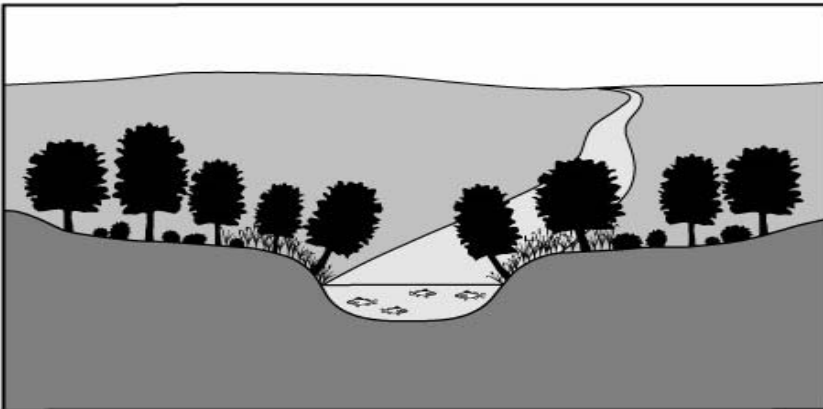
Natural Flood

-  Fish are able to feed and spawn in floodplain areas
-  Riparian plant seeds germinate on flood-deposited sediments
-  Insects emerge from water to complete their lifecycle
-  Wading birds and waterfowl feed on fish and plants in shallow flooded areas



Absence of Flood

-  Fish unable to access floodplain for spawning and feeding
-  Riparian vegetation encroaches into river channel
-  Insect habitats smothered by silt and sand
-  Many birds cannot use riparian areas when plant species change





Balancing the Restoration Flow Demand and Supply Equation

Objectives:

Instream Conditions
Floodplain Conditions



Water management
techniques to:
generate water
when, where and in
amounts desired

Parameters:

Magnitude, Duration,
Frequency, Location,
Seasonality



Physical Solutions

- Practical alternatives that the courts can adopt to provide the benefits secured by senior water rights *in lieu* of their literal exercise.
- To reduce conflicts among water users and “achieve better overall utilization of the resource.”
- Classically, these conflicts have been among water rights holders drawing on a common source. More recently, these conflicts are increasingly needed to accommodate environmental water demands.

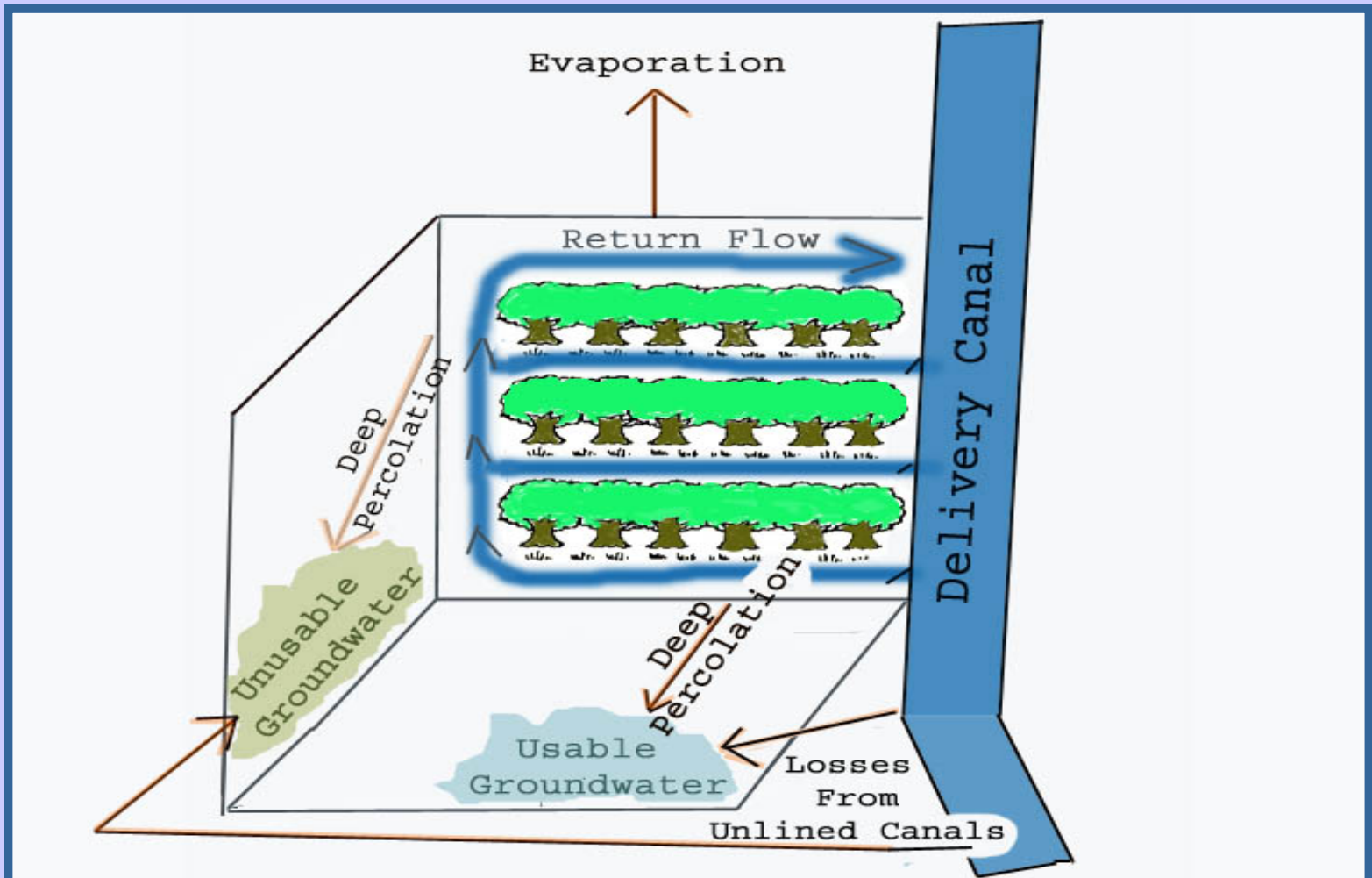


The Physical Solution Toolkit

- 1) Desalinization (aquifers)
- 2) Reduce physical losses in the system
- 3) Transfers of rights (not just water rights in the future)
- 4) Infrastructure reoperation
- 5) Enhanced storage (conjunctive use-groundwater banking)

Reduce Physical Losses to the System


E.g., Agriculture





Water Transfers for the Environment

- Every western jurisdiction now has a mechanism
- Limitations
 - Produces static rather than dynamic flows
 - Opportunistic rather than strategic
 - Public funding requirements are large
 - Water project domination in CA limits potential
- Future will entail a broader conception of the rights to be marketed



The Infrastructure Reoperation Toolbox

- Techniques depend on the type of infrastructure—For instance dams:
 - Flood control
 - Hydropower
 - Irrigation



Flood Management:

- Floodplain accommodations of seasonal inundations
- Flood easements
- Flood routing and storage in retention basins
- Levee setbacks



Hydropower:

- Changing the role and function of the hydro dam in the generator mix
- Substitution of daily peaking facilities
- Re-regulation reservoirs
- Pumped storage
- Better coordination of cascades of dams



Irrigation:

- **Conjunctive water management**
(Integrating groundwater and surface storage)
- Aquifer recharge and recovery (groundwater banking)
- Reductions in physical losses from irrigation systems
 - Reducing evaporative losses in water conveyance and applications
 - Reducing deep percolation to salty aquifers
- Relocating points of diversion and return flow
- Retiring waterlogged or salinized lands
- Water transfer arrangements



Conjunctive Water Management

- Large storage dam(s) controlling flows into formerly productive floodplains
- Operated also for flood control
- Dewater aquifers
- Downstream channel:
 - Not encroached
 - Not incised
 - Sediment available



System-Wide Investigation of Central Valley Conjunctive Water Management Opportunities

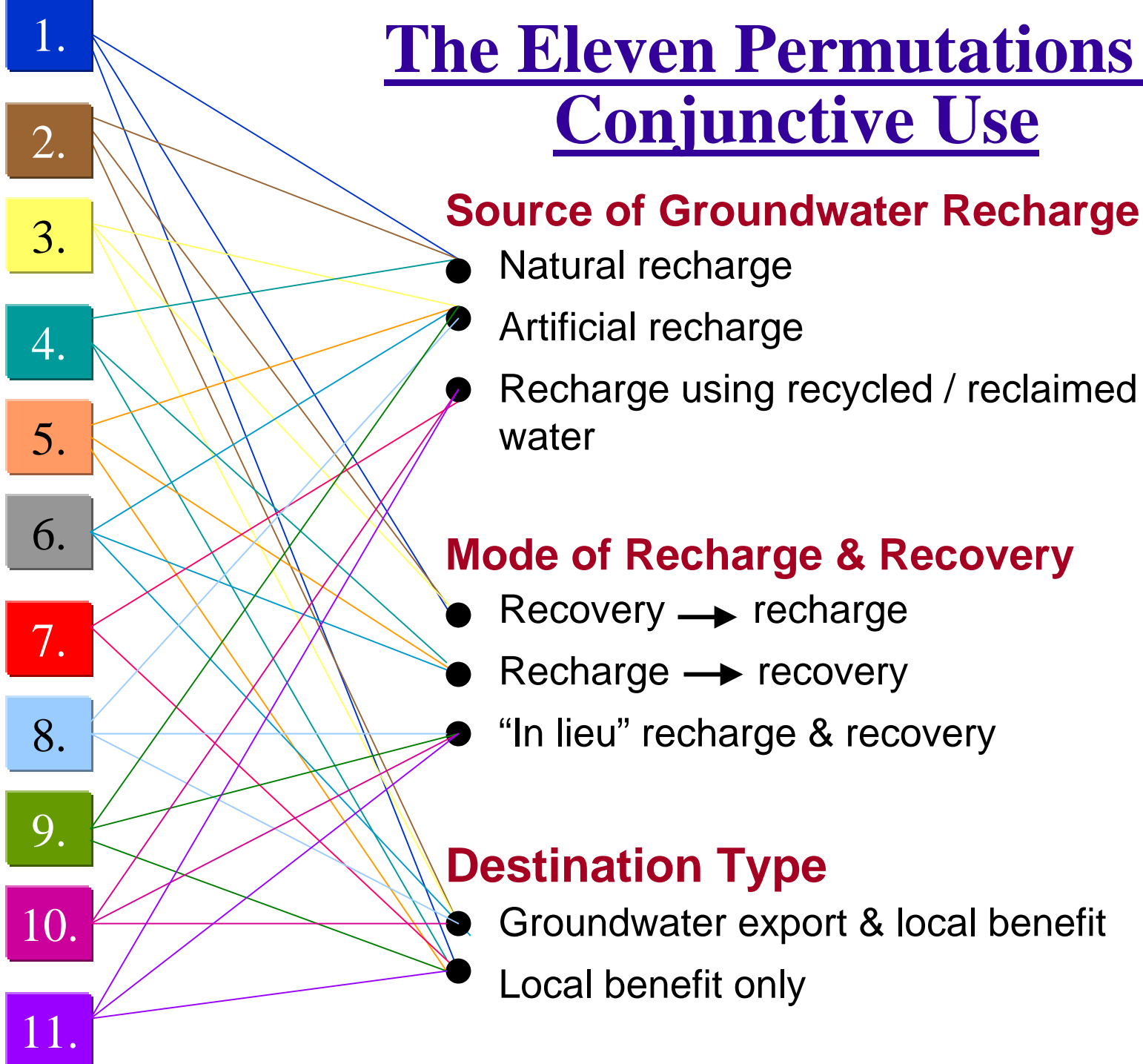


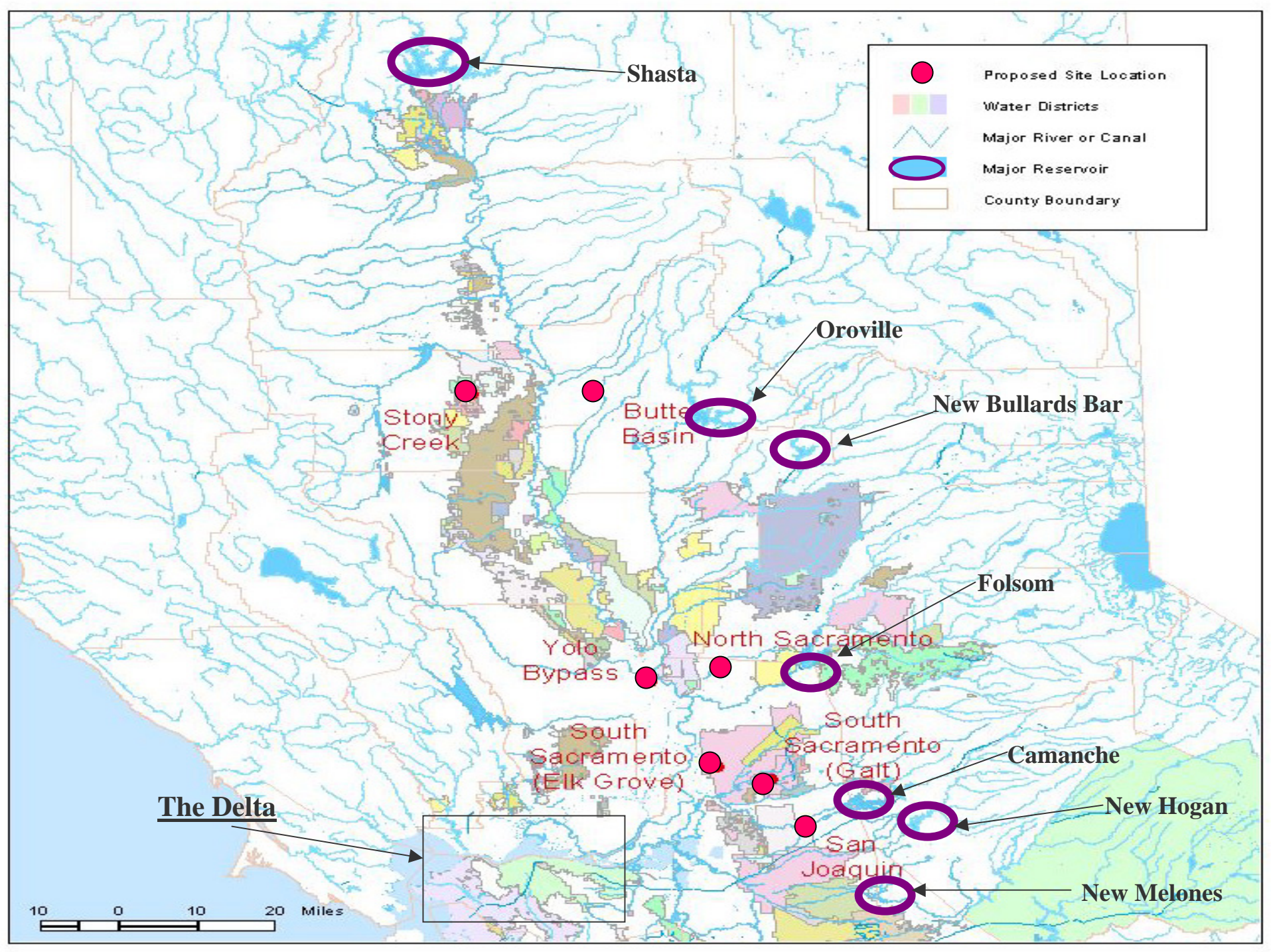


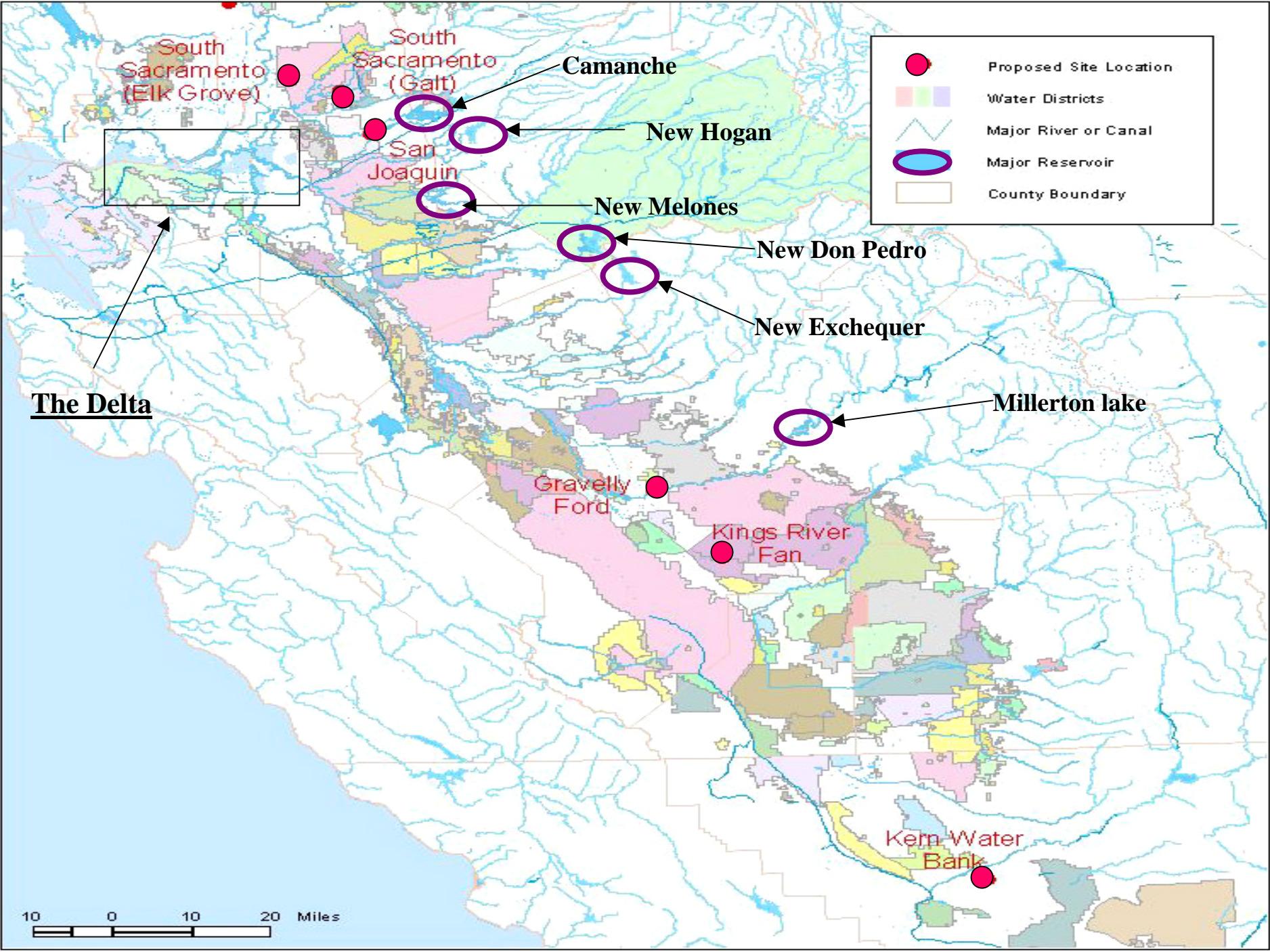
Components

- Reservoir operators would agree to re-operate the reservoir to generate source water for groundwater banking
- Local groundwater management authorities “rent” unused aquifer storage space for a fee or share of the water
- Potential beneficiaries of the groundwater banking program would purchase a specified amount of the banked groundwater

The Eleven Permutations of Conjunctive Use





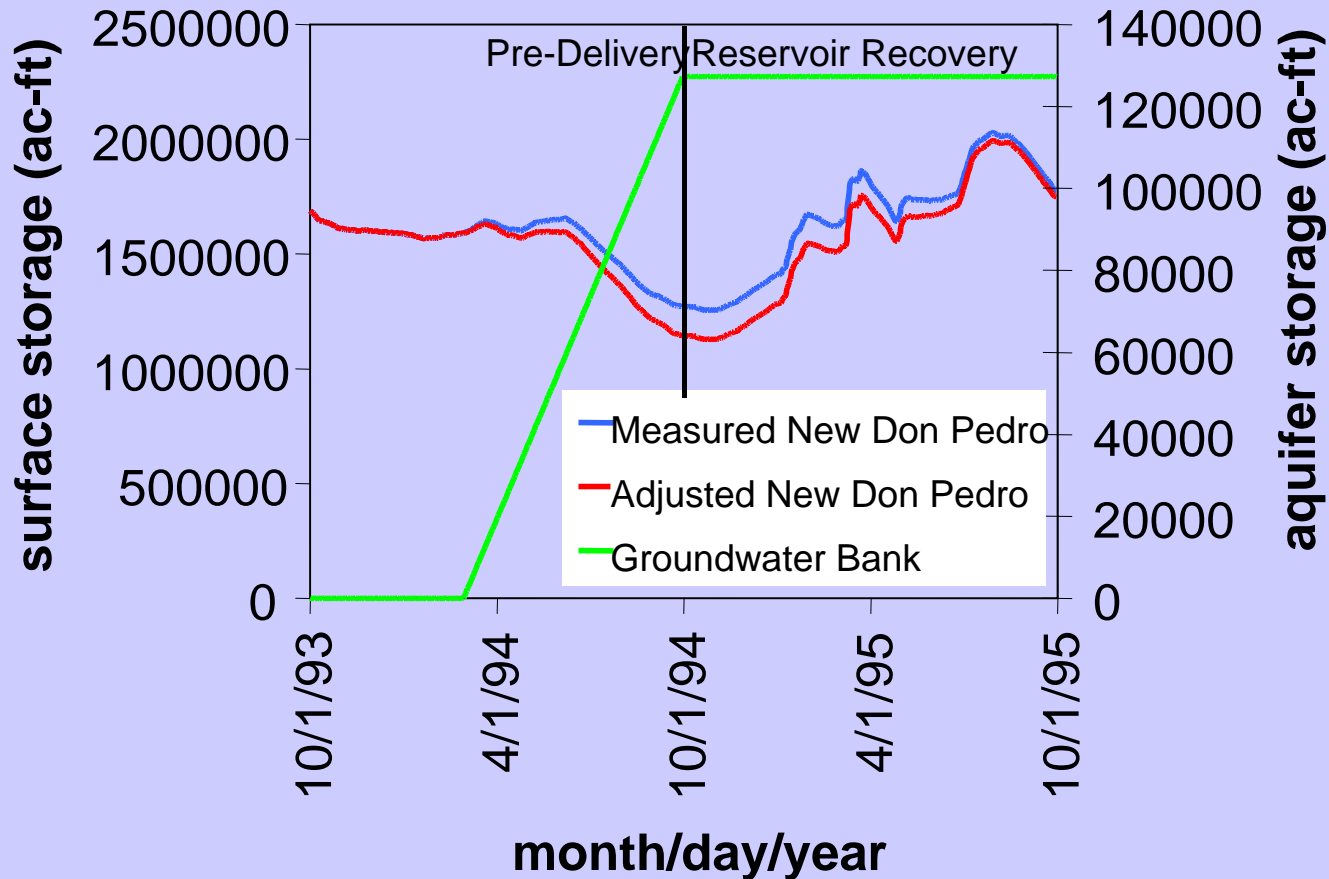


Reservoirs, Ownership, and Capacity

River	Reservoir/ Dam	Operator	Storage	Mean
			(TAF)	1921–1983 unimpaired flow
Sacramento	Shasta	USBR/CVP	4,552	8,303
Feather	Oroville	DWR/SWP	3,538	4,441
Yuba	New Bullards Bar	YCWA	966	2,333
American	Folsom	USBR/CVP	974	2,660
Mokelumne	Camanche	EBMUD	417	730
Calaveras	New Hogan	COE	317	163
Stanislaus	New Melones	USBR/CVP	2,420	1,131
Tuolumne	New Don Pedro	MID/TID	2,030	1,841
Merced	New Exchequer	Merced ID	1,025	967
San Joaquin	Millerton Lake	USBR/CVP	520	1,740

Modes of Groundwater Banking

NHI Approach

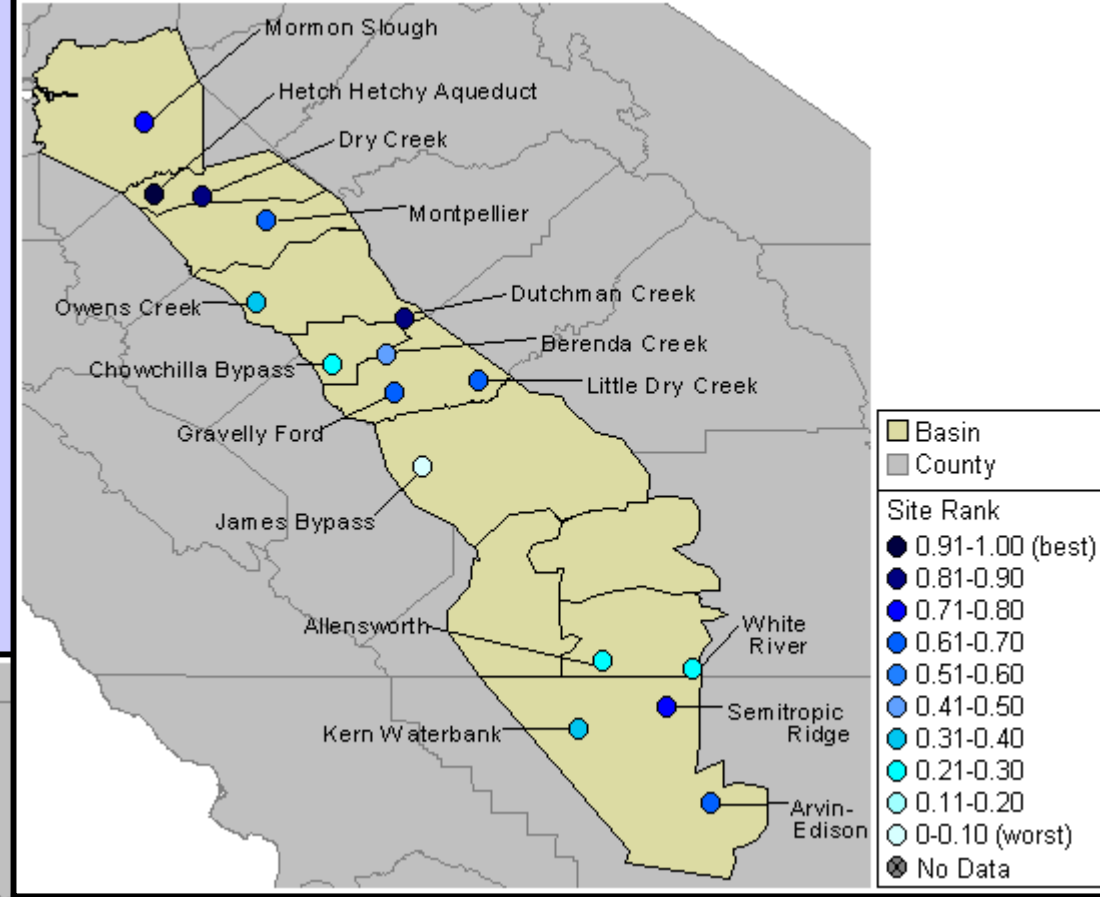
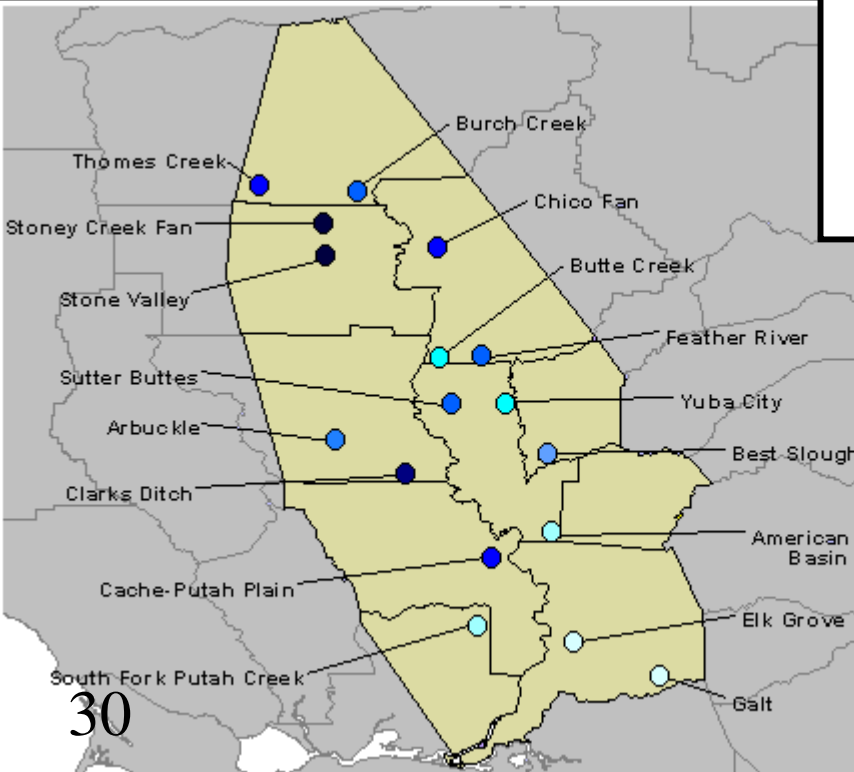


Average Annual Yield Estimates for 11 Regulated Tributaries of the Central Valley

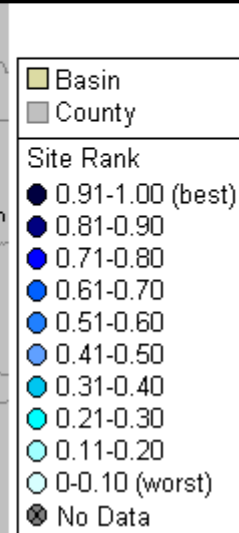
River	Conjunctive Use Re-operation (TAF)
Sacramento	170.8
Feather	107.3
Yuba	117.5
American	64.8
Mokelumne	53.7
Calaveras	12.8
Stanislaus	51.6
Tuolumne	65.3
Merced	92.9
Upper San Joaquin	100.0
Pine Flat Reservoir	108.0
TOTAL	944.7

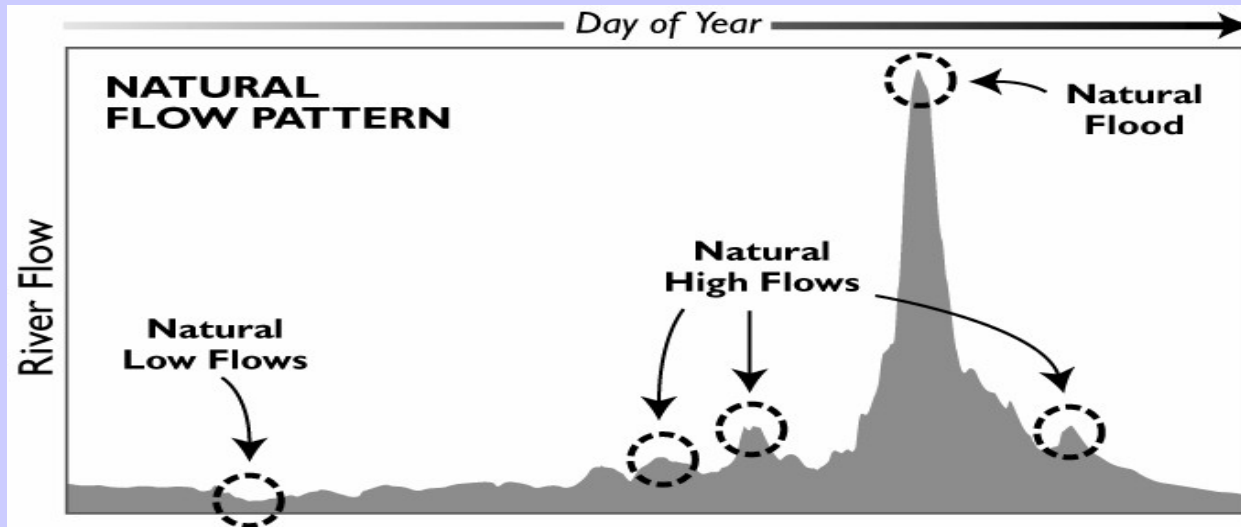
Hydrogeologic Suitability Sub-index

Sacramento Valley







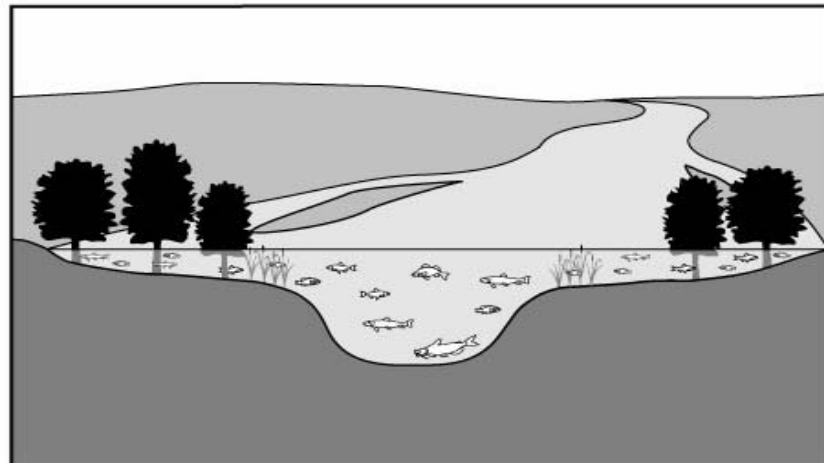
San Joaquin Valley





Natural Flood

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Fluvial Restoration Concept

Problem: Shaving hydrologic peaks reduces natural variability

Solution: Convert from uncontrolled to controlled floods





Defining the Environmental Flow Restoration Potential:

- Determine the available water for environmental flows
- Define environmental flow requirements*
(magnitude, frequency, duration)
- Identify the floodplain constraints that limit the magnitude parameter
- Assess the sediment needs and availability for geomorphic restoration

* **Already under way on Sacramento, San Joaquin, Merced, Tuolumne, and Stanislaus Rivers. Needs to be accomplished for the Feather, American, Yuba, Calaveras, Mokelumne, and Kings Rivers.**

SYSTEM-WIDE CONJUNCTIVE WATER MANAGEMENT

**DESIGNING SUCCESSFUL GROUNDWATER
BANKING PROGRAMS IN THE CENTRAL VALLEY:**

LESSONS FROM EXPERIENCE



THE NATURAL HERITAGE INSTITUTE

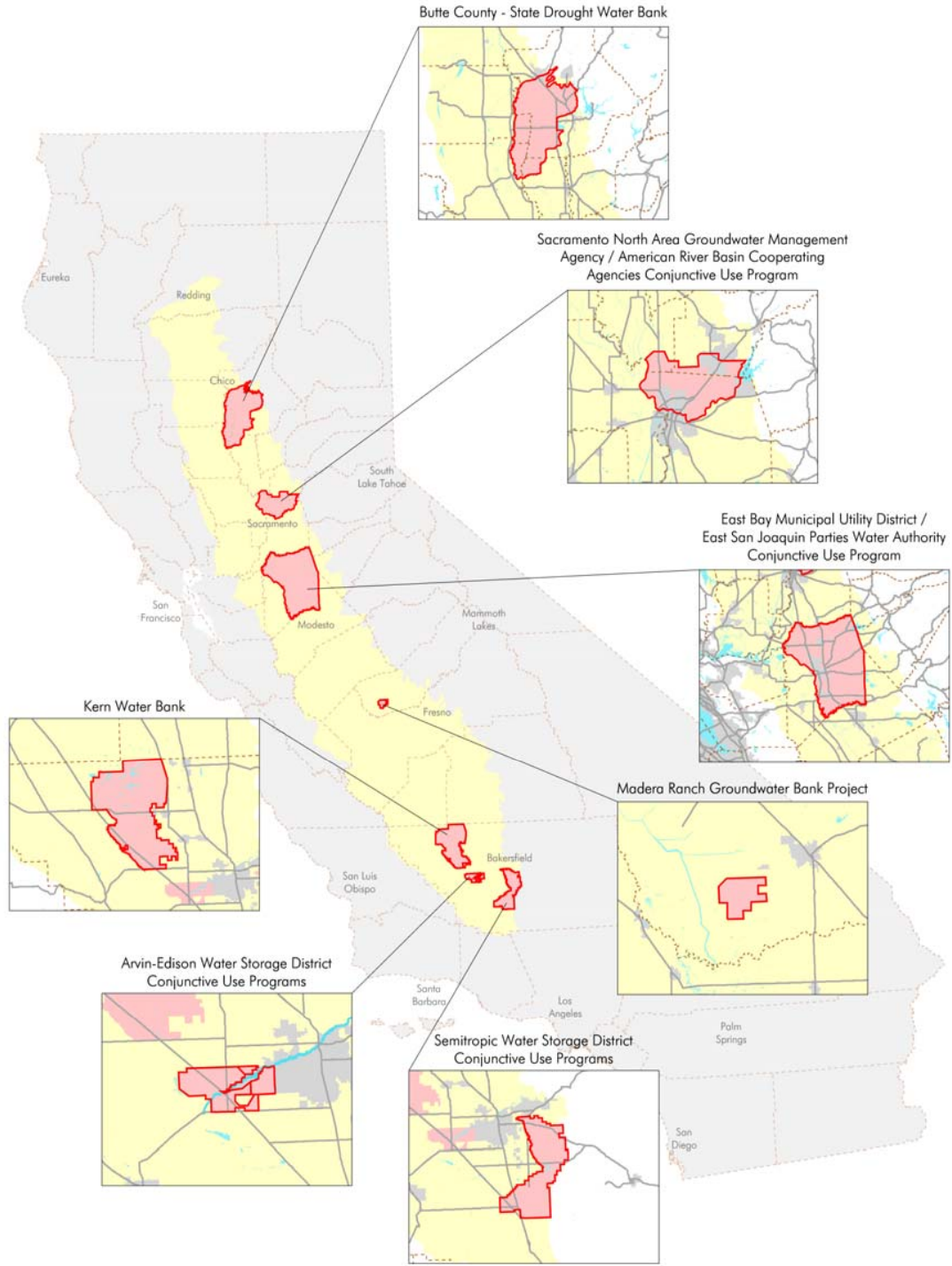
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Jennifer L. Spaletta, Herum Crabtree & Brown LLP

and legal research by

Peter Kiel, Hastings College of the Law





Risk Factors Analyzed

- **Hydrogeologic**

- “Leaky” aquifers
- Adverse effects on other groundwater pumpers
- Reduced natural infiltration
- Groundwater invasion of crop root zones / wetlands regulations

- **Water Quality**

- Degrading aquifer water
- Leaching soil contaminants

- **Financial**

- Delta pumping restrictions to delivery of banked water

- **Political**

- Local Control: Who, What, How?



Risk Factors Analyzed

- Legal
 - Raiding of banked water by other groundwater users
 - Reductions in amounts, timing or costs of extractions by historic (or future) groundwater users
 - Fomenting legal actions over groundwater rights

**Fundamental Principle:
No Injury to Lawful Users of Water**



**Pervades common and statutory law on
correlative groundwater rights**

Project Design Features that Avoid Friction with “*No Injury*” Rule

1. Preference right to recapture imported recharge water (Los Angeles v. San Fernando):

in order “to credit the importer with the fruits of his expenditures and endeavors in bringing into the basin water that would not otherwise be there.”

2. Program operator = a “public entity”

Avoiding prescriptive rights to stored groundwater (Los Angeles v. San Fernando):

repudiated mutual prescription of overdrafted basin doctrine as applied to public agencies—including water districts



**3. Recharge before extraction
(in San Joaquin basin)**

OR

**Extraction before recharge
(in Sacramento basin)**

**Issue: How to cope with uncertainties
regarding:**

--operating losses (San Joaquin)

--failure to recharge (Sacramento)



Option #1: Provide absolute guarantee of compensation for increased lifting costs over historic baseline:

Even if increased costs caused by increased pumping by third party water user. Project would then pursue reimbursement from third party under subrogation theory.

Option #2: Provide a physical solution:

Project guarantees all potentially affected correlative pumpers a substitute surface water delivery out of the groundwater bank at the historic costs of pumping, in exchange that party agrees to forego pumping or leases its well to the project. See, *City of Lodi v. EBMUD*



4. Manipulating groundwater levels: Limit extraction and recharge as necessary to prevent:

- ⊕ Land subsidence
- ⊕ Invasion of root zones or inundation of building foundations
- ⊕ Creation of artificial wetlands that may become subject to jurisdiction by
- ⊕ Corps of Engineers or EPA as “waters of the United States”
- ⊕ Dewatering of phreatophytic habitats

5. Assure a quality of recharge water superior to the native groundwater with which it would be commingled.

Residual Legal Problems

- ⊕ “Recovering” water banked *in lieu* without liability to correlative groundwater pumpers
- ⊕ Reducing the capacity of the aquifer to infiltrate natural recharge
- ⊕ Holding groundwater users to historic levels of usage
- ⊕ Assessing, managing, and compensating for the hydrologic risks of unrecoverable banked water
- ⊕ Statutory groundwater export restrictions (water code § 1220)
- ⊕ Local groundwater export ordinances

Constraints and Design Specifications for System-wide Conjunctive Use

- ⊕ The program will operate on the basis of voluntary, compensated contractual arrangements among operator owners, land and water rights holders in the groundwater banking sites, conveyance operators and end users to ensure local control
- ⊕ It will cause no uncompensated adverse impacts on other groundwater or surface water rights holders
- ⊕ It will cause no unmitigated environmental impacts
- ⊕ It will be operated in an economically optimal fashion (i.e. the volumes of water and scale of operations will be limited by the marginal cost of substitute supplies)

Constraints and Design Specifications for System-wide Conjunctive Use

- ⊕ No new surface water storage will be assumed (although the analysis may describe how additional temporary surface storage capacity and enhanced water conveyance capacity might affect potential yield and operations)
- ⊕ No new public subsidies (i.e., unamortized or concessionary public investment) will be assumed. That is to say, the project will be entirely self-financing.
- ⊕ No changes in existing laws will be assumed, although the final report may identify legal reforms or measures to clarify existing law that would facilitate the program.



New Tools (“Rights”) for a New Era

- **Reservoir reoperating rights**
- **Storage rights (groundwater banks)**
- **Priority rights to water in storage**
- **Rights to orchestrate groundwater extractions**



New Tools (“Rights”) for a New Era

- **“Change orders” to permit surface water storage to be banked, extracted and beneficially used**
- **Floodplain inundation rights**
- **Sediment transport rights**
- **Sequential use rights**

**Fish don't just need water--
they need a river!**

