

PublicStudies.org

School of Earth & Environmental Sciences

Planning Document — February 2026

1. Overview & Origin

This document captures the findings from a research conversation exploring western U.S. water crisis solutions—from cloud seeding to desalination to agricultural reform—and how the interconnected topics naturally map to a new school within PublicStudies.org.

The core insight: the western water crisis is not a single-discipline problem. It spans climate science, hydrology, agricultural economics, energy policy, environmental law, and political science. This makes it ideal for a comprehensive, cross-linked school within the Quarex/PublicStudies architecture.

2. The Western Water Crisis — Key Findings

2.1 The Structural Deficit

The problem: The Colorado River is overallocated. The 1922 Compact assumed ~18 MAF/year of flow during an unusually wet period. Actual average flow is ~12 MAF. Consumptive use from 2000–2019 averaged 19.3 MAF/year against 12.7 MAF of actual flow—a structural deficit of ~6–7 MAF annually.

Stakeholders: 40+ million people, 5.5 million acres of farmland, 30 tribal nations, 7 U.S. states, Mexico, and critical ecosystems.

Timing: Post-2026 operating guidelines are being negotiated now. The seven states missed the February 2026 federal deadline without agreement.

2.2 Why Cloud Seeding Alone Cannot Solve It

- Cloud seeding increases storm snowfall by 8–15%, streamflows by ~5%
- Colorado's program yields ~80,000 acre-feet/year; Utah boosts snowpack 6–12%
- Maximum theoretical basin-wide yield: ~500K–1M acre-feet—a rounding error against a 6+ MAF deficit
- Cannot create clouds in clear skies; requires existing moisture
- Climate change is reducing seedable storm events

As one Colorado official stated: “The problem is levels of magnitude above what any weather modification can fix.”

2.3 The Three-Legged Hybrid Solution

The only approach that scales to the problem combines three strategies:

Leg 1: Agricultural Reform (2–3 MAF potential)

- Agriculture consumes ~52% of all Colorado River water; ~80% of human use
- Alfalfa alone uses 5+ MAF—more than all cities, commercial, and industrial users combined
- 55% of ag water goes to livestock feed crops (alfalfa, grass hay, corn silage)
- Saudi Arabia's Almarai Company farms 10,000 acres of Arizona alfalfa—after banning it domestically to conserve water
- Tools: crop switching (Kernza, sainfoin, silflower being tested), efficiency upgrades, paid fallowing, alfalfa export restrictions, marginal land retirement
- \$1.2B federal program already conserving 3 MAF through 2026 via temporary fallowing

Leg 2: Water Recycling & Potable Reuse (1–2 MAF potential)

- Cheapest new water source—roughly half the cost of desalination
- \$47.1B in municipal reuse infrastructure CAPEX forecast through 2035
- Potable reuse expected to account for 37% of all new reuse capacity by 2035
- Arizona approved Advanced Water Purification rules effective March 2025
- Orange County's Groundwater Replenishment System is world's largest potable reuse facility
- CVWD received \$39M grant to expand Thermal Water Reclamation Plant—projected to conserve 33,600 AF from 2029–2058

Leg 3: Desalination (1–2 MAF potential, long-term)

- Most expensive leg, but drought-proof
- Key insight: don't pump desal into the river—use it to replace river water at the coast
- If Southern California metro areas shifted to desal + reuse, their ~1.5 MAF river draw drops dramatically
- Carlsbad plant (largest in Western Hemisphere): 56,000 AF/year, cost ~\$1B to build
- Closing the full deficit would require ~100–125 Carlsbad-sized plants
- Colorado River Abundance Act proposes 7 MAF of new supply via desal, reuse, and efficiency
- Current federal funding: Trump FY2026 budget proposes just \$6.8M for desalination—woefully inadequate

2.4 The Cost Math

Strategy	Realistic MAF	Cost Estimate	Timeline
Ag reform	2–3	\$1–3B/yr transition	5–15 years
Water recycling	1–2	~\$47B over decade	5–10 years
Desalination	1–2	\$50–100B over decade	10–20 years
TOTAL	4–7	\$100–150B / 15–20yr	Phased

Context: The Colorado River basin generates hundreds of billions in annual economic activity. The cost of inaction—collapsed agriculture, depopulated cities, stranded infrastructure—dwarfs the investment.

2.5 The Fourth Leg: Climate-Driven Crop Migration

Climate change is already pushing agriculture northward:

- USDA Plant Hardiness Zones are shifting north nationwide
- California farm operations are testing crops in Oregon and Washington
- Maize has shifted northwest in the U.S.; the Corn Belt may not survive the century
- Agricultural climate zones could shift northward up to 1,200 km by 2099
- Crop switching could reduce U.S. agricultural climate losses by half

This natural migration, if managed rather than resisted, could free up millions of acre-feet of Colorado River water as water-intensive agriculture moves to where water is more abundant.

2.6 Palm Springs / Coachella Valley Context

- CVWD holds Priority 3(a) allocation of 330,000 AF + transfers ramping to 103,000 AF by 2026
- ~260,000 AF delivered to local farms; balance to groundwater replenishment and other uses
- California's senior water rights mean AZ and NV get cut first in shortages
- Key risk is aquifer health: if river shrinks and replenishment is cut, groundwater levels drop
- CVWD's recycling plant expansion is insurance against this scenario
- Conservation program paying \$340/AF for voluntary reductions through 2026

3. School of Earth & Environmental Sciences

A new school within PublicStudies.org, broad enough to house multiple curricula over time.

3.1 Potential Curricula Within the School

1. **Environmental Studies** (founding curriculum—ten books, see Section 4)
2. **Western States Water** (deep-dive curriculum—see Section 5)
3. Climate & Atmospheric Sciences
4. Marine & Ocean Sciences
5. Geology & Earth Systems
6. Conservation & Wildlife Biology
7. Environmental Engineering
8. Sustainable Development
9. Environmental Data Science

Each curriculum generates its own set of books via the iceberg method. Books cross-list in the broader Quarex taxonomy for multiple discovery paths.

4. Environmental Studies Curriculum — Ten Founding Books

These ten books form the initial collection. Plan: one full dedicated day to define shelf/chapter/topic structure for all ten.

#	Book Title	Scope / Key Topics
1	Climate Science	Atmospheric physics, greenhouse effect, paleoclimate, climate modeling, feedback loops, IPCC projections, regional climate impacts
2	Water Resources & Policy	Hydrology, water law, prior appropriation, desalination, recycling, aquifer management, interstate compacts, tribal rights
3	Energy & Environment	Fossil fuels, renewables, nuclear, grid infrastructure, energy-water nexus, carbon capture, transition economics
4	Agricultural Systems & Food Security	Crop science, irrigation technology, crop migration, food supply chains, alfalfa/cattle-feed nexus, global food trade, soil health
5	Environmental Law & Policy	NEPA, Clean Water Act, Clean Air Act, ESA, interstate compacts, international agreements, regulatory frameworks
6	Environmental Justice	Disparate impacts, tribal water rights, farmworker communities, urban heat islands, pollution burden, Flint/Imperial Valley case studies

7	Environmental Economics	Externalities, carbon pricing, water markets, cost-benefit analysis, green finance, stranded assets, circular economy
8	Ecology & Conservation	Ecosystems, biodiversity, habitat loss, restoration science, Colorado River delta, endangered species, invasive species
9	Sustainability & Urban Planning	Green building, transit, urban water systems, smart cities, land use, zoning, climate-resilient design
10	Environmental Health	Air quality, water contamination, toxic exposure, epidemiology, environmental carcinogens, public health infrastructure

5. Western States Water Curriculum

A deep-dive curriculum born directly from the research in this conversation. Potential books:

10. The Colorado River: History, Law & Crisis
11. Western Water Rights & the Law of the River
12. The 1922 Compact & Its Legacy
13. Desalination: Technology, Cost & Scale
14. Water Recycling & Potable Reuse
15. Agricultural Water Use & Reform
16. The Great Crop Migration
17. Tribal Water Rights in the American West
18. The Politics of Water: 2026 Negotiations & Beyond
19. Groundwater & Aquifer Management
20. The Salton Sea Crisis
21. Imperial Valley: Agriculture, Water & Power
22. Urban Water Conservation in the Arid West
23. Dam Infrastructure & Hydropower
24. Mexico, the Delta & Binational Water Policy

6. Cross-Links & Integration

6.1 Quarex Taxonomy Cross-Listing

Each book lives in its home curriculum AND in the broader Quarex taxonomy. Examples:

- Water Resources & Policy → also shelved in Political Science or Public Policy libraries
- Environmental Economics → also shelved in Economics libraries
- The Great Crop Migration → also in Agricultural Systems AND Climate Science
- Tribal Water Rights → also in Indigenous Studies or American History

6.2 elecciones2026.net Integration

Every candidate in AZ, NV, CA, CO, UT, NM, and WY has a stake in water policy. The Western States Water curriculum feeds directly into politician library content:

- Candidate positions on post-2026 Colorado River operating guidelines
- Votes and statements on desalination funding, ag reform, tribal water rights
- State-level water policy comparisons across all seven basin states
- Interactive: voter explores candidate → hits water policy topic → tunnels into Western States Water curriculum

6.3 PublicStudies.org Mission Alignment

Environmental science education is being defunded or deprioritized in multiple states. A rigorous, free, AI-powered School of Earth & Environmental Sciences fills a real gap—and the political urgency of the 2026 water negotiations makes the timing ideal.

7. Action Plan

Day 1: Environmental Studies Curriculum (Ten Books)

Block one full day. For each of the ten books:

25. Define shelf structure (chapters)
26. Define topic breakdowns within each chapter
27. Calibrate for iceberg method (AI-generated deep content at every level)
28. Identify cross-list locations in broader Quarex taxonomy

Follow-up Sessions

- Western States Water curriculum: define book structures for all 15 titles
- School naming finalized (School of Earth & Environmental Sciences or alternative)
- Integration points with elecciones2026.net mapped
- Additional curricula scoped (Climate & Atmospheric Sciences, etc.)

8. Key Sources & Data Points for Reference

Compiled from research during this conversation:

Colorado River Data

- 1922 Compact assumed ~18 MAF/year; actual average ~12 MAF
- 2000–2019: 12.7 MAF flow vs 19.3 MAF consumption = structural deficit
- Need to cut 2.4–3.4 MAF/year to stabilize + 0.8–2.4 MAF more by 2050 for climate
- Alfalfa: 5+ MAF, 26% of all basin consumption
- Agriculture: 52% of all consumption; 80% of human use
- Urban: 18% | Natural vegetation: 19% | Reservoir evaporation: 11%

Coachella Valley / CVWD

- Priority 3(a): 330,000 AF base + 103,000 AF QSA transfer by 2026
- ~260,000 AF to local farms; balance to replenishment/environment/other
- \$39M Reclamation grant for Thermal Water Reclamation Plant expansion (Jan 2025)
- Conservation program: \$340/AF for voluntary reductions through 2026
- Coachella Canal: 123 miles, mid-canal storage project completed 2024

Desalination

- Carlsbad (largest Western Hemisphere): 56,000 AF/year, ~\$1B to build
- Colorado River Abundance Act targets 7 MAF via desal + reuse + efficiency
- Trump FY2026 budget: \$6.8M for desalination (grossly insufficient)

Water Recycling

- \$47.1B in municipal reuse CAPEX forecast 2025–2035
- Potable reuse = 37% of new capacity by 2035
- Arizona AWP rules effective March 2025
- Orange County GWRS = world's largest potable reuse facility

Crop Migration

- USDA Plant Hardiness Zones shifting north
- Agricultural climate zones could shift up to 1,200 km northward by 2099
- California farms testing crops in Oregon/Washington
- Crop switching could cut U.S. ag climate losses by ~50%