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Law, Environmental Dynamism, and Reliability

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LAW, ENVIRONMENTAL DYNAMISM, AND RELIABILITY

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This article examines conceptual frameworks often used to understand and resolve controversies involving scarce and legally protected natural resources. It proposes that those traditional frameworks, though ingrained in legal structures and conventional expectations, fail to adequately address tensions between resource consumption, environmental protection, and the reliability of resource allocation patterns, and thus can induce the adoption of solutions that prove fragile in contexts of environmental uncertainty and change. It then proposes a different conceptual approach capable of facilitating more lasting solutions. The article illustrates the importance of that conceptual shift by analyzing an important environmental controversy in California. Efforts to resolve that controversy, though widely praised in the legal academic literature, have not succeeded, and this article proposes that those failings partly reflect conceptual frameworks ill-suited for dynamic and uncertain environmental conditions.

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I. INTRODUCTION

Environmental managers[1] often attempt to allocate scarce natural resources in ways that will remain stable despite environmental unpredictability and change. Unfortunately, their attempts often fail; whether addressing fisheries, forests, water, or clean air, to provide a few examples, management schemes often fall short of achieving the mandates of our environmental laws. Those failures often produce wrenching ecological, economic, and social consequences, leaving ecosystems degraded, resource-dependent economies and communities damaged, or, often, both.[2] This article asks why, despite laws ostensibly protecting natural resources, such failures so often happen.

The answers to that question are invariably complex, with political process quirks, skewed economic incentives, hostility to environmental protection, and a variety of other causes, all heavily analyzed by legal scholars, contributing to unsuccessful outcomes. But an additional contributing factor deserves attention. Flaws in our basic conceptual framework for understanding resource crises—a conceptual framework that both flows from and influences the legal schemes that govern resource management—also play an important role. Environmental managers often understand their task as balancing environmental protection and resource consumption in a particular way: they think they should allow resource consumption right up to perceived brinks of illegality, and should provide just enough protection to avoid legal violations, but no more. That understanding follows logically from our legal systems, which often encourage resource consumption and environmental protection but do little to promote preservation of margins for error. A variety of legal and policy responses flow from that conceptual approach, including selection of management systems designed to allow, facilitate, or subsidize increased

[1] I use the term environmental managers to refer to government agencies acting in both regulatory and proprietary capacities. I use the term "environmental laws" as an umbrella term referring both to laws traditionally understood as controlling pollution, like the Clean Air Act, and to laws understood as resource management statutes, like the Wild and Scenic Rivers Act. While distinguishing the two groups has some pedagogical utility, in practice the distinctions are muddy; the Clean Water Act, for example, is an environmental quality law with significant resource-allocation implications.

[2] *See, e.g.,* STEPHEN YAFFEE, THE WISDOM OF THE SPOTTED OWL (1994) (describing the consequences of timber harvesting conflicts in the Pacific Northwest); Holly Doremus and A. Dan Tarlock, *Fish, Farms, and the Clash of Cultures in the Klamath Basin*, 30 ECOLOGY L.Q. 279, 283-84 (2003) (describing the costs of water use conflicts); *see also* JAY LUND ET AL., ENVISIONING FUTURES FOR THE SACRAMENTO-SAN JOAQUIN DELTA 105 (2007) (hereinafter "ENVISIONING FUTURES") (estimating at $10 billion/year the costs of a sudden cutoff of Bay-Delta water exports).

consumption even of scarce resources. But because environmental conditions often change, frequently in unexpected and dramatic ways, brinks of illegality can be shifting and difficult to discern, and resource management schemes deriving from that basic approach often require rapid adjustment. And if, as is often the case, adjusting is institutionally or politically difficult—that is, if adaptive management, which environmental managers often propose as a response to variability and uncertainty, is difficult to implement[3]—that traditional approach can lead to fragile solutions prone to costly collapses. This article therefore articulates a different conceptual framework designed to preserve the durability and reliability[4] of resource allocations even in a changing, unpredictable world.

I illustrate the importance of that conceptual shift by analyzing one of the nation's highest-profile and most intractable environmental controversies. Approximately forty miles northeast of San Francisco, in California's Central Valley, the Sacramento and San Joaquin rivers flow through a maze of channels and sloughs before discharging into San Francisco Bay. The Bay-Delta, as that estuary is called, is one of California's most valuable natural resources. Its watershed supplies most Californians with drinking water, irrigates millions of acres of agricultural land, supports recreational uses from birdwatching to wakeboarding, and provides crucial habitat for diverse fish and wildlife species, many of which are threatened or endangered.[5] Balancing those often-competing needs is challenging, and the watershed has generated some of the longest-lasting battles in California's water wars.[6]

Those battles have created a legal laboratory, in which the state and federal governments have tested many approaches to environmental management. Dozens of

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[3] *See* Holly Doremus, *Adaptive Management, the Endangered Species Act, and the Institutional Challenges of "New Age" Environmental Protection*, 41 WASHBURN L.J. 50, 55 (2001) (describing tensions between adaptive management's premise of uncertainty and institutional preferences for finality).

[4] By "reliable," I mean stable and predictable, but not necessarily abundant. *See* CLARENDON PRESS, THE OXFORD ENGLISH DICTIONARY (2nd ed. 2000) vol. XIII at 562 (defining reliable: "That may be relied upon; in which reliance or confidence may be put; trustworthy, safe, sure").

[5] *See* LITTLE HOOVER COMMISSION, STILL IMPERILED, STILL IMPORTANT: THE LITTLE HOOVER COMMISSION'S REVIEW OF THE CALFED BAY-DELTA PROGRAM 3-4 (2005); CALFED BAY-DELTA PROGRAM, PROGRAMMATIC RECORD OF DECISION 1-2 (2000) (hereinafter "CALFED ROD").

[6] *See* LITTLE HOOVER COMMISSION, *supra* note 5, at 3 (describing the Delta as the "battleground for the state's perennial water war").

published cases, many groundbreaking, have emerged from the Bay-Delta's conflicts.[7] Congress and the California Legislature have repeatedly intervened, first authorizing exploitation of the Bay-Delta and then drafting laws designed to protect it.[8] In the shadow of those legal constraints, agencies and interest groups have employed novel institutional arrangements and innovative regulatory techniques, many in support of the recently-developed "CALFED" program, which modestly describes itself as "the largest, most comprehensive water management program in the world."[9] CALFED devised, on a grand and expensive scale, a set of complex strategies for allowing increasing water consumption from an estuary where scarcity is common and variability endemic. Those strategies generated academic attention, with legal authors gravitating to Bay-Delta

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[7] *See, e.g.,* Cal. v. Sierra Club, 451 U.S. 287 (1981); Westlands Water Dist. v. United States, 337 F.3d 1092 (9th Cir. 2003); O'Neill v. United States, 50 F.3d 677 (9th Cir. 1995) (addressing environmental limitations on water deliveries); Cent. Delta Water Agency v. United States, 327 F. Supp. 2d 1180 (E.D. Cal. 2004); San Francisco Baykeeper v. United States Army Corps of Eng'rs, 219 F. Supp. 2d 1001 (N.D. Cal. 2002); Tulare Lake Water Basin Storage District v. United States, 49 Fed. Cl. 313 (2001); State Water Resource Control Board Cases, 136 Cal. App. 4th 674 (2006); In Re Bay-Delta Programmatic Environmental Impact Report Coordinated Proceedings, 133 Cal. App. 4th 154 (2005); Central Delta Water Agency v. State Water Resources Control Board, 124 Cal. App. 4th 245 (2004); Planning and Conservation League v. Department of Water Resources, 83 Cal. App. 4th 892 (2000); United States v. California State Water Resources Control Board, 182 Cal. App. 3d 82 (1986). For a partial sampling of cases addressing the Bay-Delta's tributary rivers, see California v. United States, 438 U.S. 645 (1978) (Stanislaus River); Westlands Water District v. United States Department of the Interior, 376 F.3d 853 (9th Cir. 2004) (Trinity and Sacramento Rivers); Dugan v. Rank, 372 U.S. 609 (1963) (San Joaquin River); United States v. Gerlach Live Stock Co., 339 U.S. 725 (1950) (San Joaquin River); Natural Resources Defense Council v. Houston, 146 F.3d 1118 (9th Cir. 1999) (San Joaquin River); Woodruff v. North Bloomfield Gravel Mining Co., 18 F. 753 (1884) (Yuba River; the decision has been described as "the nation's first environmental injunction," *see* LITTLE HOOVER COMM'N, *supra* note 5, at 6); NRDC v. Patterson, 333 F.Supp.2d 906 (2004) (San Joaquin River); NRDC v. Rodgers, 381 F.Supp.2d 1212 (E.D. Cal. 2005) (San Joaquin River); Environmental Defense Fund v. East Bay Municipal Utilities Dist., 26 Cal.3d 183 (1980) (Mokelumne River); Environmental Defense Fund v. East Bay Municipal Utilities District, 20 Cal. 3d 327, 344 (1977) (same).

[8] *E.g.* Central Valley Project Improvement Act, Pub. L. 102-575, 106 STAT. at 4706-31 (1992); California Bay-Delta Authority Act, codified at Cal. Water Code §§ 79400-76. For a summary of earlier statutes authorizing exploitation of the Bay-Delta, see *El Dorado Irrigation District v. State Water Resources Control Board*, 2006 Cal. App. LEXIS 1358 (2006).

[9] CALFED ROD, *supra* note 5, at 1. The ROD adds that CALFED is

> an unprecedented effort to build a framework for managing California's most precious natural resource: water… the most complex and extensive ecosystem restoration project ever proposed… one of the most intensive water conservation efforts ever attempted… the most far-reaching effort to improve the drinking water quality of millions of Californians as well as an unprecedented commitment to watershed restoration… and [] the most significant investment in storage and conveyance in decades.

Id.; *see also* Jody Freeman and Daniel A. Farber, *Modular Environmental Regulation*, 54 DUKE L.J. 795 (2005) (describing Bay-Delta regulatory structures as positive examples of regulatory innovation); Barton H. Thompson, *Markets for Nature*, 25 WM. & MARY ENVTL. L. & POL'Y REV. 261, 307-09 (2000) (hereinafter Thompson, *Markets for Nature*) (describing the "Environmental Water Account"); Elizabeth Ann Rieke, *The Bay Delta Accord: A Stride Toward Sustainability*, 67 U. COLO. L. REV. 341 (1996).

controversies like evolutionary biologists to the Galapagos.[10] Almost without exception, their scholarship has described CALFED's innovations as models of creative pragmatism.[11]

But the success of those innovations currently is in doubt.[12] Despite many advantages—regulatory creativity and cooperation, sometimes-substantial funding, attention from high-level officials, and an impressive confluence of government and private expertise—the federal-state programs designed to redress the Bay-Delta's resource conflicts have so far produced markedly uneven results. Several efforts show preliminary signs of success,[13] but some key environmental parameters have taken a significant turn for the worse.[14] Already-suffering fisheries recently suffered "dramatic declines;"[15] new species have been listed under the federal Endangered Species Act; the Bay-Delta's levees remain dangerously prone to collapse;[16] and only a few years after CALFED approved a major program designed to fix the Bay-Delta, the Bay-Delta's ecological health by some measurements appears worse than ever before—

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[10] *See, e.g.*, JOSEPH L. SAX ET AL., LEGAL CONTROL OF WATER RESOURCES 554-65 (3rd ed. 2000); Freeman and Farber, *supra* note 9; Alf W. Brandt, *An Environmental Water Account: The California Experience*, 5 U. DENV. WATER L. REV. 426 (2002); Patrick Wright, *Fixing the Delta: the CALFED Bay-Delta Program and Water Policy Under the Davis Administration*, 31 GOLDEN GATE U.L. REV. 331 (2001); Thompson, *Markets for Nature*, *supra* note 9; Robert Jerome Glennon and John E. Thorson, *Federal Environmental Restoration Initiatives: An Analysis of Agency Performance and the Capacity for Change*, 42 ARIZ. L. REV. 483, 516-21 (2000); Robert W. Adler, *Watersheds and the Integration of U.S. Water Law and Policy: Bridging the Great Divides*, 25 WM. & MARY ENVTL. L. & Pol'y Rev. 1, 37-45 (2000); Rieke, *supra* note 9; Gregory A. Thomas, *Conserving Aquatic Biodiversity: A Critical Comparison of Legal Tools for Augmenting Streamflows in California*, 15 STAN. ENVTL. L.J. 3 (1996); Michael Graf, *Using The Public Trust Doctrine To Achieve Proportionate Reductions of Water Diversions From The Delta*, 13 UCLA J. ENVTL. L. & POL'Y 263 (1994/1995). Historians and other non-legal authors have written as well. *See, e.g.,* NORRIS HUNDLEY, THE GREAT THIRST 407-25 (revised ed. 2001); MARC REISNER, CADILLAC DESERT (revised ed. 1993) (analyzing the politics of western water development, with extended attention to the Central Valley's controversies); DONALD WORSTER, RIVERS OF EMPIRE (1985) (analyzing water use politics throughout the west, and particularly in the Central Valley).

[11] *E.g.* Freeman and Farber, *supra* note 9; Thompson, *Markets for Nature*, *supra* note 9; Brandt, *supra* note 10; Rieke, *supra* note 9.

[12] *See* ENVISIONING FUTURES, *supra* note 2, at 14 ("The current Delta is unsustainable for almost all stakeholders."), 39-40.

[13] *See* Freeman and Farber, *supra* note 9, at 860-62 (discussing improved salmon runs and groundwater storage); CALIFORNIA DEPARTMENT OF FINANCE, IMPLEMENTATION STATUS OF THE CALFED BAY-DELTA PROGRAM, YEARS 1 THROUGH 5 92 (2005).

[14] *See* THE BAY INSTITUTE, ECOLOGICAL SCORECARD: SAN FRANCISCO BAY INDEX 2005 (2005), *available at* http://www.bay.org/Scorecard/2005.Bay.Index.Report.pdf.

[15] LITTLE HOOVER COMM'N, *supra* note 5, at 33.

[16] *See* ENVISIONING FUTURES, *supra* note 2, at 43-51, 58. That problem is less central to this article's analysis than the recent ecological crashes, but it is perhaps the most ominous challenge confronting the Bay-Delta's managers.

notwithstanding the recent absence of droughts.[17] As one EPA scientist recently stated, "[s]omething is really, really wrong. It is not just the sensitive fish. The cockroaches are dying off."[18]

Those ecological declines coincided with an institutional collapse.[19] The CALFED bureaucratic structure, though praised by legal scholars, has been selectively ignored by key participants in the Bay-Delta controversies;[20] received withering critique from independent reviewers and legislators;[21] and faces an uncertain funding future.[22] The Bay-Delta Authority, the joint federal-state agency created to coordinate CALFED's implementation, soon may cease to exist.[23] Yet many of the key conflicts that originally necessitated CALFED persist. California's water wants continue to grow, variability and uncertainty remain, and the federal and state agencies responsible for delivering Bay-Delta water propose to escalate pumping levels.[24] Such export pumping contributed to both historic and recent ecological declines,[25] and if those declines aren't reversed, the CALFED agencies could lose species or leave the hub of California's water supply system an injunction away from a major shutdown—exactly the outcomes the CALFED process attempted to prevent. Speaking of the degraded fisheries and other problems,[26]

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[17] *See* 71 FED. REG. 17,757 (NMFS, April 7, 2006) (describing declines in fish populations ""to the lowest levels ever recorded"); Mike Taugher, *Environmental Sirens in Delta Are Screaming*, CONTRA COSTA TIMES, May 1, 2005 (quoting EPA biologist Bruce Herbold); California Department of Water Resources and California Cooperative Snow Surveys, *Chronological Reconstructed Sacramento and San Joaquin Valley Water Year Hydrologic Classification Indices* (2005), *at* http://cdec.water.ca.gov/cgi-progs/iodir/WSIHIST (showing water year classifications dating back to 1901).

[18] *See* Taugher, *supra* note 17.

[19] *See* ENVISIONING FUTURES, *supra* note 2, at 1.

[20] *See, e.g.,* LITTLE HOOVER COMM'N, *supra* note 5, at 80.

[21] *See* Freeman and Farber, *supra* note 9, at 872; LITTLE HOOVER COMM'N, *supra* note 5, cover letter at 1 ("To a new generation of officials, CALFED is costly, underperforming, unfocused and unaccountable"); KPMG LLP, CALFED INTERVIEW AND SURVEY FINDINGS REPORT (2005) (finding widespread dissatisfaction).

[22] *See* Freeman and Farber, *supra* note 9, at 873-75 ("It was extremely fortunate that the CalFed ROD was adopted at a time when both the state and federal budget surpluses were at an all-time high."); LITTLE HOOVER COMM'N, *supra* note 5, at 41 (describing the CBDA funding plan as a "failure").

[23] Mike Taugher, *CALFED Reorganization Includes New Delta Plan*, CONTRA COSTA TIMES, July 3, 2006; *see* LITTLE HOOVER COMM'N, *supra* note 5, at 41 (describing "the ambiguity of [CALFED's] mission, the lack of legislative and executive leadership and waning stakeholder support").

[24] *See, e.g.,* Glen Martin, *The California Water Wars: Water Flowing to Farms, not Fish; Environmentalists Lose Leverage as Agribusiness Locks in Cheap, Plentiful Supplies—for Decades*, SAN FRANCISCO CHRONICLE, October 23, 2005.

[25] *See* ENVISIONING FUTURES, *supra* note 2, at 124 ("Recent work on (the) pelagic organism decline indicates that Delta pumping may play a significant role in the decline of delta smelt.").

[26] Levee fragility, funding shortfalls, and increased political discord also contribute to CALFED's presently poor reputation. *See id.*

California's Little Hoover Commission recently summarized the situation bluntly: "CALFED was forged from a crisis, and to a crisis CALFED has returned."[27]

Those setbacks raise important questions about the ways we attempt to understand and resolve environmental crises, for the Bay-Delta controversy involved a classic environmental challenge. From the Columbia River to the Okavango Delta, water managers wrestle with similar dilemmas as they attempt to sustain ecosystems while allocating scarce water to meet growing human needs.[28] Other natural resources present analogous challenges; whether they are managing energy supplies,[29] ocean fisheries,[30] or forests,[31] to provide just a few examples, environmental decision-makers often must balance protection and consumption of scarce and variable resources. Those challenges are likely to become increasingly common, as growing populations and developing economies place increased demand upon many resources, and as climate change exacerbates the instability of natural systems.[32] If the CALFED agencies, though blessed with access to "enormous intellectual talent,"[33] a political consensus demanding solutions, and the creativity to develop new management techniques, struggled to resolve

[27] LITTLE HOOVER COMM'N, *supra* note 5, cover letter at 1. The CALFED ROD has been challenged and is currently being reviewed by the California Supreme Court. Cites to the "CALFED Administrative Record" refer to the record from that litigation.

[28] *See, e.g.*, MARQ DE VILLIERS, WATER: THE FATE OF OUR MOST PRECIOUS RESOURCE 3-9 (2000) (describing conflicting demands placed on Botswana's Okavango Delta); SANDRA POSTEL, THE LAST OASIS: FACING WATER SCARCITY (1992) (describing water conflicts worldwide); Reed Benson, *"The Supreme Court of Science" Speaks on Water Rights: National Academy of Sciences Columbia River Report and its Water Policy Implications*, 35 ENVTL. L. 85, 86-87 (2005).

[29] *See* Craig Canine, *California Illuminates the World*, ONEARTH, Spring 2006, *available at* http://www.nrdc.org/onearth/06spr/ca1.asp (describing the California energy crisis).

[30] *See, e.g.*, Jeff Brax, *Zoning the Oceans: Using the National Marine Sanctuaries Act and the Antiquities Act to Establish Marine Protection Areas and Marine Reserves in America*, 29 ECOLOGY L.Q. 71, 94-97 (2002) (describing the demise of many fisheries).

[31] *See, e.g.*, YAFFEE, *supra* note 2 (describing logging controversies in the Pacific Northwest); Dave Owen, *Prescriptive Laws, Uncertain Science, and Political Stories: Forest Management in the Sierra Nevada*, 29 ECOLOGY L.Q. 747 (2003) (describing Forest Service efforts to balance environmental protection, the amount of timber harvests, and the reliability of those harvests).

[32] *See, e.g.,* CALIFORNIA CLIMATE CHANGE CENTER, OUR CHANGING CLIMATE: ASSESSING THE RISKS TO CALIFORNIA (2006) (hereinafter "OUR CHANGING CLIMATE").

[33] Glennon and Thorson, *supra* note 10, at 520.

their high-profile problem, the obvious and important questions are what went wrong,[34] and how could decision-makers lacking such advantages hope to do better? [35]

As in any environmental crisis, the answers to those questions are complex and multifaceted, and several recent reports have explored aspects of CALFED's troubles. California's Little Hoover Commission[36] meticulously dissected flaws of CALFED's institutional structure and political leadership.[37] The consulting company KPMG and California's Department of Finance have helped explain sources of widespread stakeholder dissatisfaction with CALFED's management and implementation.[38] The Public Policy Institute of California analyzed the Bay-Delta's full array of problems from the perspective of scientists, economists, and engineers; its authors attribute the Bay-Delta's ecological declines largely to attempts to impose stability upon a naturally fluctuating ecosystem.[39] All reports agree that Washington's faltering support—federal funding has been a fraction of anticipated levels, and the Bush Administration never has provided high-level leadership—also created obstacles to the program's success, as did the failure to ensure reliable funding from stakeholders.[40]

All of those critiques are cogent and important,[41] but this article argues that they leave out a significant contributing flaw in the CALFED approach.[42] The Little Hoover Commission and KPMG reports focus largely on institutional flaws, but CALFED's

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[34] To critique the CALFED process is not to condemn it, for that process tackled problems no one previously had been able to solve, and that many entities had shown little interest in solving. *See* LITTLE HOOVER COMM'N, *supra* note 5, at ii.

[35] *See* Freeman and Farber, *supra* note 9, at 857 (attributing CALFED's successes partly to "a favorable stakeholder environment in which parties not only wanted agreement, but had the expertise, resources, and relationships necessary to contribute to it").

[36] The Little Hoover Commission "is an independent state oversight agency." Its "mission is to investigate state government operations and—through reports, recommendations and legislative proposals—promote efficiency, economy and improved service." About the Commission, *at* http://www.lhc.ca.gov/lhcdir/about.html (last checked August 9, 2006).

[37] *See* LITTLE HOOVER COMM'N, *supra* note 5.

[38] KPMG, *supra* note 21; CALIFORNIA DEPARTMENT OF FINANCE, *supra* note 13.

[39] *Id*. at 157-58. Historically, the Bay-Delta system was spatially and temporally heterogenous, with salinity conditions varying with seasons and tides. Most of its native species co-evolved with that regime. But because of the need of both in-Delta and export water users for freshwater, the Delta now is managed to provide a stable freshwater system, and this stability favors invasive species that have altered food chains upon which native species depend. *See id.* at 71-73.

[40] *See* ENVISIONING FUTURES, *supra* note 2, at 40-41.

[41] Despite agreeing with those critiques, I concur with Freeman and Farber's core argument that the CALFED process generated exemplary innovations and improved upon prior modes of Bay-Delta management.

[42] This article also supplements those analyses by providing a detailed legal discussion.

flawed institutional arrangements still were better than those often utilized in environmental management,[43] and even when stakeholders thought CALFED's institutional arrangements were working well, management decisions were laying the foundations for future troubles.[44] The PPIC report identifies weaknesses in the physical arrangement and management of Bay-Delta infrastructure and takes huge steps toward envisioning fixes, but the key solution it proposes—allowing more hydrologic variability—could take years, lots of money, and intense political wrangling to implement,[45] and is less likely to ever succeed if coupled with continued demands for reliably increased water consumption.[46] Similarly, while funding may have been short of CALFED's managers' expectations, the program still has received far more government money than typically is available for resolving environmental problems.[47] Attributing CALFED's struggles to institutional shortcomings, leadership failures, paltry legislative allocations, and attempts to impose stability upon a naturally-variable ecosystem therefore provides a partial but not complete answer; that diagnosis can help identify key elements of a positive solution, but also can lead toward measures unlikely to succeed in a world of imperfect, rigid, and chronically under-funded institutions.

This article adds to those reports, and to prior legal analyses of the CALFED process, by explaining that the Bay-Delta's resource allocation crises are partially rooted in a basic conceptual model for understanding environmental crises—a model that, while often employed, is ill-suited for a world of environmental variability and institutional fallibility. That conceptual model posits that environmental laws and policies exist to

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[43] *See* Freeman and Farber, *supra* note 9 (explaining the fragmented, piecemeal decisionmaking and federal-state tensions that CALFED partially succeeded in overcoming); William W. Buzbee, *Recognizing the Regulatory Commons: A Theory of Regulatory Gaps*, 89 IOWA L. REV. 1, 8-14 (2003) (describing several "confused regulatory terrains").

[44] *See infra* Part IV.

[45] *See* ENVISIONING FUTURES, *supra* note 2, at 179 ("politically, our analysis is purposefully naïve").

[46] One of the two promising solutions identified by the PPIC—reducing both the amount and reliability of pumping—is facially irreconcilable with such trends. The other—developing infrastructure to move water around, rather than through, the Delta—might somewhat reconcile tensions among pumping, protection, and reliability, but any system of water extraction is likely to create environmental strains and the commensurate threat of unexpected outcomes, and those strains could increase if pumping volumes grow.

[47] *See* ENVISIONING FUTURES, *supra* note 2, at 88-89, 187.

promote and balance two things: consumption and protection.[48] We debate, for example, how much water each user should be allowed to pump from our rivers and how much must remain to satisfy the needs of fish, and we seek a permanent and stable allocation among those ends. Moreover, in accordance with a consensus that we should not over-regulate,[49] environmental managers routinely assume that all resources not necessary for legally-required environmental protection should or even must be available for consumption, and legal schemes often both incorporate and encourage that assumption.[50] Those managers frequently believe their job is to determine exactly where the brink of legal non-compliance lies, and to allow, or even encourage, consumption right up to the perceived edge. Hence, for example, the CALFED agencies determined, in the record of decision that defined their program,[51] that even though they were legally obligated to improve environmental conditions, they also would attempt to provide more water for consumption and would leave less surplus water in the system. Encouraged by a legal system prioritizing consumption yet demanding baseline levels of protection, and by

[48] *See, e.g.*, Natural Resources Defense Council v. Daley, 209 F.3d 747, 753 (D.C. Cir. 2000) (describing the mandates of the Magnuson-Stevens Fishing Conservation and Management Act); CONGRESSIONAL BUDGET OFFICE, *Preface to* WATER USE CONFLICT IN THE WEST: IMPLICATIONS OF REFORMING THE BUREAU OF RECLAMATION'S WATER SUPPLY POLICIES (1997) ("Environmentalists, who want water to be left in the rivers to preserve threatened species, are now competing with urban and agricultural users for the West's limited water resources.").

[49] For critique of some of theories of overregulation, see Buzbee, *supra* note 43.

[50] *E.g.* Bennett v. Spear, 520 U.S. 154, 176-77 (1997) (describing the Endangered Species Act as a statute that attempts to protect species yet prevent "needless economic dislocation"). Environmental management provides numerous examples of attempts to walk tightropes between over- and under-regulation. Air quality managers, for example, often attempt to regulate only to the minimum extent necessary to ensure compliance with the federal Clean Air Act's National Ambient Air Quality Standards (and believe they have no choice to go further), without preserving some margin for error. *See, e.g.*, *James D. Fine and Dave Owen, Technocracy v. Democracy: Conflicts Between Modeling and Participation and Environmental Law and Planning*, 56 HASTINGS L.J. 901, 959 & n.302 (2005). Environmental managers commonly attempt to determine the minimum amount of habitat necessary to allow endangered species to recover, with the assumption that development up to those limits will be allowed. *See, e.g.*, Tony Davis, *San Diego's Habitat Triage*, HIGH COUNTY NEWS, November 10, 2003. Water managers are commonly torn between policies promoting environmental protection and maximal consumptive use. *See* Cal. Const. art. X § 2 (promoting both goals).

[51] One benefit of "modular" regulatory processes, Freeman and Farber argue, is that they de-emphasize "peak-level" decisions like the ROD and instead diffuse decision-making into ongoing implementation processes. Freeman and Farber, *supra* note 9, at 825-26. But peak-level decisions are more visible than ongoing implementation processes and usually specify road maps for future actions, and thus play a crucial role in defining expectations. Additionally, peak-level decisions provide important opportunities for participants with limited time (such as political leaders) or money (such as public interest groups) to participate in decision-making processes.

conventional expectations that they should constrain consumption as little as possible, they perceived no other choice.[52]

The flaw in that conceptual framework is its tendency to encourage fragile, unreliable resource allocation patterns. In many natural systems, conditions vary chaotically, and changes, surprises, and catastrophic events are the norm. The rules apportioning scarce resources therefore rarely can set just one permanent balance among consumptive uses and protection requirements, and we cannot assume we may safely consume right up to some fixed and discernable brink of illegality. Instead, resource-management rules should anticipate the burdens of uncertainty, managerial fallibility, and change. When dry weather leaves rivers low, for example, rules determine who gets the remaining water and whether the river is pumped dry, and when conditions are wet, managers must determine whether we leave a buffer for drought, or whether we instead allow habitual consumption beyond dry-year limits.[53] Likewise, if we misunderstand a natural system, and protected species' survival requires more water than we had anticipated, either our consumptive patterns or our protective goals must adjust. But the traditional consumption vs. protection, consume-to-the-brink conceptual framework says little about preparing for such variability.[54] Moreover, adaptive policies, though often emphasized in academic and policy literature as a means to address variability and uncertainty, can prove dauntingly difficult to implement, largely because common preferences for stability can undermine the institutional dexterity upon which adaptive

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[52] *See* CALFED BAY-DELTA PROGRAM FINAL PROGRAMMATIC ENVIRONMENTAL IMPACT STATEMENT/ENVIRONMENTAL IMPACT REPORT CR-30 (2000) (hereinafter "CALFED EIR") (rejecting export reductions as an alternative worth considering).

[53] Of course, law doesn't always determine outcomes, and gaps often exist between rules and practice. *See, e.g.,* Reed D. Benson, *Maintaining the Status Quo: Protecting Established Water Uses in the Pacific Northwest, Despite the Rules of Prior Appropriation*, 28 ENVTL. L. 881 (1998).

[54] *See, e.g., infra* Part III.C (describing the structure of California water law). The Endangered Species Act, for example, imposes stringent protections when species are listed and no protections at all until listing occurs. *See* J.B. Ruhl, *Who Needs Congress? An Agenda for Administrative Reform of the Endangered Species Act*, 6 N.Y.U. ENVTL. L.J. 368, 384-85 (1998). Similarly, the Clean Air Act's air quality planning provisions contain little guidance on addressing uncertainty and variability; they seem to assume that modeling for a plan will either demonstrate compliance, in which case the plan is acceptable, or will not, in which case the plan must be rejected, with little acknowledgment that modeling can only offer probabilistic predictions. *See* Fine and Owen, *supra* note 50, at 933-34, 972 n.373.

management approaches depend.[55] The common consequence is fragile solutions ill-suited for a variable world.

Rather than focusing only on traditionally-understood conflicts between consumption and protection, this article proposes an improved conceptual framework that integrates environmental variability and uncertainty, and that directly addresses the relationship between that variability and the reliability—that is, the consistency and predictability—of resource allocations.[56] It acknowledges that in contexts of scarcity and environmental dynamism, protection, consumption, and reliability are often[57] in tension, with reliability increased only at the expense of protection or consumption. It also acknowledges that ignoring those tensions, and trying to maximize all competing goals simultaneously, can leave resource management schemes dangerously prone to costly and damaging legal collapses.[58] Consequently, solutions like those devised by the CALFED agencies, which are designed to increase consumption and protection of already-scarce resources, all in political environments where reliability is of paramount importance, will depend upon luck, managerial dexterity, brilliant engineering, and ample funding. Absent such good fortune, and even sometimes with it, such solutions will prove fragile, for reliability requires margins for error.

This article's analysis proceeds as follows. Part II discusses traditional theories—the "capture" paradigm and the "tragedy of the commons"—that underlie our resource management laws and often provide our conceptual foundations for understanding environmental problems, and that, in combination with traditional misconceptions of environmental stability, encourage us to understate or ignore the unreliability inherent in many resource allocation systems. It then develops an improved conceptual framework incorporating the role of environmental dynamism and change. Parts III and IV turn from general theory to the Bay-Delta's story, using those conflicts to illustrate the importance of the conceptual shift described in Part II. Part III discusses how environmental conditions, engineered infrastructure, and legal systems have created deep

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[55] *See* Doremus, *supra* note 3, at 55; *compare* Freeman and Farber, *supra* note 9, at 837 ("conditions of radical uncertainty… call for a spirit of provisionalism").

[56] *See supra* note 4 (explaining this article's definition of reliability).

[57] This isn't always true, of course (*see infra* pages __). My more limited thesis is that this conceptual framework is applicable often enough to be more useful than conventional conceptualizations.

[58] By legal collapse, I mean a management scheme that must be scrapped because it proves incapable of achieving the substantive mandates of applicable laws.

tensions among consumption, protection, and reliability, and have encouraged the adoption of solutions ill-suited to survive environmental change. Part IV discusses how those tensions came to a head during the Bay-Delta crisis, and how resource managers attempted to resolve them.

That discussion does not provide a comprehensive analysis of the CALFED process. It focuses on one aspect, albeit a key one, of CALFED's troubles. I also don't claim that poor results resulted solely from conceptual mis-framings, or that those results can be attributed to any single cause.[59] But I do explain how conceptual frameworks helped increase CALFED's vulnerability to failure, and Part V therefore closes the article by returning to the alternative conceptual framework proposed in Part II, and describing how it can inform improved resolutions of resource conflicts in the Bay-Delta and elsewhere.

II. CONCEPTUAL FRAMEWORKS AND DYNAMIC ENVIRONMENTS

A. Traditional Paradigms

A good starting point for understanding the challenges facing managers of many shared natural resources, and for explaining some the legal roots of the Bay-Delta's crises, is the traditional set of conceptual frameworks often used to understand resource allocation.

One traditional framework derives from what some scholars label the "capture"[60] or "dominion"[61] paradigm. That framework defines resource consumption as a good to be rewarded and a measure of economic health; if it acknowledges limits at all, it generally assumes that economic signals and rational self-interest will facilitate responses to shortage without regulatory intervention.[62] Though now often criticized as an anachronism from an era when human populations were low and natural bounty seemed

[59] *See* ENVISIONING FUTURES, *supra* note 2, at 137-38 (arguing that no single solution has yet been identified for the Bay-Delta's ills).

[60] *See* Michael C. Blumm and Lucas Ritchie, *The Pioneer Spirit and the Public Trust: The American Rule of Capture and State Ownership of Wildlife*, 35 ENVTL. L. 673, 684-90 (2005).

[61] *See* Jonathan Baert Wiener, *Beyond the Balance of Nature*, 7 DUKE ENVTL. L. & POL'Y FORUM 1, 5-6 (1996).

[62] *See* Douglas A. Kysar, *Law, Environment, and Vision*, 97 NORTHWESTERN L. REV. 675 (2003) (criticizing "a pre-analytic worldview in which nature is assumed to be boundless"); John G. Sprankling, *The Anti-Wilderness Bias in American Property Law*, 63 U. CHI. L. REV. 519 (1996).

unlimited,[63] influential vestiges of that paradigm remain throughout our legal systems for environmental management,[64] and those vestiges tend to be bolstered by a political and academic climate overtly hostile to any "over-regulation" that might interfere with consumptive patterns.[65] Some resources remain purposefully unregulated, many rules subsidize or otherwise encourage consumption even of scarce resources, [66] and many resource users, even while acknowledging in theory that limits might exist, are loathe to admit they might be approached.[67] Despite the critiques of environmental economists, we still often determine the strength of our economy partially by measuring resources consumed.[68] Similarly, resource users routinely resist consumptive limits, and that resistance often succeeds, at least temporarily.[69]

Almost forty years ago, biologist Garret Hardin defined the classic critique of the capture paradigm. He observed that exploitation of an open-access resource—that is, a resource open to many but controlled by none—creates a tendency toward tragedy.[70] Each user's most "rational" strategy is to take as much as possible, even if the collective effect of many individuals pursuing that strategy is exhaustion of the resource.[71]

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[63] *E.g.* Blumm and Ritchie, *supra* note 60, at 686-92; Kysar, *supra* note 62; Wiener, *supra* note 61, at 10 ("it represents an ethic of hubris, disdain, and despotism").

[64] *See* Kysar, *supra* note 62, at 678. Kysar argues that the continued vitality of this paradigm helps explain the lack of urgency with which we approach many environmental problems.

[65] *See* Buzbee, *supra* note 43, at 8-14 (describing this climate); Richard W. Parker, *Grading the Government*, 70 U. CHI. L. REV. 1345, 1345-55 (2003) (questioning the basis for this culture).

[66] *E.g.* Harry Scheiber, *Ocean Governance and the Marine Fisheries Crisis: Two Decades of Innovation*, 20 VA. ENVTL. L.J. 119, 121 (2001) (noting that fishery exploitation was encouraged by government subsidies); Michael Axline, *Salvage Logging: Point & Counterpoint: Forest Health and the Politics of Expediency*, 26 ENVTL.L. 613, 619-20 (1996) (discussing timber harvest subsidies); Joseph L. Sax, *We Don't Do Groundwater: A Morsel of California Legal History*, 6 U. DENV. WATER L. REV. 269 (2003).

[67] *See, e.g.*, *infra* Part III.C (describing state and federal laws allocating California's waters). Such reluctance to acknowledge limits forms a recurring theme throughout environmental management, and seems particularly pronounced when the resource at stake is water. *See, e.g.*, Barton H. Thompson, *Tragically Difficult: The Obstacles to Governing the Commons*, 30 ENVTL. L. 241 (2000) (hereinafter Thompson, *Tragically Difficult*); WALLACE STEGNER, WHERE THE BLUEBIRD SINGS TO THE LEMONADE SPRINGS xv-xix (1992) (castigating the water booster culture of the American west).

[68] *See* Kysar, *supra* note 62, at 680-81.

[69] *See, e.g.*, Thompson, *Tragically Difficult*, *supra* note 67 at 243 (analyzing why such resistance occurs).

[70] Garret Hardin, *The Tragedy of the Commons*, 162 SCIENCE 1243-48 (1968); *see* Kysar, *supra* note 62, at 682-83 (describing the significance of Hardin's insight).

[71] *Id*; *see* ELINOR OSTROM, GOVERNING THE COMMONS 2-3 (1990). People do not always behave this way. As numerous commentators have pointed out, people recycle, vote, avoid littering, contribute to charities, and even volunteer for dangerous military duties despite seemingly reaping only a tiny share of the benefits of their efforts. *See* Ann E. Carlson, *Recycling Norms*, 89 CALIF. L. REV. 1231, 1232, 1247

Individual restraint would be pointless, for resources saved through conservation would only be consumed by someone else.[72] The implications of this insight were profound, for it undermined paradigms that treat resource consumption as an inherent good, and posited that only the intervention of regulatory schemes can prevent tragic outcomes.

The power of Hardin's metaphor[73] derived not only from its simplicity, but also from its relevance to the modern world. Many natural resource dilemmas involve some variation of the tragedy of the commons.[74] Water bodies, for example, are easy to exploit and difficult to control. Fisheries,[75] timber harvesting,[76] and even air pollution[77] pose similar challenges. Hardin pointed out several of these examples, other scholars have discussed many more (and have refined his search for solutions),[78] and the commons has

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(2001); Korobkin and Ulen, *Law and Behavioral Science: Removing the Rationality Assumption from Law and Economics*, 88 CALIF. L. REV. 1051, 1138-42 (2000).

[72] *Hardin, supra* note 70, at 1247 (discussing the "pathogenic effects of conscience"). This problem is closely related to collective action problems identified by Mancur Olson and others; because each commons user would gain disproportionately little benefit from his own restraint, his incentive is to act as a free rider. *See* MANCUR OLSON, THE LOGIC OF COLLECTIVE ACTION (1965); Carlson, *supra* note 71, at 1243-44.

[73] Hardin did not create the idea of the tragedy of the commons. Instead, he presented it in compelling fashion, gave it a pithy name, and cogently explained such tragedies' frequency. *See* H. Scott Gordon, *The Economic Theory of a Common-Property Resource: the Fishery* (1954); OSTROM, *supra* note 71, at 2-3 (tracing the historic evolution of the idea, and quoting Aristotle and Hobbes).

[74] *See* Hardin, *supra* note 70, at 1244-45 (discussing rangeland grazing, fisheries management, urban parking, and population growth).

[75] *Id.* at 1244; *see* Thompson, *Tragically Difficult*, *supra* note 67, at 247-49; Harry N. Scheiber and Christopher J. Carr, *From Extended Jurisdiction to Privatization: International Law, Biology, and Economics in the Marine Fisheries Debates*, 1937-1976, 16 BERKELEY J. INT'L L. 10, 17-18 ("A map of the world's ocean fishery stocks today illustrates a shocking number of areas in which stocks are seriously endangered or actually depleted"); J.R. MCNEIL, SOMETHING NEW UNDER THE SUN 237-52 (chronicling declining fisheries and whale populations); Carol M. Rose, *Essay: Scientific Innovation and Environmental Protection: Some Ethical Considerations*, 32 ENVTL. L. 755, 760-61 (2002) (describing mechanisms that can lead to a fishery's demise).

[76] MCNEIL, *supra* note 76, at 229-37 (describing worldwide disappearance of forests).

[77] *See* Hardin, *supra* note 70, at 1245; *e.g.* Thompson, *Tragically Difficult*, *supra* note 67, at 253-55 (discussing CO_2 emissions and global climate change); Carlson, *supra* note 71 (recycling); Daniel H. Cole, *From Local to Global Property: Privatizing the Global Environment?: Clearing the Air: Four Propositions About Property Rights and Environmental Protection*, 10 DUKE ENVTL L. & POL'Y REV. 103 (acid rain).

[78] *See, e.g.*, OSTROM, *supra* note 71 (1990) (discussing community forests and farmlands, inshore fisheries, surface-water allocation systems, and groundwater allocation systems); Thompson, *Tragically Difficult*, *supra* note 67 (discussing fisheries, groundwater extraction, and climate change); Carlson, *supra* note 77 (recycling); Cole, *supra* note 77 (acid rain). For summary discussion of later refinements of the commons concept, see Buzbee, *supra* note 43, at 7-22.

become the classic conceptual model for understanding and evaluating legal and policy regimes for resource management.[79]

In practice, commons-management problems often are even more difficult than Hardin's essay might suggest, for many natural resources serve multiple and competing purposes. Hardin's primary example—a pasture where herdsman graze their cattle—implies single-purpose management; he did not discuss whether some grass might need to be reserved for the pleasure of picnickers.[80] Yet many resources are not amenable to such single purpose management. Rivers, for example, often support irrigation, hydropower, cities, fisheries, and recreation.[81] National forests cannot be managed solely for timber production; they also provide wildlife habitat, sustain water quality, and allow people to enjoy the woods.[82] Consequently, the challenges of managing common-access resources typically are multifaceted, with environmental values, consumptive uses, and non-consumptive uses all threatened.

In practice, much natural resource regulation is founded upon the uneasy and shifting balance between the multifaceted tragedy-of-the-commons theory and the traditional capture/anti-overregulation paradigm. Regulators typically rely upon environmental laws to mark the points at which tragedies of the commons are occurring, and are charged with taking sufficient action to avoid compromising backstop environmental protection requirements, even if that necessitates limiting consumptive use. But, based on the belief that resource exploitation should not be limited unnecessarily—in other words, that government should regulate just enough to prevent illegal degradation, but no more—we often discourage anything that might be termed

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[79] *See* Brady v. FERC, 416 F.3d 1, 11 (D.C. Cir. 2005) (Williams, Senior Judge, concurring) ("Two generations have now grown up with Garrett Hardin's famous article, *The Tragedy of the Commons*"). Many studies also discuss successful management efforts. *E.g.* OSTROM, *supra* note 71; JARED DIAMOND, COLLAPSE: HOW SOCIETIES CHOOSE TO FAIL OR SUCCEED 277-308, 329-357 (2005); NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, IMPLEMENTING THE SUSTAINABLE FISHERIES ACT: ACHIEVEMENTS FROM 1996 TO THE PRESENT 2-6 (2003); Marine Stewardship Council, *Certified Fisheries*, *at* http://www.msc.org/html/content_484.htm (last visited January 14, 2006) (listing fisheries that MSC has certified as sustainably managed).

[80] Many of the resources described in Ostrom's studies—waters used exclusively for agricultural, in-shore fisheries, and southern California aquifers—were managed for single purposes. *See* Ostrom, *supra* note 71.

[81] *See, e.g., infra* Part III (discussing multiple purposes served by California's rivers).

[82] *See* 16 U.S.C. § 528 ("It is the policy of the Congress that the national forests are established and shall be administered for outdoor recreation, range, timber, watershed, and wildlife and fish purposes.").

overregulation,[83] sometimes subsidize consumption,[84] and ask environmental managers to find exactly the balance point at which environmental protection requirements are met and human use is limited no more than necessary, assuming that such balance points can be readily discerned and that our consumption patterns will be stable so long as we stop just shy of the brink.[85] Those balance points are often contested, with environmental advocates and resource consumers vigorously disputing where the brink lies; but far less often do we debate the wisdom or legality of consuming to that perceived brink. We seek, in short, to avoid tragedies of the commons but are often willing to fully allocate resources, and often strive to consume right up to the limits of the law.

B. Environmental Dynamism, Shared Resources, and a New Conceptual Approach

That standard conceptual framework predicts that resource managers face a daunting task, for they must resolve multifaceted tensions among consumers, and between consumption and protection. In practice, however, another dimension adds additional difficulty: resource managers also must address environmental dynamism and change.

Though notions of natural harmony and equilibrium once were standard among ecologists and still remain widespread among non-scientists—and although those views were still widely accepted when most of our major environmental laws were drafted—environmental scientists have long since discovered that many natural systems are neither stable nor predictable.[86] The available amounts of many resources fluctuate chaotically. Weather varies and climates change, even without anthropogenic influences, and Katrina-like catastrophes, though infrequent, are not anomalous.[87] Throughout much of the world, droughts and floods are the norm rather than the exception. Species migrate, often

[83] *E.g.* Bennett v. Spear, 520 U.S. 154, 176-77 (1997) (describing the ESA as partly designed to prevent overregulation). The California Constitution exemplifies this approach, mandating that water be used as much as possible but no more than is reasonable. Cal. Const. art X § 2.

[84] *See, e.g., infra* Part III.C.2 (describing subsidies for water consumption); *supra* note 66.

[85] *E.g.* Fine and Owen, *supra* note 50, at 959 & n.302.

[86] *See generally* DANIEL BOTKIN, DISCORDANT HARMONIES (1990). Botkin discusses ecological research that undermined traditional understandings of natural harmony and stability. *See also* Wiener, *supra* note 61 (describing this change).

[87] BOTKIN, *supra* note 86, at 56-68 (discussing the historic dynamism of climate, even during interglacial periods, corresponding ecosystem changes); DIAMOND, *supra* note 79, at 12-13 (identifying climate change as a major factor affecting the resilience of human societies).

with human assistance, and invade new territories, sometimes with major consequences.[88] Even absent human influence, wildlife populations can vary wildly, and slight alterations to an ecosystem can trigger major changes in abundance.[89] Many ecosystems, including the Bay-Delta, depend upon change, and struggle to survive without some natural variability.[90]

Incomplete knowledge exacerbates the effects of natural unpredictability.[91] To provide one notorious example, Colorado River allocations for years were premised upon overestimates of flows, and water supply forecasts for much of the southwest thus were compromised not only by natural dynamism but also by human mistakes.[92] Wildlife species often are misunderstood, and biologists sometimes have limited knowledge about how many individuals there are or where they live.[93] Similar examples abound throughout environmental science; with many natural systems, we do not know what conditions might be normal, or whether or why changes are occurring.[94] That limited knowledge increases the difficulty of predicting how much of a resource will reliably be available for human use, how stringent environmental protection must be, and where exactly the brink of unsustainability lies.

Because of that variability and uncertainty, most schemes for managing common-access resources cannot just define one permanent balance between resource consumption and environmental protection. Though our conventional approaches may demand such balance points, they can be difficult to find, and are likely to change with time. Our management schemes instead must select—whether intentionally or inadvertently—the adjustments to be made when conditions change, and the extent to which we are prepared for variability. If drought strikes or unexpected environmental

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[88] *See, e.g.*, *Invasivespeciesinfo.gov: A Gateway to Federal and State Invasive Species Activities and Programs*, *at* http://www.invasivespeciesinfo.gov/impacts.shtml (last visited January 16, 2006).

[89] *See* BOTKIN, *supra* note 86, at 27-71.

[90] *See, e.g.*, ENVISIONING FUTURES, *supra* note 2, at 157; Robert Jerome Glennon and Peter W. Culp, *The Last Green Lagoon, How and Why the Bush Administration Should Save the Colorado River Delta*, 28 ECOLOGY L.Q. 903, 906-07 (2002) (explaining flooding's beneficial impacts on the Colorado River); Owen, *supra* note 31, at 753-54 (discussing negative impacts of forest fire suppression).

[91] *See, e.g.,* Freeman and Farber, *supra* note 9, at 889 ("the dearth of knowledge about virtually every aspect of the Bay-Delta system is striking").

[92] *See* Glennon and Culp, *supra* note 90, at 916.

[93] *See, e.g.*, Owen, *supra* note 31, at 778-80 (describing limited understanding of the California spotted owl).

[94] *See, e.g.*, Mike Taugher, *Delta Fish Crash Remains a Mystery*, CONTRA COSTA TIMES, Dec. 28, 2005.

needs occur, for example, rules help decide whether water will remain in our rivers or lakes, or whether pumping will continue at environmental expense.[95] Similarly, during periods of abundance, or times when environmental limits aren't understood, rules help decide whether the resource will be consumed to the maximum extent possible, creating the potential for sudden and drastic cutbacks when times change, or whether consumption limits will reserve a margin of safety. The rigidity of our rules also influences preparedness; if our rules create *de jure* or *de facto* inflexibility, adjustment to change can be significantly more difficult. And when catastrophes strike—when natural disasters damage our supply infrastructure, for example, or when drought sets in, or protected species' populations plummet—our schemes for managing consumption and protection will likely have played important roles in determining whether we were prepared, or whether we must attempt costly changes in course.

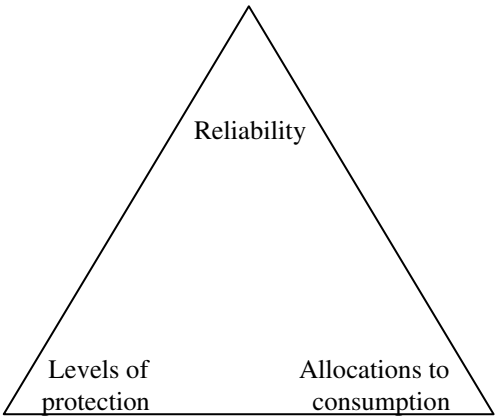
Rather than merely balancing consumption and preservation, resource managers therefore frequently must address tri-polar tensions between resource consumption, environmental protection, and the reliability of resource allocations. The conceptual diagram below graphically depicts this tension. The bottom left corner represents the amount of a resource devoted to environmental protection. The top corner represents reliability. The bottom right corner represents the amount of consumption.[96] A management scheme for allocating a scarce resource may be plotted by placing it closer to the values it favors and further from those it disfavors.[97] Moving a management scheme closer to any one corner, however, necessarily means moving it further from at least one, if not both, of the others. Maximizing reliability, for example, can require reducing commitments to both protection and consumption, and leaving an increased

[95] *See, e.g.*, Rieke, *supra* note 9 (describing competition over water supplies during California's 1987-92 drought, and the role environmental laws played in determining allocation of dry year flows).

[96] In contrast, a traditional conceptual model could be represented by a two-dimensional continuum between consumption and protection, and the task of resource managers would be simply to find an optimum point long that line.

[97] Management schemes for wilderness areas, for example, plot close to the endpoint of pure environmental protection; preservation is paramount, resource consumption is limited, and the reliability of consumption is basically irrelevant. *See* 16 U.S.C. 1133 (precluding all but a limited set of uses of wilderness areas). Once a species approaches extinction, the Endangered Species Act plots similarly. *See* Tennessee Valley Auth. v. Hill, 437 U.S. 153, 173-74 (1978) ("Congress intended endangered species to be afforded the highest of priorities"). A prior appropriation water-allocation system unfettered by environmental constraints would plot closer to the lower right corner. Such a legal system prioritizes consumption, but reliability is of secondary importance for all but the most senior users, and environmental protection is irrelevant. *See infra* Part III.C.1 (describing prior appropriation).

amount of a resource unallocated. The figure thus reflects the common reality that protection, consumption, and reliability can be mutually exclusive.



This diagram obviously is highly schematic. Protection and consumption are broad terms describing things not always amenable to clear definition, let alone measurement or quantification. Reliability, as defined in this article, is a clearer concept, but still is difficult to measure or predict.[98] Additionally, though the diagram might suggest unity among environmental protections or consumptive uses, tensions commonly exist within each of the endpoints. Conditions favoring one wildlife species can harm another,[99] and consumptive uses also conflict. Water users lower in a river system may share more interests with environmentalists devoted to preserving in-stream flows, for example, than with upstream appropriators, and fishermen and irrigators are often at odds.[100]

This conceptual framework also is by no means universally applicable or fully descriptive of resource management controversies. Its premise—that reliability, allocations to environmental protection, and resource consumption are inexorably in tension—is rarely entirely true, and its applicability can vary over time. Some resources aren't that scarce. Others are, but only some of the time or in some locations, leaving opportunities to increase consumption without any significant threat of degradation or

[98] *See supra* note 4.

[99] *See* ENVISIONING FUTURES, *supra* note 2, at 83 ("in the present Delta, the delta smelt and Chinook salmon have different, and at times opposing, needs").

[100] *E.g.* State Water Resources Control Board Cases, 136 Cal. App. 4th 674 (2006) (aligning environmental groups and within-Delta agricultural interests). Different types of consumptive uses also tend to conflict; salmon fishermen, for example, are routinely at odds with irrigators.

unreliability.[101] Even where such scarcity is persistent, many actions—for example, introducing technologies that augment resource availability, or altering the place or method of resource extraction—can simultaneously improve consumption, protection, and reliability.[102] Environmental protection occurs in multiple ways, many of which do not conflict with resource consumption, and much of the work of environmental managers focuses on finding such win-win solutions.[103] Environmental protection also often creates reliability benefits and can support consumption; without protection, resources can entirely disappear.[104]

For all of these reasons, this conceptual approach provides neither a universal explanation for environmental dilemmas nor an algorithmic tool capable of spitting out fully-formed solutions. But so long as we respect those caveats, it can be useful.[105] The tensions it describes are exceedingly common, at least where resources are scarce; taking more water from a depleted river or more trees from a degraded forest, for example, almost necessarily creates environmental strains, and those strains, by increasing threats of non-compliance with environmental laws, can threaten the reliability of consumptive patterns.[106] And even a generalized conceptual framework can help environmental decision-makers understand and resolve those tensions. We routinely use simplified paradigms or rely on "pre-analytic worldviews"—traditional economics' treatment of consumption as an inherent good, a desire to avoid overregulation, the classic tragedy-of-the-commons theory, for example—to understand environmental controversies, evaluate the urgency of problems, and develop solutions, just as in other legal areas we rely upon simple concepts to organize our understanding of problems and inform or exclude

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[101] The CALFED ROD, for example, was partly premised on the assumption that such conditions existed. *See infra* notes 342-343 and accompanying text.

[102] For example, desalination might someday allow increased consumption, improved reliability, *and* increased environmental protection of California's freshwater resources. *See* CALIFORNIA DEPARTMENT OF WATER RESOURCES, CALIFORNIA WATER PLAN UPDATE 2005, V.2 ch. 6 (2006) (hereinafter 2005 WATER PLAN) (discussing desalination's benefits and potential problems).

[103] *See, e.g.,* ENVISIONING FUTURES, *supra* note 2, at 171 (describing infrastructure changes that might facilitate consumption and improve environmental performance).

[104] *See*, *e.g.,* Blumm and Ritchie, *supra* note 60, at 690-92 (describing the demise of the passenger pigeon); Brax, *supra* note 30, at 100-01 (observing that marine sanctuaries can boost fishing by providing refuges from which fish can repopulate surrounding areas).

[105] *See generally* Guido Calabresi and A. Douglas Melamed, *Property Rules, Liability Rules, and Inalienability: One View of the Cathedral*, 85 HARV. L. REV. 1089, 1128 (1972) (explaining why conceptual models, despite their perils, are often worth developing).

[106] *See generally* DAVID QUAMMEN, THE SONG OF THE DODO (1996) (explaining ecological research connecting habitat reductions to extinction).

possible solutions.[107] Those conceptual frameworks ought to address tensions between consumption, protection, and reliability, for the stability of resource allocation patterns tends to be ecologically, economically, and politically important.[108] But many traditional environmental paradigms address those tensions obliquely, if at all,[109] and thus encourage adoption of solutions that prove insufficiently robust or demand rapid adaptation when environmental conditions change. This approach, by contrast, provides an improved basis for evaluating and explaining whether solutions will be durable or are built only for best-case scenarios.

And those explanations can be politically and legally important. Although existing legal frameworks and economic incentives often encourage policymakers to allow or even promote consumption right up to perceived brinks of legal non-compliance, rarely do laws mandate such an approach.[110] Instead, agencies generally possess the legal discretion, though they may not realize it,[111] to plan for margins for error—so long as they are able to offer rational explanations for imposing such restraint. Similarly, while political pressure for consumption may be intense, it isn't always immutable; the importance of long-term reliability is something resource-consuming businesses can appreciate, and agencies generally have institutional incentives toward developing lasting solutions.[112] Legal frameworks also are subject to change, and legislators often can

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[107] *See* Kysar, *supra* note 62, at 678 (arguing that flawed conceptual worldviews encourage us to underestimate the urgency of environmental problems). A classic example of a simplified organizing principle is the legal concept of "separation of powers." The concept is general, but we routinely use it to understand constitutional dilemmas and narrow the range of permissible resolutions. Such general concepts are particularly important to non-expert decision-makers struggling to understand complex problems—a description often applicable to the judges and political leaders or appointees who oversee environmental management, yet may know little of environmental science.

[108] While variability may promote the vitality of healthy ecosystems, it can be devastating to already-degraded systems. *See, e.g.,* QUAMMEN, *supra* note 106, at 293-96 (1996) (describing how natural variability and scarcity can combine to cause extinctions).

[109] A traditional capture approach, which does not acknowledge limits, obviously also does not acknowledge the unreliability that follows from exceeding those limits, and an approach that perceives consumption/protection balance points as determinable and stable provides little reason to consider unreliability.

[110] *See, e.g., infra* Part III.C (describing the legal systems for managing California water).

[111] *See* Fine and Owen, *supra* note 50, at 959 & n.302 (describing California air quality regulators' perception that they could not legally impose a margin of safety in their regulations).

[112] Of course, while resource users may embrace this principle in the abstract, they may be reluctant to acknowledge the need for such margins or error in particular instances, or even to agree that non-compliance with environmental mandates is a problem worth avoiding. *See, e.g.*, Thompson, *Tragically Difficult*, *supra* note 67 (analyzing resource users' common resistance to protection of resources upon which they depend).

decide whether to enact or perpetuate laws encouraging scarce resource consumption. A traditional conceptual model for resource management provides no argument against such policies or laws; to a judge or resource consumer believing that environmental limits are fixed and determinable and that consumption up to those limits poses no threat, or believing that adaptive policies can quickly address any unexpected developments that arise, any regulatory reluctance to allow consumption right up to those limits might seem capricious. A reliability-based approach, however, can provide the theoretical basis for environmental managers to develop and justify solutions that reserve margins of error.

To ground this discussion in practical experience, the next sections turn from theory to exposition, and discuss ongoing efforts to resolve one of the nation's most important and intractable resource allocation crises. That discussion, though not intended as comprehensive, is necessarily detailed; the CALFED controversy involves a complex and dynamic ecosystem, rich history, convoluted politics, and an intricate and somewhat conflicting web of laws, and this discussion focuses on just one aspect—albeit an important one—of CALFED's troubles. Yet underlying all that detail lies the story of a typical environmental dilemma, and its faltering resolution illustrates the importance of developing better conceptual approaches to environmental management and law.

III. CREATING THE TENSIONS: CONVENTIONAL FRAMEWORKS AND CALIFORNIA'S WATERS

For decades, allocating California's waters has caused controversy. The state's waters support diverse, economically and ecologically important, and legally protected ecosystems, but agricultural and municipal water needs are enormous, and total demands often exceed supply.[113] Those competing demands create tensions, and litigious water wars, often involving the Bay-Delta, are as distinctively Californian as Hollywood or the Golden Gate Bridge.[114]

Though those conflicts are complex, the conceptual model described above summarizes the competing goals Californians hold for their water and the challenges they face in achieving those goals. Water in California is a regulated commons, with widespread access and limited overall quantities. Californians generally wish to consume

[113] *See generally* HUNDLEY, *supra* note 10; DAVID CARLE, INTRODUCTION TO WATER IN CALIFORNIA (2004); 2005 WATER PLAN, *supra* note 102, at V.1 pp. 3-8 to 3-9 (describing the allocation of California's water).

[114] *See supra* note 7 (citing cases).

lots of water, want reliable access to that water, and expect protection of the state's water-dependent natural systems, even as their consumption places those systems under strain. Yet the amount of available water varies with changing precipitation patterns and evolving human and environmental needs. Consequently, managers allocating California's waters must determine not only how much protection to provide and how much consumption to allow, but also how reliable that consumption will be when the weather turns dry. As discussed in detail in the following sections, California's water management schemes have often addressed those challenges in dysfunctional ways.

A. The Physical Environment

To someone spending winter in Eureka, in the northwest corner of California, Wallace Stegner's description of California as a "semi-desert with a desert heart" might seem odd.[115] Much of northern California receives extraordinary amounts of rain and snow. Areas of northwestern California's mountains are doused by 140 inches of precipitation in an average year.[116] Those storms then migrate eastward, piling up Sierra Nevada snowpacks that fill rivers through spring and summer.[117] Even some of California's urban areas would not appear, from a brief glance at an annual precipitation map, to be dry. San Francisco, for example, receives an annual average of approximately twenty-five inches of rain.[118]

Rich ecosystems evolved in dependence upon that precipitation. Prior to the dams of the twentieth century, rivers swollen with Sierra Nevada snowmelt flooded much of the Central Valley each spring, creating habitat for millions of waterfowl.[119] Hundreds

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[115] STEGNER, *supra* note 67, at 60 (quoting Walter Webb's description of the American west); *see* CARLE, *supra* note 113, at *3*-4 (2004) (describing Eureka's rainfall). For maps of California's natural and manmade water systems, see DWR, *Rivers and Water Project Maps*, *at* http://www.water.ca.gov/maps/ (last checked July 27, 2006); United States Geological Survey, *Average Annual Precipitation in California*, *at* http://education.usgs.gov/california/maps/california_precipitation1.htm (last checked July 27, 2006).

[116] *See* United States Department of Agriculture, Natural Resource Conservation Service, *California Annual Precipitation Map*, *available* at ftp://ftp.ftw.nrcs.usda.gov/pub/ams/prism/maps/ca.pdf (last checked April 16, 2006); 2005 WATER PLAN, *supra* note 102, at V.1 pp. 3-1.

[117] Natural Resource Conservation Service, *supra* note 116; CARLE, *supra* note 113, at 3-1 (describing California rainfall patterns); 2005 WATER PLAN, *supra* note 102, at V.1 pp. 3-1.

[118] *See* National Resource Conservation Service, *supra* note 116.

[119] CARLE, *supra* note 113, at 38-39 (showing historic extent of California wetlands), LITTLE HOOVER COMM'N, *supra* note 5, at 4 ("overhead skies blackened with migrating birds").

of thousands of salmon spawned in those same rivers.[120] The rivers met saltwater in the Bay-Delta, which then was an enormous and wildlife-filled maze of channels and marshlands.[121] In the southern San Joaquin Valley, Tulare Lake, formed by the discharge of the Tule, Kaweah, and Kings rivers, lay at the heart of another vast and explosively fecund wetland system.[122] Even in the deserts of southernmost California, runoff pooled in desert playas, creating oases amid the dry heat.[123]

Precipitation maps, however, and the historic extent of California's wetlands both are deceptive.[124] In summer, when temperatures are hottest, California gets little rain. Though much of the Central Valley flooded each spring, unwatered areas by May turn "dead and dry and crisp, as if every plant had been roasted in an oven."[125] Only isolated thunderstorms water the Sierra Nevada. Even the rain forests of the northwest coast rely on fog and stored groundwater for summer sustenance. Further south, the aridity isn't just seasonal. Many of California's most populated areas—the Los Angeles Basin, San Diego, and their suburbs—are near-deserts, with only limited and episodic winter rainfall.[126]

That natural environment is dynamic. In average years, California produces 71 million acre-feet[127] of runoff, but the variations are immense.[128] In 1983, for example, heavy rains fed 135 million acre-feet of runoff, while in 1977 the statewide total was 15 million acre-feet.[129] Catastrophic floods have occurred throughout California history.[130] The floods of 1997 washed away campgrounds in Yosemite National Park and temporarily resurrected Tulare Lake; more recently, Governor Schwarzenegger, warning

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[120] NRDC v. Patterson, 333 F.Supp.2d 906, 909 (2004) (describing the historic abundance of San Joaquin River salmon); LITTLE HOOVER COMM'N, *supra* note 5, at 4 (quoting "reports of salmon runs so dense that 'rivers looked like pavement'").

[121] *See* ENVISIONING FUTURES, *supra* note 2, at 17-18.

[122] MARK ARAX AND RICK WARTZMAN, THE KING OF CALIFORNIA 48-49 (2003); *see* CARLE, *supra* note 113, at 71.

[123] *See* HUNDLEY, *supra* note 10, at 6 (showing historic wetland locations).

[124] *See* United States v. State Water Resources Control Bd., 182 Cal.App.3d 82, 98 (1986).

[125] JOHN MUIR, MY FIRST SUMMER IN THE SIERRA 3 (1911).

[126] *See* Natural Resource Conservation Service, *supra* note 116; CARLE, *supra* note 113, at 53, 78.

[127] An acre-foot of water is an amount sufficient to flood one acre of land one foot deep.

[128] *See* CARLE, *supra* note 113, at 23-31.

[129] CARLE, *supra* note 113, at 23.

[130] *See* CARLE, *supra* note 113, at 29-30; HUNDLEY, *supra* note 10, at 79-84, 236-37; *Rapanos v. United States*, 126 S.Ct. 2208, 2242 (2006) (Kennedy, J. concurring) (describing the wildly variable hydrology of the Los Angeles River).

of Katrina-like disasters, declared the state's aging levies a flood-prone disaster area.[131] Dry years also are extreme, and often occur in succession; California's 1987-1992 drought was the latest episode in a longstanding pattern.[132] Tree-ring studies indicate that California, like much of the southwest, has suffered from dry periods far longer than those of the past century, and sooner or later such extended droughts will likely recur.[133]

California's natural reservoir systems somewhat mitigate that variability. Mountain snowpacks usually last well into summer and ensure that in most years runoff continues long after precipitation ceases.[134] Some precipitation also infiltrates the subsurface, where it remains in aquifers that replenish streams and supply wells even as surface runoff diminishes.[135] But each of those reservoir systems has its limitations. California's snowpacks are variable and have been declining, and because almost all of California's snows melt each year, they primarily mitigate within-year variability.[136] Groundwater reserves do last from year to year, but many of the state's aquifers already are depleted, and mining overdrawn aquifers can cause subsidence of the ground surface, raise pumping costs, and deplete streams by depriving them of recharge.[137] Consequently, irregular surface flows remain a fact of California life.

Other sources of natural variability similarly affect California's hydrologic systems. Because many aquatic species are legally protected, fluctuations in fish and wildlife populations can have direct consequences for water supplies. Earthquakes have similarly enormous potential to disrupt California's water system, potentially limiting water deliveries to southern California or the San Francisco Bay area.[138] Human

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[131] *See* CARLE, *supra* note 113, 29-30; Andy Furillo, *Bush Facing Levee Pressure*, SACRAMENTO BEE, April 20, 2006, at A1.

[132] CARLE, *supra* note 113, at 23-25; Hydrologic Classification Indices, *supra* note 17 (showing historic variability); 2005 WATER PLAN, supra note 102, at V.1 p. 4-27.

[133] 2005 WATER PLAN, supra note 102, at V.1 p. 4-27; *see* California Department of Water Resources, *Background, Droughts in California*, *at* http://watsup2.water.ca.gov/background.cfm (last checked April 23, 2006) (describing past climatic variations).

[134] *See* 2005 WATER PLAN, supra note 102, at V.1 p. 3-9 (showing California's water cycle).

[135] *Id.* at V.1 p. 3-1, V.4 p. 4-640; *see* Sax, *We Don't Do Groundwater*, *supra* note 66, at 270 ("[groundwater] functions as one form of insulation against both drought and increasing regulation").

[136] *See* Katherine Hayhoe et al., *Emissions Pathways, Climate Change, and Impacts on California*, 101 PNAS 12422, 12425-26 (2004) (describing declining snowpacks).

[137] *See* 2005 WATER PLAN, supra note 102, at V.1 p. 3-14 (tentatively estimating statewide overdraft at between one and two million acre-feet annually).

[138] *See* Mike Lee, *Weak Levees Threaten the State's Economy and S.D. Water Supply*, SAN DIEGO UNION TRIBUNE, February 5, 2006; 2005 WATER PLAN, supra note 102, at V.1 pp. 4-27 to 4-30; *see also id.* at 4-31 to 4-32 (describing other potential threats).

activities create additional dynamism. New land use developments, upstream forestry practices, pesticide applications, and species introductions all can further alter the state's aquatic ecosystems, affecting both the amount of water in rivers and environmental need for those flows.

Perhaps the most significant source of variability is anthropogenic climate change.[139] Most simulation models predict that global warming will drastically reduce Sierra snowpacks, decimating the capacity of California's primary freshwater storage system.[140] Even if overall runoff remains steady, that runoff is likely to occur in larger pulses earlier in the year; floods will be larger, and in summer, when California needs water most, less will be available.[141] Rising sea levels will further complicate water management. Bay-Delta water users already struggle with saltwater approaching drinking-water intakes and below-sea-level lands present huge flooding threats, and those problems will grow as polar icecaps melt.[142] Additionally, climate change may increase the vulnerability of many water-dependant species by raising water temperatures and relocating climate zones uphill or further north.

Because of all this dynamism, California's waters never have conformed to George Perkins Marsh's idealized description of nature's "almost unchanging permanence of form."[143] Even without human influence, aquatic environments fluctuated chaotically, and human activity, though sometimes intended to impose stability, has also introduced new sources of dynamism.

B. Engineering Systems and Environmental Impacts

As California grew from a sparsely settled frontier into the nation's most populous state, its precipitation patterns created demands for infrastructure that could store and move water, and Californians repeatedly turned to water supply engineers to

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[139] *See* CALIFORNIA DEPT. OF WATER RESOURCES, PROGRESS ON INCORPORATING CLIMATE CHANGE INTO MANAGEMENT OF CALIFORNIA'S WATER RESOURCES (2006).

[140] *See, e.g.,* Hayhoe et al., *supra* note 136, at 12425-26; 2005 WATER PLAN, supra note 102, at V.1 pp. 4-33 to 4-34.

[141] *See* 2005 WATER PLAN, supra note 102, at V.1 4-33 to 4-34.

[142] *Id.* at V.1 p. 3-15 to 3-16, 4-35. Global climate change also may slightly increase agricultural water demand, and could also increase stress on salmonids by reducing the amount of cold water in California's rivers. Maurice Roos, *Accounting for Climate Change*, in CALIFORNIA WATER PLAN UPDATE, supra note 102, at V.4 p. 4-622.

[143] BOTKIN, *supra* note 86, at at 54 (quoting GEORGE PERKINS MARSH, MAN AND NATURE (1864)).

keep floods at bay, make deserts bloom, and help cities grow.[144] The result was one of the most extraordinary plumbing systems in the world.[145]

Cities and local irrigation districts initially developed their own infrastructure,[146] but by the middle of the twentieth century, perceived engineering needs had outgrown the capacity of local governments to respond. The state and federal governments then took the lead, and turned to the Bay-Delta watershed as their primary source.[147] In the 1930s, the United States Bureau of Reclamation[148] began developing the Central Valley Project ("CVP"), a massive project that would ultimately tap the Trinity,[149] Sacramento, and San Joaquin watersheds and provide millions of acre-feet of agricultural water supply, much of it pumped from the southern edge of the Bay-Delta.[150] In the 1960s, California's Department of Water Resources (DWR) built a parallel project, the State Water Project ("SWP"), which relies primarily on dams on the northern Sierra Nevada's Feather River and pumps also in the southern Bay-Delta.[151] The SWP now delivers millions of acre-feet of water to southern California, with municipal suppliers in the Los Angeles and San Diego areas and Kern County agribusinesses taking the lion's share.[152] By the 1980s, water projects had dammed all but one of the Central Valley's rivers, and only a few

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[144] Those engineers were almost always employed by some level of government. Because of its capital-intensive requirements and low returns, major private irrigation projects rarely succeeded. *See* W.M. Hanemann, *The Economic Conception of Water*, in WATER CRISIS: MYTH OR REALITY 74-76 (Peter P. Rogers et al., eds. 2006); REISNER, *supra* note 10 (criticizing the history of government-sponsored water development throughout the American west).

[145] *See* United States v. California State Water Resources Control Board, 182 Cal.App.3d 82, 98 (1986); HUNDLEY, *supra* note 10, at 204; CARLE, *supra* note 113, at 89 (showing engineered redistributions of California water). Other systems—for example, Indus River irrigation projects in Pakistan or the exploitation of the former Aral Sea's tributary rivers—are similar in scale, *see* MCNEIL, *supra* note 75, at 157-82, but no other project combines such scale with California's resolute indifference to topography.

[146] *See* National Audubon Society v. Superior Court, 33 Cal. 3d 419, 426-27 (1983) (describing Los Angeles' water supply efforts); HUNDLEY, *supra* note 10, at 121-202, 230-34 (chronicling Los Angeles' and San Francisco's efforts); Brian E. Gray, *The Battle for Hetch Hetchy Goes to Congress*, 6 HASTINGS W.-N.W. J. ENV. L. & POL'Y 199 (2000).

[147] *See* HUNDLEY, *supra* note 10, at 234-302 (chronicling the development of the CVP and SWP).

[148] Referred to hereinafter as "Reclamation."

[149] A diversion on the Trinity River sends water into the Sacramento River. *See* Westlands Water District v. Dept. of Interior, 376 F.3d 853, 860-63 (9th Cir. 2004).

[150] *See* HUNDLEY, *supra* note 10, at 234-76; United States v. California State Water Resources Control Board, 182 Cal.App.3d 82, 98-99 (1986).

[151] *See* HUNDLEY, *supra* note 10, at 276-303; *State Water Resources Control Board*, 182 Cal.App.3d at 99-100; Cal. Dept. of Water Resources, *Rivers and Water Project Maps*, *supra* note 115. DWR manages the SWP.

[152] *See* CARLE, *supra* note 113, at 127-28 (showing SWP allocations).

major watersheds, mostly in the coast ranges of northwestern California, remained largely untapped.[153]

Those water projects shaped modern California, partly by providing enormous benefits. California's reservoirs offer both flood and drought protection, mitigating some of the effects of dynamic precipitation patterns.[154] Their waters irrigate some of the most productive agricultural areas in the world.[155] The Los Angeles, San Francisco, and San Diego areas have grown into bustling urban regions and economic powerhouses.[156] From San Joaquin Valley farmers to San Francisco restaurateurs to Silicon Valley high-tech manufacturers, almost all Californians now depend, on a daily basis, upon water procured from someplace far away.[157]

The costs also were immense.[158] The projects were expensive both to construct and to operate, and the general public bore much of the financial burden, and continues to provide multi-million dollar annual subsidies to some project operations.[159] The environmental consequences were drastic. Tulare Lake—once larger than Lake Tahoe—no longer exists.[160] Many stretches of California's rivers, including areas famous for both scenic beauty and recreational value, now lie submerged beneath reservoirs.[161]

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[153] *See* HUNDLEY, *supra* note 10, at 312-13;

[154] *See* 2005 WATER PLAN, *supra* note 102, at V.1 pp. 4-646 to 4-650 (showing capacity and uses of California's reservoirs); CONGRESSIONAL BUDGET OFFICE, *supra* note 48, at 49 ("Large water projects provide some degree of protection against those fluctuations.").

[155] *See* 2005 WATER PLAN, supra note 102, at V.1 pp. 3-4.

[156] CARLE, *supra* note 113, at 88 ("enormous population growth of Southern California and the San Francisco Bay Area was made possible by damming distant rivers"); Hanemann, *supra* note 144, at 84-87 (concluding that water supply probably is a necessary though not sufficient condition for economic growth).

[157] *See* REISNER, *supra* note 10, at 333 ("The whole state thrives, even survives, by moving water from where it is, and presumably isn't needed, to where it isn't, and presumably is needed.").

[158] *See, e.g.*, CONGRESSIONAL BUDGET OFFICE, *supra* note 48, summary (observing that Reclamation's "allocation often comes at the expense of urban, environmental, and Native American water users, and at a large cost to taxpayers.").

[159] *See* CONGRESSIONAL BUDGET OFFICE, *supra* note 48, at 13 (describing CVP subsidies); REISNER, *supra* note 10, at 334 (describing the SWP as "one of the country's foremost examples of socialism for the rich"), 347-55 (describing the funding for the SWP); Environmental Working Group, *About the Central Valley Project* (last checked April 23, 2006), *at* http://www.ewg.org/reports/watersubsidies/part2.php ("depending on how the market value of the water is defined, CVP farmers are receiving between $60 million and $416 million in water subsidies each year." The CVP's water recipients argue that the subsidies are much smaller.); UNITED STATES GENERAL ACCOUNTING OFFICE, WATER SUBSIDIES: BASIC CHANGES NEEDED TO AVOID ABUSE OF THE 960-ACRE LIMIT (1989) *available at* http://archive.gao.gov/t2pbat12/139927.pdf (claiming that evasion of acreage limitations was increasing federal subsidies).

[160] CARLE, *supra* note 113, at 71-72 (describing the loss of Tulare and Buena Vista Lakes).

[161] *See* HUNDLEY, *supra* note 10, at 366-73.

Others—most notably the San Joaquin River below Friant Dam—for long periods received none of their historic flows.[162] Those environmental impacts in turn have had major economic impacts, including, despite expensive hatcheries, the near-extirpation of many commercial, recreational, and tribal fisheries.[163]

Because of increasing public awareness of those costs, the era of grand infrastructure construction eventually came to a halt.[164] The State Water Project never was completed. Before dams could be constructed on the several of California's northwestern rivers, first the state government and then Congress designated them as wild and scenic.[165] Plans to construct a "peripheral canal," which would have connected the Sacramento River directly to southern California's aqueducts, were rejected by the state's voters, many of whom perceived the canal as a Southern California assault on northern California's water.[166] In the past twenty-five years, new dam construction has been limited, and water supply development has occurred primarily through increased conservation, changed management of existing supplies, and increased extraction from the existing infrastructural system.[167]

Partly because development ceased, California's major water projects deliver less water than their proponents had hoped. The State Water Project, originally intended to deliver approximately 4.2 million acre-feet per year, has averaged only approximately 2.3

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[162] NRDC v. Patterson, 333 F.Supp.2d 903, 909-11 (E.D. Cal. 2004); CARLE, *supra* note 113, at 71 ("All of those rivers (in the Tulare Lake basin) have stretches below the foothills that are now completely dewatered.").

[163] *See, e.g.*, Hoopa Valley Indian Tribe v. Ryan, 415 F.3d 986, 987-88 (9th Cir. 2005) (describing harm to the Trinity River's salmon fishery); CARLE, *supra* note 113, at 138-46.

[164] *See* HUNDLEY, *supra* note 10, at 302-64; 2005 WATER PLAN, supra note 102, at V.1 pp. 3-7 ("Rising costs and the enactment of State and federal environmental legislation have resulted in few major development projects being built since 1980.").

[165] *See* HUNDLEY, *supra* note 10, at 312-13; Harrison C. Dunning, *California Water: Will there Be Enough?*, 25 ENVIRONS ENVTL. L. & POL'Y J. 59, 59-60 (2002) (describing the battle over the north coast rivers).

[166] *See* HUNDLEY, *supra* note 10, at 313-34 (describing the defeat of the peripheral canal proposal); LITTLE HOOVER COMM'N, *supra* note 5, at 10. Recent ecological problems in the Bay-Delta have led to resurgent interest in around-delta conveyance. *See, e.g.,* ENVISIONING FUTURES, *supra* note 2, at 123-25 (explaining potential benefits).

[167] ELLEN HANAK, WATER FOR GROWTH: CALIFORNIA'S NEW FRONTIER v (2005) ("the old way of doing business—damming up rivers and building aqueducts to move the captured surface water—is [] no longer a viable strategy for accommodating growth"); ENVISIONING FUTURES, *supra* note 2, at

million acre-feet.[168] The Central Valley Project has come closer to its proponents' expectations, but in drought years some CVP users also have faced major cutbacks.[169] Nevertheless, water deliveries continued to grow even after dam construction largely stopped, and increased even through the first years of California's 1987-92 drought.[170] Though deliveries then dropped, following agreements and legislation designed to reallocate some water to in-stream flows, Bay-Delta exports have since climbed again, reaching all-time highs in the past several years.[171]

That growing consumption has sustained the enormous environmental impacts of water project operations past the development era.[172] Water quality and quantity problems are chronic in many of California's rivers, and in summer, significant stretches of many rivers have no water at all.[173] Replacement of the San Joaquin River's freshwater by agricultural return flows has changed water quality so drastically that the river, though arising in Sierra Nevada wilderness areas, is known as the "lower colon" of California.[174] The Bay-Delta also has been severely changed, and now is managed largely to convey freshwater to in-Delta water users and the south Delta pumps. Partly because of that pumping and the altered flow regime, many of the fish species that live in

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[168] CARLE, *supra* note 113, at 92, 127-28 (showing 2002 actual deliveries); *see* Planning and Conservation League v. Department of Water Resources, 83 Cal. App. 4th 892, 908 n.5 (2000) ("there is a huge gap between what is promised and what can be delivered"); *id.* at 912-913, 914 n.7.

[169] *See, e.g.*, O'Neill v. United States, 50 F.3d 677, 681-82 (9th Cir. 1995) (describing cutbacks in the mid-1990s); HANAK, *supra* note 167, at 7 ("since the late 1980s, a series of court rulings, administrative decisions, and legislative actions have prompted the return of some developed water sources to instream flows and wildlife habitats").

[170] *See* ENVIRONMENTAL DEFENSE, FINDING THE WATER: NEW WATER SUPPLY OPPORTUNITIES TO REVIVE THE SAN FRANCISCO BAY-DELTA ECOSYSTEM 2 (2005) (showing pumping levels).

[171] *Id.*; *see also* LITTLE HOOVER COMM'N, *supra* note 5, at 5 ("highly engineered water projects divert nearly 9 million acre-feet, or roughly one-third of the (Bay-Delta) watershed's supply of freshwater").

[172] *See* 2005 WATER PLAN, supra note 102, at V.1 p. 3-7 ("environmental requirements are not always met").

[173] *See* California State Water Resources Control Board, *2002 CWA Section 303(d) List of Water Quality Limited Segments* (2003), *available at* http://www.waterboards.ca.gov/tmdl/docs/2002cwa303d_listof_wqls072003.pdf; 2005 WATER PLAN, supra note 102, at V.1 p. 4-16 (showing unmet environmental flow objectives); CONGRESSIONAL BUDGET OFFICE, *supra* note 48, at 7 (observing that multiple California rivers have average flows below levels considered necessary to sustain instream wildlife).

[174] CARLE, *supra* note 113, at 108; *see* THE FRESNO BEE, *Restoring the San Joaquin* (1999), *at* http://www.fresnobee.com/man/projects/savesjr/mainbar.html.

or migrate through the Bay-Delta face extinction, and water quality violations are chronic.[175]

Despite this scarcity and degradation, California's recent water management history also contains many positive stories. In most years, most Californians do have enough water.[176] Californians are becoming more creative in managing, conserving, and reusing water supplies, and both urban and agricultural conservation could feasibly achieve great reductions in water use.[177] DWR currently predicts that overall water use could actually decrease, even as population grows, through aggressive conservation and demand management.[178] Some non-governmental studies conclude the conservation potential is much greater than DWR has estimated.[179] Agricultural land retirement, though politically controversial, also holds enormous potential to reduce water demand, and desalination has begun to appear more realistic.[180] Altering economic incentives by removing subsidies, requiring beneficiaries to pay for storage and delivery infrastructure, and charging water users something close to the market value of their water all could similarly reduce demand.[181] Environmental restoration also is an increasing theme of

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[175] *See* Thomas, *supra* note 10, at 3, 6 ("today the single greatest threat to the estuary is direct alteration and diminution of natural stream flows"); HUNDLEY, *supra* note 10, at 398-99 (describing the Bay-Delta's ills); 2005 WATER PLAN, supra note 102, at V.1 pp. 3-25.

[176] *See* 2005 WATER PLAN, supra note 102, at V.1 p. 3-4 ("California meets most of its agricultural, municipal, and industrial water management objectives in most years."). *But see id.* at V.2 p. 3-7 ("In dry years, California's water supply is inadequate to meet its current level of use…").

[177] *See, e.g.*, HANAK, *supra* note 167 (explaining how California can grow without consuming more water); 2005 WATER PLAN, *supra* note 102, at V.1 pp. 3-4, 3-12 (noting that urban water use has remained steady since the mid-1990s even as urban populations have grown), 4-25 (noting trends of increased agricultural efficiency and decreased land use), V.2 p. 3-3 (showing trend toward more efficient irrigation techniques, but also showing how much land remains irrigated by less efficient gravity-drainage and sprinkler systems), V.2 ch. 16 (discussing water recycling), V.2 ch. 20 (discussing land use planning and water conservation), ch. 22 (discussing urban water use efficiency). The Water Plan Update notes that "water use efficiency and conservation approaches have become a viable long-term supply option, saving considerable capital and operating costs for utilities and consumers, avoiding environmental degradation, and creating multiple benefits." *Id.* at V.2 p. 22-2.

[178] *See* 2005 WATER PLAN, supra note 102, at V.1 pp. 4-17, 4-20 to 4-21 (showing projected demand under multiple future scenarios), V.2 p. 1-5 (showing potential demand reduction or supply augmentation).

[179] *See, e.g.,* PETER GLEICK ET AL., WASTE NOT, WANT NOT: THE POTENTIAL FOR URBAN WATER CONSERVATION IN CALIFORNIA 1 (2003); HANAK, *supra* note 167. For detailed discussion of desalination, see HEATHER COOLEY ET AL., DESALINATION, WITH A GRAIN OF SALT: A CALIFORNIA PERSPECTIVE (2006).

[180] *See* Mike Taugher, *State Plans to Retire Half of Water District's Farms*, CONTRA COSTA TIMES, June 20, 2006; 2005 WATER PLAN, *supra* note 102, at V.2 ch. 6 (describing increasing use of, and interest in, desalination).

[181] *See* 2005 WATER PLAN, *supra* note 102, at V.2 pp. 8-2 to 8-3 (describing benefits from economic incentives), 8-4 (recommending economic incentive measures); TERRY L. ANDERSON AND PAMELA S. SNYDER, PRIMING THE INVISIBLE PUMP (1997), *available at*

California water management, albeit outside the Bay-Delta; in recent years, Californians have taken significant steps toward restoring Mono Lake and the Trinity, Owens, and San Joaquin Rivers.[182]

Nevertheless, in many ways California water management remains a near-zero-sum challenge of managing a variable and often scarce commons. Millions of people want to use California's water, and thousands of competing institutions attempt to supply not only those needs but also anticipated future demand increases. Though in most years those people get the water they need, aggregate demands speak for most water available even in good years, and in dry years shortages are likely to be endemic.[183] With environmental systems degraded and ecological needs partly unmet,[184] intermittent shortage is now a fact of life.[185] Consequently, California's water managers face the constant challenge of balancing consumption and protection of a scarce, valuable, and variably-available resource.

C. The Legal Regime and its Inherent Tensions

The legal system for managing California's water is as complex as the plumbing systems it governs and the dynamic ecological systems it protects. Both the federal and state governments have extensive and intertwined systems of constitutional, statutory, and common law applicable to water resources management. Those laws complement an intricate contractual regime, and the statutes are implemented and contracts administered

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http://www.perc.org/perc.php?id=746 (describing how economic incentives could induce farmers to switch to higher-value crops and use less water).

[182] *See* Craig Anthony Arnold and Leigh A. Jewell, *Litigation's Bounded Effectiveness and the Real Public Trust Doctrine: The Aftermath of the Mono Lake Case*, 8 HASTINGS W.-N.W. J. ENV. L. & POL'Y 1 (2001) (describing the Mono Lake controversy); Westlands Water District v. United States Department of the Interior, 376 F.3d 853 (9th Cir. 2004) (upholding plans to increase Trinity River flows); Lewis Sahagun, *In Owens River, Water Flows Again*, LOS ANGELES TIMES, December 7, 2006; Glen Martin, *Settlement Will Restore San Joaquin River*, SAN FRANCISCO CHRONICLE, September 13, 2006, at B1.

[183] *See* 2005 WATER PLAN, supra note 102, at V.1 p. 3-7 ("In dry years, California's water supply is inadequate to meet its current level of use…"); Ryan Waterman, *Addressing California's Uncertain Water Future by Coordinating Long-Term Land Use and Water Planning: Is a Water Element in the General Plan the Next Step?*, 310 ECOLOGY L.Q. 117, 120-22 (2004) (describing, pessimistically, California's water prospects)

[184] *See* 2005 WATER PLAN, supra note 102, at V.1 pp. 3-18 to 3-26 (summarizing challenges faced by California's hydrologic regions).

[185] *See* Marion W. Jenkins et al., *Improving California Water Management: Optimizing Value and Flexibility* 6-2 (2001), *available at* http://cee.engr.ucdavis.edu/faculty/lund/CALVIN/Report2/CALVINReport2001.pdf ("Planning to always supply all water 'requirements' everywhere is prohibitively expensive without massive subsidies and would impose politically intolerable environmental impacts.").

by a diverse set of governmental institutions—many of which act at cross-purposes.[186] The entire system contains uneasy juxtapositions borne of diverging political agendas and varied historical roots. The frontier impulse to conquer the wilderness, the New-Deal-era's infatuation with massive government-sponsored infrastructure, conservative predilections to use government for the benefit of large business interests, and modern preferences for environmental protection all have left lasting imprints on California water law, and those competing influences have helped create a system plagued by internal tensions.[187] Many elements of that legal system encourage aggressive consumption; yet mandates for baseline levels of environmental protection are stringent and inflexible, at least in theory, and reliability, though valuable to both human consumers and environmental systems, enjoys little protection. The system thus epitomizes the traditional management approach described in Part II; to the extent its conflicting requirements and incentives can be resolved into a coherent whole, it mandates backstop protections yet promotes consumption right up to those legal limits.

1. The Appropriative Rights System

The legal system's incentives toward consumption derive partly from the traditional doctrinal rules of western water law. Most[188] surface[189] water allocation in California is governed, at least in theory,[190] by prior appropriation law.[191] Under that

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[186] Those institutions include regulatory agencies like EPA, the California State Water Resources Control Board, and the Fish and Wildlife Service, among others, and resource management agencies, like Reclamation and DWR, which build and manage water projects without exercising regulatory authority.

[187] *See* HUNDLEY, *supra* note 10 (describing the influences of various political movements upon California water development).

[188] Not all California surface water rights are appropriative. Many riparian rights remain, Native Americans hold sovereign rights, the federal government can reserve rights, and a few cities possess pueblo rights held over from California's time as Mexican territory. *See, e.g.*, Lux v. Haggin, 69 Cal. 255 (1886) (recognizing riparian rights); City of Los Angeles v. City of San Fernando, 14 Cal.3d 199 (1975) (sustaining Los Angeles' pueblo rights); *In re Water of Hallett Creek Stream System*, 44 Cal. 3d 448, 455 n.3 (1988) (describing federal reserved rights); *Escondido Mut. Water Co. v. Fed. Energy Regulatory Comm.*, 692 F.2d 1223, 1235-37 (9th Cir. 1982 (acknowledging reserved water rights held by several southern California tribes). However, because most California water allocation occurs, at least on paper, through the appropriative system, the primary focus of this article is appropriative rights.

[189] Groundwater allocations in California are subject to a separate and far less comprehensive system of regulation, a circumstance which has received extensive criticism. *See* Sax, *We Don't Do Groundwater*, *supra* note 66.

[190] Because of limited monitoring of withdrawals and enforcement of violations, some scholars have argued that in practice California's system really is closer to riparianism, and that legal rules bear only loose correspondence to actual practice. *See* Hanemann, *supra* note 144, at 72 n.23; *see also* Benson, *supra* note 50 (arguing that other states prioritize protecting established uses over enforcing prior appropriation doctrine's rules).

system, a user establishes a surface water right by obtaining a permit from the State Water Resources Control Board,[192] removing water from a stream, and putting it to reasonable and beneficial use.[193] The scope of a right depends upon the actual extent of that reasonable use, and an appropriator cannot, in theory, possess a right to more water than he actually needs and uses.[194] The priority of his right—that is, the extent to which it subordinates, or is subordinate to, the rights of other users of the same water source—is a function of timing; the first person to perfect a water right becomes senior to others.[195] He then may use his entire right in dry years, even if no water will be left for other junior appropriators.[196] So long as he continues to reasonably exercise that right, he will not lose it.[197]

The appropriative rights system does not preclude full allocation of a river, and instead can encourage aggressive water use. The need to withdraw water from a stream to establish a right and the greater priority of earlier-established rights create incentives to pump water out of rivers as soon as possible.[198] Once a right is established, the threat of forfeiture discourages conservation; water saved, under traditional prior appropriation doctrine, is water lost.[199] No payment for the actual water is required; instead, it essentially is free for the taking so long as a permit exists.[200] Consequently, many rivers

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[191] For concise basic descriptions of prior appropriation law, see SAX ET AL., *supra* note 10, at 98-99 or Benson, *supra* note 50, at 886-87.

[192] Cal. Water Code § 1260; *see* National Audubon Society v. Superior Court, 33 Cal. 3d 419, 441-42 (1983) (explaining the evolution of a permitting requirement). Prior to 1914, no such requirement existed, and a water right was created merely through diversion and beneficial use. United States v. California State Water Resources Control Board, 182 Cal.App.3d 82, 102 (1986).

[193] *See* Environmental Defense Fund v. East Bay Municipal Utilities Dist., 26 Cal.3d 183, 195-98 (1980) (hereinafter "EDF v. EBMUD II") (describing the steps necessary to apply for and perfect a right).

[194] *See California State Water Resources Control Board*, 182 Cal. App. 3d at 105 ("This '*rule of reasonable use*' is now the cardinal principle of California's water law.") (emphasis in original).

[195] *Id.* ("appropriators are limited by priorities in time; their rights are subordinate to the rights of preexisting holders").

[196] SAX ET AL., *supra* note 10, at 99; *but see* Hanemann, *supra* note 144, at 72 n.23 (observing that seniority is often difficult to enforce).

[197] *State Water Resources Control* Bd., 182 Cal.App.3d at 101 ("once rights to use water are acquired, they become vested property rights").

[198] *See* Thomas, *supra* note 10, at 13-14.

[199] *See* North Kern Water Storage Dist. v. Kern Delta Water Dist., 2007 Cal. App. LEXIS 156, *31 ("the rights holder is subject to forfeiture for *not using* water, a practice generally thought to be socially responsible and usually called 'conservation.'") (emphasis in original).

[200] *See* Hanemann, *supra* note 144, at 76-78 ("the prices which most users pay for water reflect, at best, its physically supply cost and not its scarcity value… there is no charge for the water *per se*."); Thomas, *supra* note 10, at 13 ("The appropriator is not required to compensate the public, as predecessor in title, in any way.").

are so fully appropriated that paper allocations exceed actual flow,[201] and a fair number of California's rivers unnaturally run dry.[202] Those incentives have led to widespread criticism that prior appropriation doctrine is an inefficient historic relic, a legal system indifferent to ecological needs and prone to accelerating resource overexploitation.[203]

Partly in response to such critiques, California has reformed its appropriative system in ways designed to encourage efficiency and environmental sensitivity. In recent decades, for example, water-marketing advocates have succeeded in creating statutory provisions allowing transfers of water rights.[204] The rationales for marketing are straightforward:[205] if conserved water can be transferred rather than lost, inefficient users should have an incentive to curb excesses and sell savings, and other needy users may obtain conserved water rather than developing new supplies.[206] Environmental water needs also could be met, in theory, by purchasing water from willing sellers who presumably can provide that water with reduced opportunity costs.[207] Additionally, agricultural and urban users could minimize treatment costs by transferring higher quality

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[201] This circumstance is not as absurd as it may seem. Because most water users return some water to the river (unless they export the water to a different basin), water can be reused. *See* Hanemann, *supra* note 144, at 72.

[202] *See supra* notes 162, 173.

[203] *See, e.g.,* Eric T. Freyfogle, *Water Rights and the Common Wealth*, 26 ENVTL. L. 27, 38-45 (1996); Thomas, *supra* note 10, at 13-14.

[204] *See, e.g.*, Central Valley Project Improvement Act, Pub. L. 102-575, 106 Stat. at 4706-31 (1992), § 3405(a); Cal. Water Code § 1011. For a sampling of arguments in favor of water marketing, see ANDERSON AND SNYDER, *supra* note 181; MARC REISNER AND SARAH BATES, OVERTAPPED OASIS 58-59 (1990); CONGRESSIONAL BUDGET OFFICE, *supra* note 48, at 32.

[205] Critiques of water marketing also are powerful. The most common criticism is that the externalities of water marketing are difficult, if not impossible, to mitigate, and often are ignored. *E.g.* Freyfogle, *supra* note 203; Joseph W. Dellapenna, *The Importance of Getting Names Right: the Myth of Markets for Water*, 25 WM. & MARY ENVTL. L. & POL'Y REV. 317 (2000). Other critics criticize allowing private parties to profit—sometimes immensely—by selling water conferred upon them by heavily subsidized projects. *E.g*. Tim Stroshane, *Water Transfers and the Imperfect Water Industry in California*, 8 BERKELEY PLANNING JOURNAL 66 (1993).

[206] *See* Thomas, *supra* note 10, at 45-57 (recommending a market-based strategy for providing environmental flows); 2005 WATER PLAN, *supra* note 102, at V.2 p. 23-6 (describing potential economic benefits of water transfers). *But see id.* at V.2 pp. 23-6 to 23-7 (describing some of the potential costs of transfers).

[207] *See* Jenkins et al., *supra* note 185, at xvii (noting that while some environmental flow requirements produce substantial opportunity costs for would-be users, others do not); *id.* at 4-18, 4-43 to 4-44 (predicting that a statewide market could reduce some of the opportunity costs created by environmental protection requirements); David Sunding et al, *Measuring the Costs of Re-Allocating Water from Agriculture: A Multi-Modal Approach*, 15 NATURAL RESOURCES MODELING 201, 220-21 (1998) (*need to check pincite*) (predicting that allocation reductions will have less economic impact upon agricultural users if markets are in place, because markets allow reductions to be met through reduced production of lower-value crops).

water used by agricultural users, who do not need treatment, for lower quality water previously allocated to municipal use.[208] Transfers are limited by multiple factors, however, including fears of third party effects, limited access to water-conveyance infrastructure, and principles of California law and aquatic ecology somewhat incompatible with marketers' attempts to treat water as a fungible commodity.[209] Consequently, while many water-marketing advocates believe water trading, though growing,[210] remains overregulated and underutilized, other commentators question whether real water markets ever can or should exist.[211]

The appropriative rights system also has increasingly tolerated instream flow rights. Historically, while the state could limit rights in order to protect environmental values, an appropriator could establish and sustain a water right only by taking water out of a river.[212] Recognizing the anti-environmental incentives of this rule, the California Legislature has repeatedly amended the state's Water Code to allow appropriators to dedicate portions of their rights to instream use, and to allow the state to claim rights in instream flows.[213] Nevertheless, the prohibition on directly appropriating instream rights remains, and, like water marketing, appropriative protection for instream flows remains limited.

Two older doctrines, one deriving directly from the state constitution and the other from ancient common-law principles, also create potential for flexibility and environmental protection within California's water rights system. First, the California Constitution allows water rights only to the extent that a use is "reasonable."[214] That

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[208] *See* Jenkins et al., *supra* note 185, at 4-25.

[209] *See* ELLEN HANAK, CALIFORNIA'S WATER MARKET, BY THE NUMBERS vi-viii (2002) (describing sources of third-party resistance). Several statutes protect "areas of origin" against water transfers, *see, e.g.*, Cal. Water Code §§ 10505, 11460, 12201, and a California appellate court recently rejected the establishment of a private surface water bank. Central Delta Water Agency v. State Water Resources Control Board, 124 Cal. App. 4th 245 (2004).

[210] For data on the amount of water marketing actually occurring, see HANAK, *supra* note 209.

[211] *See, e.g.* Scott S. Slater, *A Prescription for Fulfilling the Promise of a Robust Water Market*, 36 MCGEORGE L. REV. 253 (2005) (discussing continuing impediments to water marketing). *But see* Freyfogle, *supra* note 203 (criticizing water marketing on both utilitarian and normative grounds); Dellapenna, *supra* note 205.

[212] Thomas, *supra* note 10, at 15; Brian Gray, *A Reconsideration of Instream Appropriative Rights in California*, 16 ECOLOGY L.Q. 667 (1989). For discussion of the challenges of implementing instream flow protections, see Jack Sterne, *Instream Rights and Invisible Hands: Prospects for Private Instream Rights in the Northwest*, 27 Envtl. L. 203, 206 (1997).

[213] Thomas, *supra* note 10; Cal. Water Code § 1707(c)(1).

[214] Cal. Const. art X § 2.

amorphous word grants state regulators and courts discretion to modify rights based on evolving conceptions of reasonability, for "no one can acquire a vested right to the unreasonable use of water."[215] That rule can mandate reductions in the place, purpose, or amount of use, and on occasion actual or threatened invocations of reasonable use doctrine have significantly changed water use.[216]

The public trust doctrine also creates potential for conservation within the traditional water law system. Under California law, water rights users may own usufructuary rights,[217] but the state owns the water and watercourses, and holds the latter as trustee for its people.[218] That trust obligates the state and all its agencies to consider whether water allocations are consistent with values like wildlife protection,[219] and no vested right can exist if a use threatens such public trust values.[220] Similarly, the public trust doctrine empowers the state to reexamine permits already issued, and to adjust those permits in light of evolving public needs.[221] The doctrine thus creates an inherent qualification upon property rights in water, essentially granting the state discretion to treat the natural environment as the most senior appropriator.

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[215] National Audubon Society v. Superior Court, 33 Cal. 3d 419, 443 n.23 (1983); *see* Environmental Defense Fund v. East Bay Municipal Utilities District, 20 Cal. 3d 327, 344 (1977) (hereinafter "EDF v. EBMUD I") ("What constitutes reasonable water use is dependent upon not only the entire circumstances presented but varies as the current situation changes."); Joslin v. Marin Mun. Water Dist., 67 Cal.2d 132, 140 (1967); *e.g.* United States v. California State Water Resources Control Board, 182 Cal. App. 3d 82, 129-30 (upholding permit modifications in response to changing needs).

[216] *See, e.g.*, Imperial Irrigation Dist. v. State Water Resources Control Board, 225 Cal. App. 3d 548 (1990) (upholding the State Board's determination that Imperial Irrigation District was wasting water and needed to change its practices); Janet C. Neuman, *Beneficial Use, Waste, and Forfeiture: the Inefficient Search for Efficiency in Western Water Use*, 28 ENVTL. L. 919, 941-42 (1998) (describing the IID litigation).

[217] Eddy v. Simpson, 3 Cal. 249, 252 (1853) ("It is laid down by our law writers, that the right of property in water is usufructuary, and consists not so much of the fluid itself as the advantage of its use.").

[218] Cal. Water Code § 102 ("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."); National Audubon Society v. Superior Court, 33 Cal. 3d 419, 434-41 (1983). For consideration of what exactly this type of ownership entails, see *State of California v. Superior Court*, 78 Cal.App.4th 1019 (2000).

[219] *National Audubon Society*, 33 Cal. 3d at 426, 434-41; *see* Joseph L. Sax, *The Public Trust Doctrine In Natural Resource Law: Effective Judicial Intervention*, 68 MICH. L. REV. 471 (1970).

[220] *See National Audubon Society*, 33 Cal. 3d at 425-26 (holding that the public trust doctrine "bars… any other party from claiming a vested right to divert waters once it becomes clear that such diversions harm the interests protected by the public trust"). The *Audubon* court held that state agencies possessed discretion to accommodate the competing goals of the two legal schemes. *Id.* at 445-47.

[221] *National Audubon Society*, 33 Cal. 3d at 447; United States v. State Water Resources Control Board, 182 Cal. App. 3d 82, 149-50 (1986).

In combination, water marketing, instream flow rights, reasonable use doctrine, and the public trust add complexity to a legal system otherwise engineered simply to encourage widespread water use at the maximum possible rate. Those doctrines do not remove incentives for water consumption—even water marketing, which does create a conservation incentive, generally does so only if someone is willing to pay to use the conserved water—but the latter two allow a substantial amount of discretionary, government-imposed flexibility, and the former two theoretically allow water users ways to achieve greater efficiency and protection.[222] But while some of those doctrines may undermine the basis for expectations of reliability, they otherwise leave intact a system strongly slanted toward promoting water use.

2. Contracts

In practice, contractual arrangements are at least as important as appropriative rights in determining the allocation of California's water, for most Californians receive water in accordance with contractual terms. Those contracts, much like California's traditional water rights system, generally are structured to promote consumption while providing few guarantees of reliability.

Most Californians do not actually hold appropriative water rights. Instead, they obtain water through municipal water agencies, water districts, irrigation districts, mutual water companies, and a few other types of governmental, quasi-governmental, or private water distributors.[223] Many obtain their water through a series of such entities.[224] Some of those distributors hold their own appropriative rights, but many—particularly those reliant on Bay-Delta water—depend in whole or in part on water from the Central Valley

[222] *See* United States v. State Water Resources Control Board, 182 Cal.App.3d 82, 104 (1986) ("Unlike real property rights, usufructuary water rights are limited and uncertain."); *id.* at 106 ("no water rights are inviolable; all water rights are subject to governmental regulation").

[223] *See* HUNDLEY, *supra* note 10, at 99-107 (describing irrigation districts and mutual water companies); HANAK, *supra* note 167, at 2-3; 2005 WATER PLAN, *supra* note 102, at V.1 p. 3-7 ("It is estimated that there are more than 3,700 public and private agencies in California dealing with some aspect of water supply, use, or treatment.").

[224] The Metropolitan Water District of Southern California, for example, wholesales but does not retail water, and users in its service areas thus receive some of their water via deliveries from the State Water Project to Metropolitan to Metropolitan's member agencies. *See* HANAK, *supra* note 167, at 2 (describing MWD); Metropolitan Water District, The District At a Glance (2005), *at* http://www.mwdh2o.com/mwdh2o/pdf/at%20a%20glance/mwd.pdf.

Project and the State Water Project.[225] Reclamation and DWR, respectively, hold the appropriative rights for those projects, and deliver water in accordance with the terms of long-term contracts.[226]

Those CVP and SWP contracts share some important common principles. Rather than creating fixed entitlements to certain amounts of water, both define maximum allocations while reserving state and federal discretion to deliver less than the full amounts.[227] The CVP contracts thus allocate more water than the Bureau typically delivers, and allow the federal government to withhold deliveries in times of drought or environmental need.[228] The SWP contracts similarly allocate more water—almost twice as much water, in fact—than the project delivers in average years, but specify mechanisms for allocating water in the event of temporary and permanent shortages or unexpected surpluses.[229] Both sets of contracts thus create a somewhat curious allocation system, in which paper rights do not reflect typical water availability or use.

In another important respect, the projects' contracts are quite different. While the SWP contracts charge rates sufficient to cover the project's operating and capital costs, the federal government subsidizes deliveries.[230] The CVP, like most Bureau of Reclamation projects, was predicated on the somewhat Jeffersonian belief that small-farm agriculture brought widespread public benefits and thus merited public financial

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[225] *See* Planning and Conservation League v. Department of Water Resources, 89 Cal. App. 4th 892, 899-900 (2000) (describing pre-1995 SWP contracts).

[226] *See State Water Resources Control Board*, 182 Cal.App.3d at 97 (describing the CVP and SWP). Though a federal agency, Reclamation must obtain its water in accordance with state law, and therefore is subject to SWRCB regulation. *See* California v. United States, 438 U.S. 645 (1978).

[227] While these provisions partly reflect the reality that water availability varies, there also is a bureaucratic explanation for these contractual amounts: the CVP's and SWP's proponents needed to promise large amounts of water to justify their projects. *See generally* REISNER, *supra* note 10 (describing the booster culture of water development).

[228] *State Water Resources Control Board*, 182 Cal. App. 3d at 147-48 ("the contracts expressly provide for governmental immunity from any liability to the contractors due to the failure to furnish the specified quantities of water in times of water shortages."); O'Neill v. United States, 50 F.3d 677 (9th Cir. 1995) (holding that the federal government was entitled to reduce deliveries in order to comply with environmental laws).

[229] *See Planning and Conservation League*, 83 Cal. App. 4th at 908 n.5 (2000) ("there is a huge gap between what is promised (by the SWP contracts) and what can be delivered").

[230] Advocacy groups argue, however, that some recipients—particularly agricultural users in Kern County—are heavily subsidized. *See* PUBLIC CITIZEN, MISMANAGING THE STATE WATER PROJECT 2-4 (2005), *available at* www.citizen.org/documents/SWPreport05.pdf.

support.[231] Though the Bureau never has succeeded delivering CVP water solely to small farms,[232] it does deliver water at substantially below-market rates.[233] The CVP's contractors' payments do not cover project operating costs and have barely begun to reimburse the public for the millions invested in constructing the project.[234] Even after attempted pricing reforms in the 1980s and early 1990s, CVP contractors remained heavily subsidized,[235] and recently-renewed contracts will continue those subsidies well into the future.[236] The consequences are predictable; as the Congressional Budget Office has warned, "pricing structures…often provide no incentive to farmers to use water efficiently and may even encourage them to increase their water use."[237]

California's primary water contract systems therefore utilize an odd allocation methodology. Large paper allocations and cheap prices encourage heavy consumption.[238] But contractual terms create little legal justification for contractors to expect certain deliveries.[239] That contractual uncertainty compounds the variability of the underlying rights, for the Bureau and DWR have no power to contract their way around the inherent

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[231] *See* 2005 WATER PLAN, *supra* note 102, at 8-1 ("This is an example of a subsidy that was designed to achieve a social goal that affects water use and agricultural development in the West."); CONGRESSIONAL BUDGET OFFICE, *supra* note 48, at 29.

[232] When the CVP was built, reclamation law forbade Reclamation from delivering water to farms exceeding 160 acres in size, yet many farms in the CVP's proposed service areas were much larger. The story of the federal government's failures to enforce those limits, or the later, higher limits set by Congress in a series of concessions to Central Valley growers, is a fascinating case study in the ability of political clout to trump law. *See* WORSTER, *supra* note 10, at 243-56.

[233] *See* Environmental Working Group, *supra* note 160; UNITED STATES GENERAL ACCOUNTING OFFICE, *supra* note 159; REISNER, *supra* note 10, at 484.

[234] *See* Hanemann, *supra* note 144, at 77.

[235] *Compare* 2005 WATER PLAN, *supra* note 102, at V.4 pp. 4-34 to 4-35 (showing rates paid by CVP contractors and other California water users); *with* Central Delta Water Agency v. State Water Resources Control Board, 124 Cal. App. 4th 245, 258 (2004) (discussing the rates, which ranged up to $700/acre-foot, that a private water seller anticipated charging on the open market). There are also structural reasons why agricultural water is cheaper than municipal water, however; it does not require treatment, is not available at the tap on demand, and isn't pumped over mountain ranges. *See* Hanemann, *supra* note 144, at 77.

[236] *See* Environmental Working Group, *supra* note 160.

[237] CONGRESSIONAL BUDGET OFFICE, *supra* note 48, at 13.

[238] *See* United States Environmental Protection Agency, *Letter to Alan Candlish, United States Bureau of Reclamation*, January 8, 1999, detailed comments at 2, *available at* http://www.epa.gov/region9/nepa/letters/cvprenew.pdf ("We fear that retaining contract quantities that exceed available supplies gives the impression of unreliable commitments and may imply a 'need' to develop new supplies.").

[239] *See* United States v. California State Water Resources Control Board, 182 Cal. App. 3d 82, 147 ("Logically, neither the project *nor* the contractors could have any reasonable expectation of certainty that the agreed quantity of water will be delivered.") (emphasis in original).

contingency of their appropriations.[240] Though encouraged to consume, water users therefore have few legal guarantees of reliability.

3. Environmental Statutes

The third major component of the California water law regime is the set of substantive and procedural obligations created by federal and state environmental laws, whose protective mandates create no small tension with the appropriative and contractual systems' incentives toward consumption. Broadly speaking, those laws define some outcomes—species extinctions, or violations of water quality standards, for example—that agencies must avoid, and establish mechanisms for public and private enforcement, but they provide few requirements for protection beyond those backstop prohibitions. They thus create potentially strict penalties for consumption that goes too far but do little to compel reservation of margins for error.

A comprehensive survey of those laws would require an entire book, and what follows is a cursory summary.

a. Substantive Constraints

Perhaps the simplest law applicable to California waters is the federal Wild and Scenic Rivers Act.[241] While most water laws require some sort of balancing or compromise; the WSRA's mandate is simple: once a river is designated, no use may impair the values for which that river was designated.[242] Additionally, unless written into the authorizing legislation, no obstructions of the river are allowed, and appropriations are extremely limited.[243] Environmental protection thus is prioritized above all else, and a WSRA-protected stretch of river essentially is removed from the water commons. But although stringent, those protections apply primarily to rivers on California's northwest coast or to stretches in terrain so rugged that the possibilities for competing appropriative uses are limited.[244]

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[240] *See* State Water Resource Control Board Cases, 136 Cal. App. 4th 674, 806 n.54 (2006) ("An appropriator cannot give away more rights than he or she has.") (quoting National Audubon Soc'y v. Superior Ct., 33 Cal. 3d 419, 447 (1983)).

[241] 16 U.S.C. §§ 1271-1287.

[242] 16 U.S.C. §§ 1271, 1281(a); *see Oregon Natural Desert Ass'n v. Green*, 953 F. Supp. 1133, 1144-46 (D. Or. 1997).

[243] 16 U.S.C. § 1278.

[244] *See* HUNDLEY, *supra* note 10, at 374; National Park Service, *Wild and Scenic Rivers by State*, *at* http://www.nps.gov/rivers/wildriverslist.html#ca (last checked April 13, 2006) (listing California's federally-designated wild and scenic rivers).

Several federal and state environmental statutes establish more widely-applicable requirements. The federal and California Endangered Species Acts, for example, limit "take" of listed species, and compel water managers to leave enough water in California's rivers to sustain and recover threatened or endangered species' populations.[245] The Central Valley Project Improvement Act (CVPIA) likewise allocates water to environmental purposes, requires restoration projects, and establishes numeric goals for recovering fish populations.[246] California Fish and Game Code section 5937 requires dam operators to maintain fisheries in good condition.[247] In combination, and with the help of numerous cases filed by environmental groups, those statutes have become important constraints on water management throughout California.

Both federal and state laws also protect water quality. The federal Clean Water Act limits point-source discharge of pollutants and requires identification of and remediation plans for waters with deficient water quality.[248] California law establishes parallel and intertwined requirements. The federal CWA allows states to implement and enforce federal water quality programs, and the state's Porter-Cologne Water Quality Control Act delegates that authority to state and regional water boards.[249] Those boards must set statewide water quality standards and must promulgate and implement plans to achieve those standards.[250] The federal Clean Water Act's citizen suit provision also facilitates public enforcement of water quality laws, and numerous non-profit groups often prosecute permit violations and other water quality transgressions.[251]

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[245] *See* Cal. Fish & Game Code §§ 2050-2097; 16 U.S.C. § 1531-44; *e.g.* O'Neill v. United States, 50 F.3d 677 (9th Cir. 1995).

[246] *See* Pub. L. 102-575, 106 Stat. at 4706-31, § 3406.

[247] *See* California Trout, Inc. v. Superior Court, 218 Cal. App. 3d 187, 210 (1990) (requiring below-dam flows sufficient to "restore the historic fishery"); Natural Resources Defense Council v. Patterson, 333 F. Supp. 2d 906, 917-19, 924-25 (E.D. Cal. 2004).

[248] *See* 33 U.S.C. §§ 1251-1387. Section 301 (33 U.S.C. § 1311) creates a blanket prohibition on point source pollutant discharges, subject only to the specific exceptions set forth elsewhere in the act. Section 303 (33 U.S.C. § 1313) requires identification of water bodies with substandard water quality and development of plans to restore those waters. Because water quality and quantity are commonly intertwined, the Clean Water Act also can limit water diversions. *See* Thomas, *supra* note 10, at 17-18.

[249] *See* United States v. California State Water Resources Control Bd., 182 Cal. App. 3d 82, 107-10 (1986) (describing the federal and state schemes for water quality protection).

[250] *See* City of Burbank v. State Water Resources Control Bd., 35 Cal. 4th 613, 619 (2005) (discussing the Porter-Cologne act); *id.* at 620-21 (discussing state and federal water quality laws).

[251] *See* 33 U.S.C. § 1365.

Other statutes grant the State Water Resources Control Board additional discretion to set environmental limitations on water use.[252] The SWRCB may establish minimum instream flow levels.[253] It may declare a river or stream "fully appropriated," meaning that no further appropriative rights can be obtained, and it need not wait for the stream to be pumped dry before making such a declaration.[254] It also may impose environmental mitigation conditions on the exercise of water rights.[255] Under the California Environmental Quality Act (CEQA), which requires identification of the environmental impacts of government projects, the SWRCB and other state and local agencies also must mitigate, if feasible, the adverse environmental impacts of any water project they approve or build.[256]

In combination, these laws mandate levels of environmental quality that do not presently exist in many California waterways. If fully and successfully enforced, federal and state water quality laws would compel cleanup of dozens of water bodies currently listed as water-quality-impaired, including all of the Sacramento/San Joaquin Delta and portions of many of its tributary streams.[257] California currently has dozens of species listed under the state or federal Endangered Species Acts, including many Bay-Delta-dependant species, and both acts require those species' recovery.[258] Similarly, the

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[252] *See EDF v. EBMUD II*, 26 Cal. 3d at 195-98 (summarizing the statutes conferring discretion upon the SWRCB); *EDF v. EBMUD I*, 20 Cal.3d at 342 (1977) (the SWRCB's "authority includes protection of the environment"); *State Water Resources Control Board*, 182 Cal. App. 3d at 103-04 ("when determining appropriative water rights, the Board is expressly empowered to protect water quality") (citing Cal. Water Code §§ 1258, 13000 et seq. and Cal. Pub. Res. Code §§ 21000, 21001).

[253] Water Code § 1257.5. In making these decisions, the SWRCB must consider instream flow proposals developed by the California Department of Fish and Game. *Id.*; *see* Cal. Pub. Res. Code §§ 10001-03 (requiring CDFG to propose such flows). But CDFG has proposed flows for very few streams. Thomas, *supra* note 10, at 40-41.

[254] California Water Code §§ 1205-07; *see* State Water Resources Control Board, *Fully Appropriated Streams List* (1998), *available at* http://www.waterrights.ca.gov/html/faslist.htm.

[255] *See EDF v. EBMUD II*, 26 Cal. 3d at 195-98; *EDF v. EBMUD I*, 20 Cal.3d at 342; *State Water Resources Control Board*, 182 Cal. App. 3d at 103-04.

[256] *See* Cal. Pub. Res. Code §§ 21000 - 21167; Mt. Lion Foundation v. Fish & Game Comm'n, 16 Cal. 4th 105, 112 (1997) ("CEQA is a comprehensive scheme designed to provide long-term protection to the environment.").

[257] *See* State Water Resources Control Board, *supra* note 173 (listing quality-impaired California water bodies); HANAK, *supra* note 167, at 7 ("The latest update of the California Water Plan, which uses estimates provided by the environmental community, reports that another 1 million acre-feet would be needed for some unmet environmental objectives.").

[258] *See* California Department of Fish and Game, Endangered and Threatened Animal List (2006), *at* http://www.dfg.ca.gov/whdab/pdfs/TEAnimals.pdf.

CVPIA demands recovery of several degraded fisheries,[259] and California Fish and Game Code section 5937 may go even further, requiring restoration of below-dam fisheries—and in California, hundreds of river miles are below dams—to historic levels.[260] Finally, CEQA's mitigation requirement ought to minimize additional environmental impacts even as project changes or developments occur.[261] Those laws severely limit the reliability of water use patterns that impede environmental recovery; through citizen suit provisions and strict substantive mandates, such uses face the ongoing possibility that a successful plaintiff may succeed in imposing drastic changes.[262]

b. Procedural and Planning Laws

Complementing the substantive component of those environmental laws is a set of federal and state laws, many recent, requiring proactive water supply planning and seeking to avoid mismatches between supply and demand. In theory, those laws can play a significant role in mitigating the conflicts between the protection and consumption goals of California law, and can soften the harshness of all-or-nothing substantive statutes, for they could alert government decision-makers and public participants to potential conflicts before they occur. However, because those laws apply primarily to new projects and new development, they are better suited to minimizing new conflicts than to mitigating old ones. They thus do little—though not nothing—to resolve the consume-to-the-brink incentives inherent in other laws governing California's waters.

The foundational planning laws applicable to California water are NEPA and CEQA. Both require environmental reports documenting the effects of, and alternatives to, government-sponsored or approved projects.[263] Since the 1970s, California's courts, in applying CEQA, have consistently held that an environmental evaluation of a water-consuming project must disclose where the water will come from, and at what

[259] *See* Pub. L. 102-575, 106 Stat. at 4706-31, § 3406(b)(1).

[260] *See* Natural Resources Defense Council v. Patterson, 333 F. Supp. 2d 906, 917-19, 924-25 (E.D. Cal. 2004).

[261] *See* Cal. Public Resources Code § 21002 ("public agencies should not approve projects as proposed if there are feasible alternatives or feasible mitigation measures available which would substantially lessen the significant environmental effects of such projects").

[262] Getting such injunction isn't easy, of course; plaintiffs must demonstrate environmental degradation and establish causality, all in the face of scientific uncertainty, and their remedies may be blunted by judges' equitable discretion. Nevertheless, environmental laws have caused major and sudden changes in resource management before, *see, e.g.,* YAFFEE, *supra* note 31, and will likely do so again.

[263] 43 U.S.C. § 4332(C); *see generally* Cal. Pub. Res. Code §§ 21000-21177.

environmental cost.[264] Because CEQA, unlike its federal counterpart, requires mitigation of adverse environmental effects, that disclosure requirement has teeth, and in theory assures that the impacts of tapping new water supplies should be considered and, if possible, mitigated prior to implementation of any new project.[265]

The California Legislature recently supplemented CEQA with several laws designed to prevent new development without identified and reliable water supplies.[266] In 1983, the Legislature enacted the Urban Water Management Planning Act, which requires urban water suppliers to adopt conservation plans.[267] In 1995, the Legislature supplemented the UWMP Act by passing AB 901, which required water supply evaluations prior to approval of new development.[268] Follow-up studies suggested that the new law was largely ignored, and in 2001 the Legislature enacted two more stringent laws linking water supply and planning.[269] SB 221, the first of the two statutes, requires that detailed water supply assessments precede approvals of major development projects, and precludes approvals without adequate water supplies.[270] SB 610, the second statute, requires water supply assessments as a component of CEQA review, and also establishes more stringent requirements for urban water management plans that anticipate reliance on

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[264] *See*, *e.g.,* Vineyard Area Citizens for Responsible Growth v. City of Rancho Cordova, 40 Cal. 4th 412 (2007); California Oak Foundation v. City of Santa Clarita, 133 Cal. App. 4th 1219 (2005); Santa Clarita Organization for Planning the Environment v. County of Los Angeles, 106 Cal. App. 4th 715 (2003); Friends of the Eel River v. Sonoma County Water Agency, 108 Cal. App. 4th 859, 868-872 (2003); *Napa* Citizens for Honest Government v. Napa County Board of Supervisors, 91 Cal. App. 4th 342, 371-74 (2001); Planning and Conservation League v. Dept. of Water Resources, 83 Cal.App.4th 892 (2000); Stanislaus Natural Heritage Project v. County of Stanislaus, 48 Cal. App. 4th 182, 194-206 (1996); Kings County Farm Bureau v. City of Hanford, 221 Cal. App. 3d 692, 724-730 (1990); Santiago County Water District v. County of Orange, 118 Cal. App. 3d 818, 829-831 (1981); People v. County of Kern, 62 Cal.App.3d 761, 771-773 (1976); People v. County of Kern, 39 Cal. App. 3d 830 (1974); *compare* Sierra Club v. West Side Irrigation Dist., 128 Cal. App. 4th 690 (2005) (upholding environmental review of a project involving assignment of agricultural water rights to urban development).

[265] *See* Cal. Pub. Res. Code § 21002.

[266] 2005 WATER PLAN, *supra* note 102, at V.1 pp. 3-30 to 3-32 (describing new laws and planning initiatives).

[267] Cal Water Code §§ 10610-57; *see* Waterman, *supra* note 183, at 162.

[268] *See* Waterman, *supra* note 183, at 129.

[269] *Id.* at 129, 152-58 (describing SB 221 and 610).

[270] *Id.*; *see generally* DEPT. OF WATER RESOURCES, GUIDEBOOK FOR IMPLEMENTATION OF SB 610 AND SB 221 OF 2001 (2003).

groundwater.[271] Preliminary research suggests compliance with those new laws has been significantly better than compliance with their predecessor.[272]

In combination, these laws link growth and water supply planning and appear to prohibit large-scale growth without water.[273] They also create some potential for reconciling the consumptive and protective goals of state and federal law, for they could focus attention where underwatered growth threatens to create excess demand.[274] Nevertheless, because planning laws are triggered largely by changes in the status quo, they do not compel or create incentives for reductions in existing use.[275] Moreover, California law contains also embodies competing goals; though water districts cannot ignore environmental constraints, they are similarly prohibited, at least in theory, from using planning laws to implement no-growth policies if additional water supplies might be procured.[276] Consequently, while these laws may slow the rate at which demand grows, they are unlikely to create any reduction in overall water use or to resolve the tensions such use creates.

4. Water Conservation Laws

The final important, though to date relatively minor, component of the legal scheme governing California water is a set of laws seeking to facilitate conservation. Beyond its reasonable use requirement,[277] neither California nor the federal government has an across-the-board rule requiring water conservation. Several statutes, however, do provide incentives or, at least on paper, limited mandates. Water Code section 375, for example, empowers water suppliers to impose conservation requirements, though it does

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[271] *See* Cal. Stats 2001 ch 643 § 4.5 (SB 610); *see also* Cal. Water Code § 10540 (providing for "Integrated Regional Water Management Plans").

[272] HANAK, *supra* note 167, at viii.

[273] Waterman, *supra* note 183, at 152-53. The statutes only apply to larger projects, and unless CEQA applies, smaller scale developments still may occur without identified supplies.

[274] *See* Planning and Conservation League v. Department of Water Resources, 89 Cal. App. 4th 892, 914-15 (2000) (noting the adverse consequences that can follow if "local decision makers are seduced by contractual entitlements and approve projects dependent on water worth little more than a wish and a prayer").

[275] *See* HANAK, *supra* note 167, at xi ("there are no automatic levers to induce conservation in communities that choose not to conserve").

[276] *See* Swanson v. Marin Municipal Water Dist., 56 Cal. App. 3d 512, 514 (1976) (upholding a moratorium on new connections, but cautioning that a district must "exert every reasonable effort to augment its available water supply in order to meet increasing demands").

[277] *See* Neuman, *supra* note 216 (chronicling courts' unwillingness to apply beneficial or reasonable use requirements to actually limit use).

not require them to do so.[278] Other provisions empower local governments to mandate reclaimed water use for landscaping, create limited requirements for recycled water use in toilets and cooling facilities, and attempt to encourage (and allay fears about) water recycling.[279] Water Code sections 13577 and 13578 set the goal of recycling a million acre-feet per year by 2020 and charge the Department of Water Resources with recommending ways to achieve that goal. Finally, California law now imposes almost-across-the-board metering requirements on residential (but not agricultural) use, a substantial improvement in a state where water use in some dry areas has historically gone unmetered.[280]

In addition, the California Legislature has repeatedly issued bonds, generally accompanied with hortatory legislative findings promoting water conservation, to provide funding for conservation projects.[281] The state's Water Pollution Control Revolving Fund also provides money for conservation and water recycling.[282] State law requires DWR to "offer assistance to agricultural water suppliers to implement efficient water management practices to improve the efficiency of water use,"[283] and requires agricultural districts to develop conservation plans—if they "determine that a significant opportunity exists to conserve water."[284] Those provisions generally offer carrots, however; they include neither sticks compelling conservation nor mandates to limit the amount of water extracted from the state's natural environment.[285]

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[278] *See also* Landscape Water Conservation and Recycling Act of 1990 (requiring adoption of local ordinances regulating landscape water use.).

[279] *See* Cal. Water Code §§ 13500-56; Cal. Water Code § 461 ("the primary interest of the people of the state in the conservation of all available water resources requires the maximum reuse of reclaimed water").

[280] Cal. Water Code §§ 500-530; *see* HANAK, *supra* note 167, at 13 ("many communities in the Sacramento and San Joaquin Valleys have traditionally charged flat fees for water, regardless of the volume of use."). Assessing whether water use is reasonable is nearly impossible when one cannot measure water actually used. *See* Water Code § 521.

[281] Cal. Water Code §§ 13955-69, 13999-13999.19, 13450-69, 14050-76; PUBLIC POLICY INSTITUTE OF CALIFORNIA, CALIFORNIA 2025: TAKING ON THE FUTURE 102-03 (2005) (describing bonds). The CALFED program, for example, relied upon bonds to support its water conservation efforts. *Id.* at 103.

[282] Cal. Water Code §§ 13480, 13481.5.

[283] Cal. Water Code § 10904.

[284] *See also* Cal Water Code § 11952 ("encourag[ing]" conservation).

[285] *See* HANAK, *supra* note 167, at xi, xiii ("there is more room in California's future for regulatory actions backed by sticks rather than financial carrots.").

Federal law contains some similar provisions. The 1982 Reclamation Reform Act, for example, required Bureau contractors to develop water conservation plans, which the Bureau then would approve; though "implementation of those plans typically has not been enforced," the requirement remains.[286] The CVPIA established similar requirements, mandating tiered pricing and allowing greater use of water transfers, which theoretically create conservation incentives.[287] But federal law, much like that of California, creates few mandates for conservation and caps water allocation only by setting maximum contract amounts, which typically are far in excess of actual availability.

The federal and state water conservation laws therefore are, at best, in their nascent stages, and appear more consistent with Vice President Cheney's famous characterization of conservation as a personal virtue than with the reality of a state faced with endemic water scarcities. Those laws create no overall limits on use and empower but rarely require conservation.

D. The False Promise of Flexibility

This legal system might superficially seem a reasonable response to California's environmental realities. Though some parts of the legal scheme encourage more water consumption and other parts demand protection of the resources that consumption endangers, the system as a whole, by preserving governmental discretion to impose cutbacks in times of shortage, ideally might allow California to wring the maximum consumptive benefit from wet periods while adaptively adjusting to dry years' environmental constraints.[288] The system thus might appear to resolve the basic tensions between consumption, protection, and reliability by encouraging consumption right up to protective limits and sacrificing reliability, instead invoking flexibility and adaptation to resolve any problems that result. In practice, however, reliance upon theoretical flexibility and adaptability seems misplaced, for the system also encourages optimistic expectations and a sense of entitlement. That encouragement, in combination with the

[286] CONGRESSIONAL BUDGET OFFICE, *supra* note 48, at 22.

[287] Pub. L. 102-575 (1992), 106 Stat. at 4706-31, § 3405; *but see* CONGRESSIONAL BUDGET OFFICE, *supra* note 48, at 36-37 (observing that few CVPIA-authorized transfers actually had occurred).

[288] *See* United States v. California State Water Resources Control Board, 182 Cal. App. 3d 82, 104 (describing the variability of rights).

often significant costs of adjustment, can make flexibility practically and politically difficult to invoke.

People generally fear a loss more intensely than they covet an equivalent gain—it is more threatening to lose fifty dollars you assumed was yours than to miss out on a fifty-dollar windfall, particularly if you already have made plans in reliance upon those fifty dollars—but the legal systems for allocating California's water seem calibrated to inflame that tendency.[289] By giving water consumers paper contracts stating fixed quantities, they encourage investment in water-dependent infrastructure and foster a sense that full deliveries are a right; the users have the paper to prove it, even if those amounts exceed what nature and existing infrastructure can consistently and legally provide.[290] Consequently, regardless of what California's legal treatises say about the inherent contingency of water rights, users may believe that reductions are deeply unfair, if not outright confiscations of property. Environmental statutes, the public trust doctrine, and reasonable use requirements create countervailing expectations. The underlying premise of the public trust doctrine is that water first and foremost belongs to the public, meaning that users who infringe on trust values or unreasonably use ecologically-needed water are essentially taking public property.[291] Regardless of what paper permits or contracts say, environmental advocates therefore can reasonably perceive ecologically beneficial flows as a public entitlement. Consequently, no matter how water is allocated, at least someone will feel, except in the wettest of years, that *their* water has been taken away, and will vigorously resist that perceived loss.[292]

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[289] *See, e.g.*, *See* Korobkin and Ulen, *supra* note 71, at 1107-09 (2000); Amos Tversky and Daniel Kahneman, *Loss Aversion in Riskless Choice: A Reference-Dependant Model*, 106 QUARTERLY JOURNAL OF ECONOMICS 1039 (1991); Thompson, *Tragically Difficult*, *supra* note 67, at 263-65 ("where the loss is distant and uncertain, people often act as if there's virtually no future risk to them at all. ….). Those tendencies help explain water management challenges, for they predict that users will prefer irregular but drastic cutoffs—and will underestimate the likelihood of those cutoffs—to predictable, smaller reductions, even though the latter may ultimately be less harmful.

[290] *See* CONGRESSIONAL BUDGET OFFICE, *supra* note 48, at 17 (noting that Reclamation's contracts and practices create the expectation of permanence).

[291] *See National Audubon Society v. Superior Court*, 33 Cal. 3d 419, 433-34 (1983) (describing the historic origins of the doctrine); Thomas, *supra* note 10, at 33 ("It is based on an ancient recognition that some natural assets are of such fundamental and universal value that they transcend the principles of sovereign dominion and exercise of exclusive rights.").

[292] *See* Freeman and Farber, *supra* note 9, at 867 (describing competing senses of entitlement); Korobkin and Ulen, *supra* note 71, at 1108-09 (describing experimental evidence that a sense of possession heightens the value people place on things); Russel Korobkin, *Policymaking and the Offer/Asking Price Gap: Toward a Theory of Efficient Entitlement Allocation*, 46 STAN. L. REV. 663, 698-703 (1994)

The regionalism and "tribalism"[293] of water politics exacerbate these senses of entitlement. The members of many of the interest groups involved California's water struggles live in somewhat insular communities, which form fertile incubators for each group's sense of right.[294] Rural Central Valley residents, for example, fairly uniformly support agricultural water diversions and are skeptical of the demands of both urban users and environmentalists.[295] For San Francisco Bay Area residents, who tend to be more favorably inclined toward environmental protection,[296] the Central Valley often seems a place with a totally different economy and political culture. Similarly, north-of-Delta water users, though generally agricultural and more skeptical of environmentalists' goals, also tend to be united in fear of Southern California's reaching grasp.[297] Urban users in southern California, meanwhile, tend to live far away from, and may never see or even be

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(applying this theory to a hypothetical resolution of the spotted owl controversy); HANAK, *supra* note 167, at xi ("getting existing residents to share [water] is more difficult because of the sense of entitlement that comes with existing law").

[293] *See* Douglas A. Kysar and James Salzman, *Environmental Tribalism*, 87 MINN. L. REV. 1099 (2002).

[294] Similar polarization can divide the agencies responsible for managing water, with wildlife agencies and EPA often in tension with the Bureau of Reclamation and DWR, both of which were founded to build dams and pump water. *See generally* Glennon and Thorson, *supra* note 10, at 492 (questioning whether Reclamation can adjust its "traditional paradigm").

[295] *See, e.g.,* Stuart T. Pyle, *Kern County View of a California Water Consensus*, *in* ACHIEVING CONSENSUS ON WATER POLICY IN CALIFORNIA 100 (Water Education Foundation and Edmund G. "Pat" Brown Institute of Public Affairs, eds. 1992) (describing environmental advocates as "becoming more strident"). *Achieving Consensus on Water Policy in California* contains several essays written from an agricultural perspective, and all evince skepticism of the urban/environmental consensus view that agricultural interests have substantial amounts of water to spare. *See also* Neuman, *supra* note 216, at 972 ("The agricultural community fears that Los Angeles (either the city itself, or Los Angeles as a symbol for all urban areas in the West) will somehow acquire all of the water from the farmers.") (parentheses in original).

[296] That support turns lukewarm, however, when water comes from Hetch Hetchy. Though Bay Area environmentalists have called for removing O'Shaughnessy Dam and restoring the valley, San Francisco relies on Hetch Hetchy for both power and water, and city leaders have opposed dam removal. *Compare* ENVIRONMENTAL DEFENSE, PARADISE REGAINED: SOLUTIONS FOR RESTORING YOSEMITE'S HETCH HETCHY VALLEY (2004) *with* Tom Philp, *Water: Bring Back Hetch Hetchy?*, SACRAMENTO BEE, April 21, 2002 (quoting Diane Feinstein's assertions, while she was San Francisco's mayor, that Hetch Hetchy was San Francisco's "birthright," and that removing it would be "dumb, dumb, dumb").

[297] *See, e.g.*, Family Water Alliance, *Water Transfers: Sweetheart Deal or St. Valentine's Day Massacre* (2003) *at* http://www.familywateralliance.com/ (urging caution on water transfers to southern California); Don Killian, *Owens Valley Revisited* (1994) *at* http://www.familywateralliance.com/ (arguing that events in Owens Valley, where Los Angeles' water acquisitions ended the local agricultural economy, could recur in the Sacramento Valley). The Family Water Alliance's website also disparages environmental protection efforts. *See* http://www.familywateralliance.com/ (providing links, many with titles like "*Is Environmentalism Turning into Religion*?").

aware of, the areas impacted by their own water consumption.[298] Some integration exists, of course, but to a striking degree perceived interests are uniform within, yet distinct among, California's various regions.[299]

That regional differentiation facilitates misunderstanding and distrust, and each region has stories discounting the legitimacy of others' claims to water. Southern California, in the eyes of many, is the phreatophytic land of sprawl and hosed driveways, all supplied through a combination of institutional arrogance and duplicity.[300] The Central Valley is perceived as the black hole for water overconsumption, a place capable of supplying all unmet urban and ecological needs were it not so wedded to profligate use and disdainful of environmental protection.[301] Environmentalists, meanwhile, are the foolish elitists who would stunt southern California's growth and deprive agriculture of its lifeblood to sustain a few precious fish.[302] Those stories validate and harden

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[298] *See, e.g.*, LITTLE HOOVER COMM'N, *supra* note 5, at 77 ("most Californians, particularly those living south of the Delta, are not aware of the significance of maintaining the Bay-Delta estuary"). Such ignorance isn't unique to southern California. I once ate at a San Francisco restaurant whose menu offered "filtered Hetch Hetchy water." The owners assumed, apparently, that few customers would realize the exotic-sounding beverage actually flowed from the municipal tap.

[299] *See* LITTLE HOOVER COMM'N, *supra* note 5, at 60 ("Geography, more than party affiliation, defines water politics in California."). Those regional differences have translated into striking results when Californians vote on water-related referendums. *See, e.g.*, HUNDLEY, *supra* note 10, at 332 (describing 1982 voting over the peripheral canal); 369 (describing the 1974 vote on New Melones Dam). Nevertheless, PPIC polling recently found a remarkable degree of consistency in statewide views on water conservation; whether in the Central Valley or San Francisco, mst voters favored conserving existing supplies over developing new facilities. CALIFORNIA 2025, *supra* note 281, at 249.

[300] The specter of Los Angeles' appropriation of the Eastern Sierra Nevada's waters looms over almost all western water debates, with both agricultural and environmental interests perpetually invoking the Owens Valley and *Chinatown* (the 1974 Jack Nicholson movie). *E.g.* Killian, *supra* note 297; Gary D. Libecap, *Chinatown: Owens Valley and Western Water Reallocation—Getting the Record Straight and What it Means for Water Markets*, 83 TEXAS L. Rev. 2055 (2005) (criticizing the conventional understanding of the Owens Valley history).

[301] Marc Reisner was perhaps the leading articulator of this critique. *Cadillac Desert* meticulously indicts the pork-barrel culture that produced most western water projects. In a typical passage, which describes the San Joaquin Valley's Westlands Water District, he wrote, "[t]here, in a nutshell, is how one of the nation's preeminent examples of reform legislation (the Reclamation Act) is turned completely on its head: illegal subsidies enrich big farmers, whose excess production depresses crop production nationwide and whose waste of cheap water creates an environmental calamity that could cause billions to solve." REISNER, supra note 10, at 484 (parentheses added). Reisner was far from alone; Wallace Stegner spoke for many when he castigated water users' "snarling states rights and anti-federal feelings whose burden Bernard DeVoto once characterized in a sentence—'Get out and give us more money.'" STEGNER, *supra* note 67, at 61.

[302] *E.g.* California Farm Water Coalition, *Shifting of Farm Water Criticized*, September 16, 2004, *at* http://www.cfwc.com/should_know/Sept04/9-20energystudyresponse.pdf (criticizing an NRDC report as reflecting "an environmental agenda that benefits only those radical groups seeking to take water away from farmers").

competing communities' perceptions of entitlement,[303] leaving those communities reluctant to acknowledge the contingency of their allocations, and further limiting the flexibility theoretically inherent in California's water rights system.

History also complicates those problems. California's major water projects were built and numerous contracts first signed before increasing environmental awareness led many people to question the dogma that water flowing to the ocean is water wasted.[304] Similarly, prior appropriation doctrine evolved when the West's population was small, cities were few, and making the desert bloom was not merely a device to strengthen the nation's economy but also an expression of manifest destiny.[305] Many of California's water allocation habits were predicated on the assumption that exploiting rivers was inherently desirable, and entire regions of California have come to accept the consequences of that assumption as the expected status quo.[306] Bureaucratic cultures reflect those views; the agencies that deliver California's water justified their existence by promising large and consistent deliveries, and still often treat delivering as much water as possible as a matter of institutional identity, obligation, and pride.[307] Those expectations exacerbate indignation when environmentalists assert that the status quo is not, and never was, acceptable, and that environmental laws legitimately limit the amount and consistency of consumptive use.

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[303] To a striking extent, those battles are among communities, and all sides tend to view water as a "heritage resource," to use Joseph Sax's phrase. Whether environmentalists seeking to protect the "common wealth," *see Freyfogle*, *supra* note 203, or urban users protecting their communities' "birthright," or rural communities complaining of Chinatown-style water heists, Californians seem consistently "to feel an attachment to their water that is strikingly similar to the strong interest that nations and cultures assert over their antiquities and other cultural properties." Barton H. Thompson, *Takings, Public Trust, Unhappy Truths, and Helpless Giants: A Review of Professor Joseph Sax's Defense of the Environment Through Academic Scholarship: Water Law as a Pragmatic Exercise: Joseph Sax's Water Law Scholarship*, 25 ECOLOGY L.Q. 363, 368 (1998) (hereinafter Thompson, *Joseph Sax's Scholarship*).

[304] *See* CONGRESSIONAL BUDGET OFFICE, *supra* note 48, at 5 ("Other benefits that rivers provide—such as habitat for fish and wildlife, recreation, and cultural values for Native Americans—were historically ignored…").

[305] *See* Hundley, *supra* note 10, at 303-04. Many western boosters also argued, and many settlers believed, disastrously, that irrigation actually would change the climate, and that "rain follows the plow." *See* David Getches, *Water Wrongs: Why Can't We Get it Right the First Time?*, 34 ENVTL L. 1, 8-9 (2004).

[306] *See, e.g.,* Letter from Mike Wade, California Farm Water Coalition, to the Bakersfield Californian, July 1, 2004, *available at* http://www.cfwc.com/should_know/2004/July04/7-1%20Bak%20CA.pdf (applauding an editorial that decried the loss of water that flowed to sea).

[307] *See* Swanson v. Marin Municipal Water Dist., 56 Cal. App. 3d 512, 514 (1976) (positing an obligation to meet new growth with new supplies).

Finally, those problems are compounded by the extent to which water managers, like many environmental managers, must rely on science when adjusting allocations. A common reason for major delivery adjustments is not total physical unavailability of water but rather a judgment that ecological systems cannot sustain further strain.[308] Those judgments must be made by often-underfunded government scientists, who must predict future conditions of complicated systems based upon limited data and partially unknown chains of cause and effect, and who may be speaking to audiences not cognizant of the prevalence of variability in ecological systems and ambiguity in environmental science.[309] Their determinations are likely to be couched in uncertainties, and even if based on good judgment and careful research may sometimes be wrong.[310] Almost any recommendation for an adjustment therefore will appear highly contestable, and resource users may believe, or at least plausibly argue, that science was manipulated or misused to deprive them of water.[311]

Consequently, rather than viewing their allocations as fundamentally contingent upon, and variable in response to, environmental needs, consumptive water users tend to expect consistency; while cognizant that precipitation varies, they may perceive environmentally-required reductions as misguided at best and at worst as bureaucratic confiscations of property.[312] The reasonable use and public trust doctrines, though theoretically providing the state with flexibility to adjust water allocations based on evolving human and environmental needs,[313] are rarely invoked for those purposes, and

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[308] *See* James R. Rasband, *Priority, Probability, and Proximate Cause: Lessons from Tort Law About Imposing ESA Responsibility for Wildlife Harm on Water Users and Other Joint Habitat Modifiers*, 33 ENVTL. L. 595, 598-99 (2003) (discussing this common scenario).

[309] *See* Doremus and Tarlock, *supra* note 10, at 18 ("natural resource management decisions are typically not closely constrained by the available data, because those data are so incomplete and ambiguous").

[310] *See, e.g., id*. at 11 (discussing scientific judgments in the Klamath controversy); *id.* at 18 ("ecology and the related biological sciences will never reach the precision and elegance of physics and mathematics"); LITTLE HOOVER COMM'N, *supra* note 5, at 31 ("Scientists rarely have been able to link specific causes to specific changes in the Delta because of the complexity and interconnectedness of numerous factors."), 66 ("uncertainties make it difficult to act decisively and confidently").

[311] *See* Doremus and Tarlock, *supra* note 10, at 5-6 (observing that increases in scientific information "if decoupled from increased understanding, can exacerbate controversy by making it easier for people to selectively reinforce their beliefs"); *see generally* Owen, *supra* note 31, at 773-76.

[312] The view of environmental protection as confiscation was perhaps most prominently articulated in *Tulare Lake Water Basin Storage District v. United States*, 49 Fed. Cl. 313, 324 (2001) ("The federal government is certainly free to preserve the fish; it must simply pay for the water it takes to do so.").

[313] *See* United States v. California State Water Resources Control Board, 182 Cal. App. 3d 82, 106 (1982) (explaining this flexibility).

in practice environmentally-based water allocation reductions infrequently occur other than in response to fairly inescapable statutory mandates or payment of public money.[314] That flexibility is not moribund; deliveries do vary substantially from year to year as both availability and demand vary in response to changing weather, and environmental enforcement has compelled major changes in California water allocations.[315] Nevertheless, major environmentally-based adjustments almost invariably induce protracted litigation, and the malleable, adaptive allocation system created, at least on paper, by California and federal water laws does not match actual practice.

Those limitations on flexibility mean that the systems governing California's water try to have it all. Though water is scarce, federal and state rules simultaneously attempt to maximize consumption and increase protection. The system thus encourages environmental managers to do what the basic conceptual framework posited by this article predicts will be quite difficult, that is, to promote consumption right up to the perceived limits of environmental law, leaving no slack to facilitate adjustment should conditions change. Yet users also demand reliability, and the flexibility that might resolve those conflicts is severely limited by practical and political realities. In the face of environmental uncertainty and dynamism, that approach creates a recipe for conflict.

IV. THE CONFLUENCE OF TENSIONS—THE BAY-DELTA CONTROVERSY

Hardly a river in California has been immune from the tensions created by scarcity, environmental variability, and an internally inconsistent legal system, but those tensions have been most visible and salient, and perhaps also most important, in the Bay-Delta.[316] The Bay-Delta is literally and figuratively the place where California's water problems flow together.[317] All of the waters draining the Central Valley flow through it, large fish and wildlife populations live within it, and each salmon born in the valley must swim downstream through the Bay-Delta to reach the ocean and back upstream to reach

[314] Recent Bay-Delta history is instructive. While water has been re-allocated, at least on paper, to environmental uses, those reallocations occurred primarily in response to litigation-forced regulatory actions (EPA's proposed new water quality standards and the federal wildlife agencies' ESA listings), the Central Valley Project Improvement Act, and payment through the Environmental Water Account. Common law doctrines creating flexibility in water allocations may have helped facilitate those changes but were hardly their cause. *See infra* Part IV.

[315] *See, e.g.*, *infra* note 333 and accompanying text.

[316] For other descriptions of the Bay-Delta history, see Little HOOVER COMM'N, *supra* note 5, at 14-34; Freeman and Farber, *supra* note 9, at 837-76; and Rieke, *supra* note 9.

[317] *See* LITTLE HOOVER COMM'N, *supra* note 5, at 4 ("Everything is connected in the Delta.").

its natal stream and spawn.[318] The Delta itself is the source of at least some of the drinking water used by approximately two thirds of Californians, and management to meet those needs dominates the Bay-Delta's hydrology.[319] Its tributary rivers supply millions more, and because the greater Bay-Delta system supplies almost everyone in California with some of their water, its fate is inextricably connected with statewide urban water demand.[320] The state's agricultural economy also relies heavily on the Bay-Delta to supply its irrigation works and carry off its return flows, and the Bay-Delta's water quality bears the signature of land use practices throughout much of California.[321] California's water problems, in short, are the Bay-Delta's problems, and the Bay-Delta's fate both depends upon and helps determine water management statewide.

By the late 1970s, the Bay-Delta was showing the strains of those conflicting demands.[322] Federal and state environmental regulators both realized that increasing Delta exports, along with several other important factors, were drastically degrading the Bay-Delta's ecology.[323] For years, however, that realization translated into little protection. The State Water Resource Control Board first set water quality standards that failed to survive judicial review,[324] then set standards that EPA rejected as insufficient to meet basic water quality goals, and then, in the early 1990s, withdrew—on Governor Pete

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[318] *See* United States Geologic Survey, Shaded Relief Map of California, *at* http://education.usgs.gov/california/maps/shaded2.htm (last checked July 27, 2006).

[319] CALFED ROD, *supra* note 5, at 2; DWR, THE STATE WATER PROJECT DELIVERY RELIABILITY REPORT 2005 2 (2006); *see* 59 Fed. Reg. 869, 870 (FWS, Jan. 6, 1994) ("the water exports from the Delta by far exceed those from any other estuary on the west coast of North America"). Export pumping and associated water releases cause major changes in within-Delta water flows and alter the location of the estuary's freshwater/saltwater interface, and pumping pulls fish out of their migration pathways and, often, into the pumps. *See* 58 FED. REG. 12854, 12859 (FWS, March 5, 1993) (describing effects of pumping); 59 FED. REG. 65256, 65257 (FWS, December 19, 1994) (same).

[320] *See* LITTLE HOOVER COMM'N, *supra* note 5, at i ("The Delta is so critical to California's future that no water policy will be successful if the estuary is not restored.").

[321] *See* ENVISIONING FUTURES, *supra* note 2, at 136 (describing pollutant sources); Firebaugh Canal Co. v. United States, 203 F.3d 568, 571 (9th Cir. 2000) (describing some of the drainage problems faced by fields in the San Joaquin Valley, and the threats they pose to both those lands and downstream waters).

[322] *See* 60 Fed. Reg. 4664, 4665-67 (EPA, January 24, 1995).

[323] *See id*; CALFED ROD, *supra* note 5, at 2; 64 FED. REG. 5963, 5973 (Fish and Wildlife Service, Feb. 8, 1999); 59 FED. REG. 65256, 65257 (Fish and Wildlife Service, Dec. 19, 1994); 59 Fed. Reg. 869, 870 (Fish and Wildlife Service, June 6, 1994); 58 Fed. Reg. 33212, 33214 (National Marine Fisheries Service, June 16, 1993); 58 FED. REG. 12,854, 12,859 (FWS, March 5, 1993).

[324] *See* United States v. State Water Resources Control Board, 182 Cal.App.3d 82 (1986) (overturning the SWRCB's 1978 standards).

Wilson's orders—standards that initially appeared stronger.[325] EPA, while rejecting the state's efforts as inadequate, set no standards of its own until it was sued, and Reclamation argued it was immune from even the weak standards the state did create.[326] Meanwhile, exports grew, exotic species multiplied,[327] and un-screened diversions and a variety of other human activities throughout the watershed contributed to what EPA described as a "severe and continuing decline of the Bay-Delta's fish and wildlife resources."[328]

California's 1987-92 drought brought conflicts to a head. In the first years of the drought, DWR and the Bureau responded to heightened demand by exporting more water than ever before.[329] But the Fish and Wildlife Service and the National Marine Fisheries Service then listed the Delta smelt and winter-run Chinook salmon, once two of the Bay-Delta's most abundant fishes, as threatened species;[330] EPA accelerated pressure for new state water quality standards and then began drafting standards of its own;[331] and Congress passed the Central Valley Project Improvement Act, which, among other provisions, mandated re-allocation of 800,000 acre-feet per year to environmental uses.[332] Those actions caused a sharp reduction in water contractors' deliveries and an intense political reaction.[333] By the mid-1990s, an all out water war, with EPA and the wildlife agencies attempting to further limit water exports and water users uniting, with tacit support from the state and federal water delivery agencies, to take on the very structure of

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[325] *See* 60 Fed. Reg. 4664, 4665-67 (EPA, January 24, 1995) (describing this process); Freeman and Farber, *supra* note 9, at 840.

[326] *See State Water Resources Control Board*, 182 Cal.App.3d at 127 (rejecting that theory).

[327] *See* ENVISIONING FUTURES, *supra* note 2, at 71-72.

[328] 60 Fed. Reg. at 4664 ("In large part due to the effects of these water diversions… the fish and wildlife resources in the Bay/Delta estuary have deteriorated drastically over the past twenty years."); CONGRESSIONAL BUDGET OFFICE, *supra* note 48, at 33 ("Reduced outflows of freshwater from the delta—resulting in part from the CVP's water diversions—are a primary cause in the decline of many of those species.").

[329] *See* Mike Taugher, *A Struggle to Quench State's Thirst for Water*, CONTRA COSTA TIMES, Dec. 29, 2005 (showing pumping levels).

[330] *See* O'Neill v. United States, 50 F.3d 677, 681 (9th Cir. 1995).

[331] *See* 60 Fed. Reg. 4664 (setting those standards).

[332] Pub. L. 102-575, 106 STAT. at 4706-31 (1992).

[333] *See* Rieke, *supra* note 9, at 345; *see also* 59 Fed. Reg. 810, 814 (EPA, Jan. 6, 1994 (quoting then-Governor Wilson's observation that "any program must begin by recognizing a disturbing truth: The Delta is broken.")

environmental law—and with urban and agricultural users simultaneously fighting side-battles with each other—was a reasonable possibility.[334]

Though much litigation did occur,[335] that all-out water war did not. Several of the major agencies and environmental groups instead signed the Bay-Delta Accord, an agreement that traded temporary reductions in water deliveries for temporary and limited immunity from further regulatory actions.[336] The agencies also began the CALFED process, a collaborative, multi-agency, multi-stakeholder effort to create a new program for sustainable management of the Bay-Delta. Over the next several years, they developed several alternative proposals, and the agencies ultimately issued a joint federal-state record of decision in 2000.[337] Following issuance of the ROD, the California Legislature authorized creation of the Bay-Delta Authority, an agency designed to coordinate the CALFED effort, and Congress provided federal agencies with similar—though more limited—legislative authorization to participate in the CALFED process.[338]

CALFED's innovations were many. Most importantly, rather than attempting to reconcile the separately-made decisions of agencies with diverging, parochial interests, it attempted to create what Freeman and Farber describe as a "modular" regulatory structure allowing agencies to collaborate and make collective policy choices.[339]

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[334] *See* HUNDLEY, *supra* note 10, at 398-407 (describing events preceding the CALFED process); *see* Planning and Conservation League v. Department of Water Resources, 83 Cal. App. 4th 892, 900-01 (describing the potential conflict between agricultural and urban users over SWP supplies). All of this conflict was occurring while the 104th Congress was re-examining environmental laws, and the Endangered Species Act "seemed in danger of snapping." Doremus, *supra* note 97, at 51.

[335] *E.g.* O'Neill v. United States, 50 F.3d 677 (9th Cir. 1995); Westlands Water Dist. v. United States, 337 F.3d 1092 (9th Cir. 2003); Tulare Lake Water Basin Storage District v. United States, 49 Fed. Cl. 313 (2001).

[336] *See* Freeman and Farber, *supra* note 9, at 843; LITTLE HOOVER COMM'N, *supra* note 5, at 14-15 (describing the "truce"). The Bay-Delta Accord is reprinted in 2 HASTINGS WEST-NORTHWEST J. ENVTL. L & POL'Y 97 (1995).

[337] CALFED ROD, *supra* note 5; LITTLE HOOVER COMM'N, *supra* note 5, at 16.

[338] *See* LITTLE HOOVER COMM'N, *supra* note 5, at 28 (describing the federal and state acts, and criticizing the limited involvement allowed by the federal act).

[339] Freeman and Farber, *supra* note 9, at 853-57. While I hold a less sanguine view of the CALFED process, Freeman and Farber's arguments about the importance of such "modular" regulation are sound. Alternatively, agencies with conflicting agendas would separately develop diverging programs for managing the same resources, and then attempt, perhaps partly through proxy litigation (with water contractors battling environmental groups), to resolve policy. *See id.* at 839-40 (describing "regulatory fracture" and the problems it causes). For that reason, Freeman and Farber's modest conclusion about modular regulation—it "may not be perfect, but it has the potential to be better than the traditional approach"—seems eminently correct. *Id.* at 805.

CALFED also sought to prioritize information development and stakeholder inclusion; agencies utilized the expertise of water users and environmental groups, and CALFED sponsored scientific research and attempted to rely upon adaptive management.[340] Finally, CALFED tried to please everyone; the program's mantra was that stakeholders should all "get better together."[341]

To achieve those ambitious goals, CALFED developed novel regulatory devices. In an attempt to minimize the zero-sum nature of water conflicts, CALFED created an "environmental water account," a system designed to use willing-seller water exchanges to minimize the burdens created by environmental restrictions, and to allow flexibility for short-term adjustments in pumping levels.[342] More broadly, the CALFED agencies attempted to design infrastructure and management programs that would allow more pumping in winter, when—in theory—water would be more abundant and less environmentally important.[343] Using substantial funding from stakeholders and several voter-approved bonds, the CALFED agencies embarked on a major ecosystem restoration program, hoping, as one farmer put it, that "[y]ou redesign the river, you restore it to a more natural functioning, and hopefully you need less water to make the system work the way it's supposed to—everybody wins."[344] CALFED also made large amounts of grant money available to agencies pursuing conservation projects.[345] The rhetoric and writing of the CALFED agencies emphasized adaptive management; rather than irrevocably fixing their future course of action, the agencies defined a broad program, with many

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[340] *Id.* at 846-53 (describing CALFED's willingness to draw upon stakeholder ideas and expertise); *id.* at 865, 889 (praising CALFED's science program); LITTLE HOOVER COMM'N, *supra* note 5, at 37 ("The ROD envisioned a CALFED that was guided by an assertive adaptive management system."), 70.

[341] *See* CALFED ROD, *supra* note 5, at 9-10 (describing CALFED's interrelated objectives); ENVISIONING FUTURES, *supra* note 2, at 87.

[342] Freeman and Farber, *supra* note 9, at 847-52 (describing the EWA's creation); Brandt, *supra* note 10 (describing how the EWA should function).

[343] *E.g.* DWR, Interim South Delta Program Draft EIR/EIS Release, August 14, 1996, *available at* http://www.publicaffairs.water.ca.gov/newsreleases/1996/Aug.14,96-So_Delta_PgmR2.html ("During high winter flows," the South Delta Improvements Program (an element of the CALFED scheme) "would allow pumping at Banks Pumping Plant to increase from 6,400 to 10,300 cfs."). *But see, e.g.,* CALFED Administrative Record at H-000013 (comments of a California Department of Fish and Game biologist questioning this approach); 64 Fed. Reg. at 5973 ("Dampening of peak spring flows by springtime diversions to storage facilities to replenish depleted reservoirs has deleterious effects on estuarine species…, which have evolved in a system with periodic spring flooding.").

[344] CARLE, *supra* note 113, at 189 (quoting Merced County rancher Chris Robinson; italics removed).

[345] *See supra* note 287.

desired items but no strict commitment to implementing any particular project, and created a science program designed to facilitate learning and adjustment.[346] Those innovations are largely responsible for CALFED's reputation, at least in the legal academic literature, as an exemplary process.[347]

Nevertheless, one of the CALFED agencies' core choices created major risks.[348] Managing a dynamic, oversubscribed resource to provide increased consumption, increased protection, and increased reliability is extraordinarily difficult, yet that is exactly what the CALFED agencies attempted.[349] Rather than mandating cuts in consumption, the agencies assessed only programs designed, on the whole, to facilitate export increases,[350] and did so while assuming they would continue pumping water through the Delta.[351] Even in their penultimate environmental study, a policy of reducing overall consumption of Bay-Delta water earned only a terse dismissal in an appendix, and the CALFED agencies appear to have believed that so long as some water not legally

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[346] *See* CALFED ROD, *supra* note 5, at 6 ("The preferred program alternative is not intended to define the site specific actions that will ultimately be implemented."). Many participants in KPMG's survey agreed that one of CALFED's greatest accomplishments was "its success in exposing all stakeholders to the vast complexities of issues, science, policy and politics that encompass the Bay Delta." KPMG, *supra* note 11, at 10.

[347] *E.g.* Freeman and Farber, *supra* note 9; Thompson, *Markets for Nature*, *supra* note 9; Rieke, *supra* note 9; Brandt, *supra* note 10.

[348] In addition to the problems described below, the CALFED agencies premised their program on fragile funding and faith in weak governance structures. *Compare* CALFED ROD, *supra* note 5, at 4 ("California taxpayers, stakeholders, and the federal government will be called upon to invest billions of dollars over the next decade on CALFED programs.") *with* ENVIRONMENTAL DEFENSE, *supra* note 170, at 16 (describing uncertain future funding for the EWA and other similar programs); *compare* Freeman and Farber, *supra* note 9, at 855-57, 905 (describing the governance structure, and arguing that it also created "obvious benefits" and that "by all accounts, [CBDA] has been quite effective in promoting coordination"), *with* LITTLE HOOVER COMM'N, *supra* note 5, cover letter at i ("Because of a faulty design, the CBDA cannot effectively coordinate activities, push agencies to perform, or provide rigorous oversight. It is unable to control or cajole."), 27-28 (observing that state authorizing legislation "stripped any meaningful authority from the Bay-Delta Authority," and that federal authorizing legislation limited federal involvement in the CBDA), 80 ("Key Meetings and Decisions Exclude Public Involvement").

[349] *See* Mike Taugher, *CALFED: Bay-Delta Authority Head Exits*, CONTRA COSTA TIMES, May 26, 2005 (quoting The Bay Institute's Gary Bobker: "You can have your cake and eat it too–that's the unspoken motto of CalFed").

[350] *See* CALFED BAY-DELTA PROGRAM FINAL PROGRAMMATIC ENVIRONMENTAL IMPACT STATEMENT/ENVIRONMENTAL IMPACT REPORT 3-8, 5.3-20 (2000) (hereinafter "CALFED EIR") (considering, as possible programs for future management of the Bay-Delta, only options that could increase overall pumping levels), CR-30 (rejecting consideration of export caps or reductions). The agencies also attempted to temper those increases by implementing a conservation program, but that program was deliberately toothless. "The conservation estimates in the Water Use Efficiency Program Plan," the agencies wrote, "are not targets, objectives, or goals. CALFED is not mandating that these or any other levels of water savings be achieved." CALFED EIR, *supra*, at CR-47.

[351] *See* ENVISIONING FUTURES, *supra* note 2, at 42.

committed to environmental protection remained in the system, they had no choice but to increase water deliveries.[352] Yet the CALFED agencies also promised environmental recovery—legally, they had no choice—which they proposed to achieve partly through augmentation of environmental flows.[353] They thus proposed to increase consumption and improve environmental conditions, while leaving less unallocated water—less slack—in the system, yet they simultaneously defined increased water supply reliability as one of their core goals, and rhetorically endorsed the importance of achieving a lasting program.[354] Those ambitions should be no surprise; the CALFED program merely reflected the underlying policy goals inherent in the state and federal legal regimes for managing California water. But by attempting to increase consumption, protection, *and* reliability, the CALFED agencies predicated their program upon a dangerous choice.

Even as the CALFED agencies moved forward with that plan, warning signs abounded. The historic degradation of the Bay-Delta correlated with increased water consumption, and almost every agency report on the Bay-Delta's environmental problems pointed to accelerating water use as a major contributing cause.[355] Some agency biologists were skeptical of an approach founded on increased exports, even if those increases were coupled with ecosystem restoration efforts and selective wet-season pumping.[356] As one biologist put it, "[t]he real problem is too many straws in the water

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[352] *See, e.g.*, CALFED EIR, *supra* note 350, at CR-30. In subsequent litigation, the California Resources Agency has argued that any reduction in deliveries would have jettisoned CALFED's basic goals, and southern California water users have argued that such reductions were simply impossible.

[353] To make sense of this seeming paradox, one must understand that paper allocations and actual wet-water flows rarely correspond. Prior to the CALFED program, some Bay-Delta outflow was theoretically surplus, meaning it remained instream but wasn't formally allocated to environmental use. Meanwhile, contractual allocations greatly exceeded actual deliveries, meaning there were substantial gaps between what contractors were allocated on paper and what they actually received. By allocating more water to the environment, the CALFED program created what on paper appears to be an environmentally-beneficial change. *See* Rieke, *supra* note 9, at 349 (describing the Bay-Delta Accord as increasing environmental water availability). But even as more paper water was committed to instream flows, those flows could contain less wet water, partly because paper allocations aren't always met, *see* ENVIRONMENTAL DEFENSE, *supra* note 170, and partly because surplus unallocated flows that formerly remained instream now could go to the contractors.

[354] CALFED ROD, *supra* note 5, at 9 (stating that solutions must "be durable"); *see also* ENVISIONING FUTURES, *supra* note 2, at 196 ("the language of the CALFED era has been steeped in assurances").

[355] *See supra* notes 323, 328; CALFED ROD, *supra* note 5, at 2 ("diversions, along with [several other factors], have had a serious effect on the fish and wildlife resources in the Bay-Delta estuary").

[356] *E.g.* CALFED Administrative Record at C-24714 (noting that Bay-Delta species "evolved under a flow regime with pronounced seasonal and year-to-year variability"), C-024475, C-024477, C-024490 (describing the importance of winter outflows to Delta smelt, longfin smelt, and splittail), H-

and not enough left in the Delta for habitat."[357] Funding also was tenuous; the environmental restoration projects that the CALFED agencies hoped would compensate for pumping increases would not be cheap, yet the agencies created no funding mechanisms to compensate if state and federal budget allocations ran short.[358] Finally, the inherent dynamism and unpredictability of California's watersheds was no secret. California's water managers were well aware of the state's history of droughts and floods, its susceptibility to earthquakes, and its vulnerability to climate change, and all of those threats, as well as the widely-acknowledged lack of understanding of the Bay-Delta's ecology, ought to have suggested the danger inherent in a program designed to recover the environment and increase the amount and reliability of Bay-Delta water use. Such a program might succeed if brilliantly implemented by resourceful and well-funded managers, and under relatively benign and stable environmental conditions, but its chances of failure seem uncomfortably large.[359]

Despite some successes,[360] that inherent fragility already seems to be contributing to major problems. In the years following the CALFED decision, pumping increased, though not yet as much as the agencies planned.[361] Populations of several pelagic species meanwhile have plummeted, and the correlation is suspicious. As one government scientist observed, "we have this coincidence where entrainments are up, fish populations

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000013 (FWS comments expressing doubt about this approach), D-014884 ("High export rates in winter and spring appear to reduce survival of important fish."); 64 Fed. Reg. at 5973 ("Dampening of peak spring flows by springtime diversions to storage facilities to replenish depleted reservoirs has deleterious effects on estuarine species such as the splittail, which have evolved in a system with periodic spring flooding.").

[357] CALFED Administrative Record at H-000006.

[358] *See* LITTLE HOOVER COMM'N, *supra* note 5, at 41.

[359] *See* Freeman and Farber, *supra* note 9, at 866 (summarizing, though not adopting, this critique of the CALFED process).

[360] *See* Mike Taugher, *CALFED: Despite Spending Billions, CalFed Can't Fix Delta*, CONTRA COSTA TIMES, May 1, 2005, available at http://calwater.ca.gov/Newsroom/NewsClips/NewsClip_5-1-05.shtml ("'Before you draw the conclusion that CalFed hasn't done anything, you have to realize CalFed has done a hell of a job on half the problem,' said Greg Gartrell, an assistant general manager at the Contra Costa Water District, referring to the salmon gains."); Freeman and Farber, *supra* note 9, at 860-62 (describing other successes, including the lack of pump shutdowns and successful implementation of new groundwater storage projects). Fears persist, however, that the absence of pump shutdowns contributed to ecological declines, and that increases in salmon populations may be undone by planned future actions. *See* Matt Weiser, *Reservoir Changes Stir Fears for Fish; State Officials, Anglers Worry About the Effect of a Federal Proposal on Delta Salmon Runs*, SACRAMENTO BEE, July 24, 2005; *Editorial: Determine the cause of Delta Degradation*, CONTRA COSTA TIMES, August 7, 2005 (noting that in early 2005, water agency officials denied biologists' requests to slow pumping rates).

[361] *See* Taugher, *A Struggle to Quench State's Thirst*, *supra* note 329 (showing pumping levels).

are down, and water exports are up."[362] Export pumping doesn't appear to be the exclusive cause of those declines; scientists are also evaluating other potential factors, such as pollutant loading and invasive species,[363] and many think a confluence of stresses is the likeliest explanation.[364] Reducing consumption also probably wouldn't be a complete solution; though it could reduce environmental strains, such reductions alone probably cannot recover the Delta to a healthy state.[365] But even if export increases aren't the sole problem and reductions should not be the singular focus of long-term solutions, [366] their probable contributing role confirms the danger inherent in attempting to achieve environmental recovery while also increasing an acknowledged source of environmental strain. At best, that approach increased the risk of troubles much like the ecological declines CALFED now faces; at worst, it may have played a major role in causing them. Those declines also bode poorly for CALFED's future. Fisheries declines can cause extinctions or major and unpredictable regulatory cutbacks in deliveries, both of which are exactly what the CALFED agencies intended to avoid. With such declines occurring even during a period of relatively wet weather, the CALFED program's prospects of long-term success seem slim.

Though one of the most salient of CALFED's troubles, the pelagic species collapse is not its only problem.[367] On both process and substance, CALFED is falling short of its own goals. One of the most widely-praised of CALFED's regulatory innovations—the EWA—is chronically short of funds.[368] Water quality problems are ongoing, and California and the federal government are once again litigating the

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[362] Matt Weiser, *Smelt Study Will Focus on Water-Pump Deaths*, SACRAMENTO BEE, November 15, 2005, at B1.

[363] *See* ENVISIONING FUTURES, *supra* note 2, at 72-73.

[364] *See* Mike Taugher, *Pumps Harming Delta Fish in Unexpected Ways, Researchers Say*, CONTRA COSTA TIMES, October 24, 2006; Associated Press, *Scientists to Meet to Examine Mystery Fish Die-Off in Delta*, June 20, 2005; Mike Taugher, *Delta Fish Populations: Agencies Mount Strategy Against Delta Fish Die-off*, CONTRA COSTA TIMES, June 19, 2005.

[365] *See* ENVISIONING FUTURES, *supra* note 2, at 149 ("the Delta will never again be as it once was").

[366] *See id.* (advocating evaluation of several potential solutions, some focused on infrastructure changes and other on pumping reductions).

[367] *See supra* note 18 (describing vulnerable levees); ENVISIONING FUTURES, *supra* note 2, at 55, 58 (describing urbanization problems).

[368] *See* ENVIRONMENTAL DEFENSE, *supra* note 170 (describing limited and uncertain funding).

allocation of responsibility for meeting in-Delta water quality standards.[369] Though water exports have in fact increased, many of the infrastructure changes desired by water contractors have not occurred, and the fisheries collapses now create doubt about whether some of those changes ever will occur.[370] Adaptive management, though theoretically central to the CALFED program, has been largely absent.[371] Finally, the political consensus supporting CALFED is gone.[372] Legislators have blasted CALFED's accomplishments and funded it reluctantly,[373] beneficiaries have successfully opposed proposals to fund restoration through water user fees,[374] the Bush and Schwarzenegger administrations have provided little political support,[375] independent audits and reviews have called its decisionmaking structure into question,[376] water users and delivery agencies have chosen to make key decisions outside of the CALFED process,[377] and many stakeholders now have little faith that CALFED can achieve its intended results.[378] The innovative institutional arrangements lauded by legal commentators appear destined for an early sunset; the Bay-Delta Authority soon may be replaced.[379]

Meanwhile, many of the basic tensions underlying CALFED's troubles are increasing. Consumption of Bay-Delta waters seems slated to increase. California's

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[369] *See* Petition for Writ of Mandate, United States of America v. State Water Resources Control Board, Sacramento County Sup. Ct. no. 06CS00862 (filed June 15, 2006); Complaint, United States of America v. State Water Resources Control Board et al. (E.D. Cal.), filed June 15, 2006.

[370] *E.g.* Preliminary Injunction Order, Planning and Conservation League v. United States Bureau of Reclamation, no. C-05-3527-CW (2006) (enjoining construction of the Intertie, an infrastructure project designed to increase water deliveries to Reclamation's San Luis Unit).

[371] *See, e.g.,* KPMG, *supra* note 11, at 11 (quoting one interviewee: "[w]e have failed to adaptively manage the program").

[372] *See* ENVISIONING FUTURES, *supra* note 2, at 1.

[373] *See* Freeman and Farber, *supra* note 9, at 873-75 (describing funding problems); ENVIRONMENTAL DEFENSE, *supra* note 170, at 16.

[374] PUBLIC POLICY INSTITUTE OF CALIFORNIA, CALIFORNIA 2025, *supra* note 281, at 114; *see id.* at 131 (noting that CALFED was supposed to use a "beneficiary pays" approach).

[375] *See* LITTLE HOOVER COMM'N, *supra* note 5, at 41, 56 (describing federal uninterest and limited funding); Jody Freeman, *Editorial: Why is Arnold Afraid of the Water?*, LOS ANGELES TIMES, August 21, 2005, *available at* http://calwater.ca.gov/Newsroom/NewsClips/NewsClip_8-21-05.shtml.

[376] *See* LITTLE HOOVER COMM'N, *supra* note 5, KPMG, *supra* note 11.

[377] *See* LITTLE HOOVER COMM'N, *supra* note 5, at 80 (describing the "Napa Agreement," in which several water users and water supply agencies set a program for future Bay-Delta management without involving environmental stakeholders, the CBDA, or wildlife agencies).

[378] *See* KPMG, *supra* note 11 (describing stakeholder views of the program, and noting that positive views mostly were based on achievements early in the program's history).

[379] *See* Taugher, *CALFED Reorganization Includes New Delta Plan*, *supra* note 23.

population continues to grow,[380] with the heaviest growth likely to occur in hot, dry inland areas with high per-capita rates of water consumption.[381] Rather than accommodating those population increases solely by increasing the efficiency of water use—a solution that NGO reports and even DWR's own California Water Plan suggest would be feasible—federal, state, and local water supply agencies all have indicated their intentions to pump more water, much of it from the Bay-Delta.[382]

Meanwhile, environmental protection requirements have not changed. Despite recent years of Republican political dominance, environmental statutes have remained

[380] HANAK, *supra* note 167, at v ("…the absolute increases predicted over the coming decades are indeed phenomenal. Between 2000 and 2030, the state is expected to add 14 million residents, to reach a total of 48 million."); 2005 WATER PLAN, *supra* note 102, at V.1 p. 3-4 (describing projected growth).

[381] *See* HANAK, *supra* note 167, at v – vii, 8-11 (noting that half of all growth will occur in these areas).

[382] Reclamation recently renewed almost all of its long-term water supply contracts. *See* United States Bureau of Reclamation, *Central Valley Water Contracts are Renewed for Farms and Cities*, February 25, 2005, *available at* http://www.usbr.gov/newsroom/newsrelease/detail.cfm?RecordID=4281; Martin, *supra* note 24 (describing controversies over contract renewals). Though some contractors rarely used their full allocations, Reclamation proposed renewing at the full amounts and at subsidized rates, and has stated its intent to deliver more water to some contractors. *See* ENVIRONMENTAL WORKING GROUP, VIRTUAL FLOOD, *at* http://www.ewg.org/reports/virtualflood/execsumm.php (describing projected increases in delivery amounts). Concurrently, the Bureau is proposing actions to alter the CVP's infrastructure to allow increased deliveries, including raising Shasta Dam and increasing the capacity of the south-Delta pumping system. *See* CALIFORNIA WATER PLAN UPDATE, *supra* note 102, at V.2 pp. 5-2 to 5-3 (describing projects designed to increase south delta pumping).

DWR has partnered in pursuing those infrastructure changes. *Id.*; *see*, *e.g.*, DWR, South Delta Improvements Program, *at* http://sdip.water.ca.gov/documents/SDIP_brochure.pdf (last checked July 28, 2006). Additionally, in published reliability reports, DWR predicts the State Water Project can reliably supply almost a million acre-feet more water than it has averaged in the past. *Compare* DELIVERY RELIABILITY REPORT, *supra* note 319, at 17-18 (predicting SWP deliveries close to three million acre-feet per year), *with* Planning and Conservation League v. Dept. of Water Resources, 83 Cal. App 4th 892, 908 n.5 (2000) ("Actual, reliable water supply from the SWP is more in the vicinity of 2 to 2.5 maf of water annually."). Because California law now requires demonstration of reliable water supplies as a condition precedent to major development, local governments are likely to rely on DWR's predictions, and optimistic projections could beget more houses and less conservation. *See* DELIVERY RELIABILITY REPORT, *supra* note 319, at 2 (describing the report as a planning resource).

While many localities are conditioning new development on conservation, and some areas have utilized water shortages to slow new growth, few local agencies have shown the inclination to reduce existing levels of use. *See* HANAK, *supra* note 167, at xi, 85-87; *compare* Craig Anthony Arnold and Leigh A. Jewell, *Litigation's Bounded Effectiveness and the Real Public Trust Doctrine: The Aftermath of the Mono Lake Case*, 8 HASTINGS W.-N.W. J. ENV. L. & POL'Y 1, 19-20 (2001) (describing conservation efforts in Los Angeles). Instead, local agencies' urban water management plans generally predict unchanged per capita water consumption, and many of those plans also project increased overall use, some of it from the Bay-Delta. *See* HANAK, *supra* note 167, at xi, 85-87 (noting that current Urban Water Management Plans as a whole do not project any reduction in per capita consumption), 11 (noting that current trends suggest that per capita use will *increase*), vii (describing utilities' dubious projections of future surpluses), 46-47 (describing MWD's plans to take more Bay-Delta water).

largely intact, and political support for such changes has been largely absent.[383] Consequently, so long as water quality problems remain chronic and species populations hover near extinction, citizen suits could compel major changes in water management. Yet political commitments to reliability also remain and may even be growing. Property rights advocates have spent recent years attempting, with partial (but diminishing) success, to use constitutional takings litigation to increase the certainty of water rights,[384] and many water users have sought regulatory commitments to the same effect.[385] Even as CALFED falters, California water management thus remains defined by incentives consume to, or past, the brinks of illegality defined by environmental laws, mandates for environmental protection, and reluctance to relinquish reliability.

Nor have reform movements accomplished much to diminish those underlying tensions. Faced with competing wants for more consumption, protection, and reliability, many commentators have suggested the answers lie in fundamental legal and administrative reforms designed to allow greater institutional adaptability. Environmentalists, for example, have argued that the flexibility promised by public trust doctrine and reasonable use requirement ought to be more widely invoked, and that water rights ought to be as contingent and as subservient to evolving community needs in

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[383] *See, e.g.*, PUBLIC POLICY INSTITUTE OF CALIFORNIA, SPECIAL SURVEY ON CALIFORNIANS AND THE ENVIRONMENT 9 (2004) (finding broad public support for environmental protection); PUBLIC POLICY INSTITUTE OF CALIFORNIA, SPECIAL SURVEY ON CALIFORNIANS AND THE ENVIRONMENT 9 (2003) (same); PUBLIC POLICY INSTITUTE OF CALIFORNIA, SPECIAL SURVEY ON CALIFORNIANS AND THE ENVIRONMENT 13 (2002) (finding that most Californians believe strict environmental regulations are worth paying greater costs); HARRIS INTERACTIVE, THREE-QUARTERS OF U.S. ADULTS AGREE ENVIRONMENTAL STANDARDS CANNOT BE TOO HIGH AND CONTINUING IMPROVEMENTS MUST BE MADE REGARDLESS OF COST, October 13, 2005, *at* http://www.harrisinteractive.com/harris_poll/index.asp?PID=607.

[384] *See, e.g.,* Tulare Lake Water Basin Storage District v. United States, 49 Fed. Cl. 313 (2001); Roger J. Marzulla, *Taking and Water Rights*, THE WATER REPORT, November 15, 2005, at 1-6 (describing several pending cases); *but see* Allegretti & Co. v. County of Imperial, 138 Cal. App. 4th 1261 (2006) (distinguishing and criticizing *Tulare Lake*); Klamath Irrigation Dist., 67 Fed. Cl. 504, 538 (2005) ("*Tulare* appears to be wrong on some counts, incomplete in others and, distinguishable, at all events"); *see also* State Water Resource Control Board Cases, 136 Cal. App. 4th 674, 806 n.54 (2006) (rejecting, in dictum, the reasoning of the *Tulare Lake* opinion).

[385] *E.g.* HUNDLEY, *supra* note 10, at 418, 423 (describing demands made by Metropolitan Water District and Westlands Water District during the CALFED process); *see also* Thompson, *Joseph Sax's Scholarship*, *supra* note 303, at 378 (arguing that active enforcement of reasonable use rules could introduce uncertainty and compromise markets); Frederick Cannon and Ronald H. Schmidt, *Why Water Markets are Good for California Agriculture*, in ACHIEVING CONSENSUS, *supra* note 295, at 65-66 (arguing that clearer water rights and marketing can remove the need for an "arbitrary 'public trust doctrine'").

practice as they are in theory.[386] Meanwhile, urban users, economists, and a mix of government bureaucrats and even environmentalists have criticized the system's incompatibility with markets, and its inability to simply redirect water to places, like cities, where users would be willing to pay substantially more for it.[387] Sometimes those critiques are as opposed to each other as to the status quo—water trading arouses widespread skepticism from some environmental advocates, and some scholars have suggested that pro-environmental regulatory actions could counterproductively stall markets[388]—but they derive from related roots, as reformers view increased flexibility, if not simply top-down reallocation, as indispensable to rationalizing the status quo system.[389]

But while those reformers have achieved some successes,[390] legal evolution has been incremental at best. Despite widespread attacks, the appropriative rights regime hasn't fundamentally changed. Federal and state contractual amounts are generally unaltered.[391] Pricing schemes are different, but only slightly so, and federal subsidies remain.[392] No wholesale re-examination of reasonable use requirements has taken place; instead, many of the uses Eric Freyfogle described as "an affront to attentive citizens who know stupidity when they see it"[393] continue, with defenders arguing that one person's stupidity is the foundation of another's financial future.[394] Efforts to trump the

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[386] *E.g.* Graf, *supra* note 10; I also base this statement on numerous conversations with environmental advocates during my time in private practice.

[387] *See, e.g.,* CONGRESSIONAL BUDGET OFFICE, *supra* note 48, at 1 ("relatively rigid allocations of water and the institutions that govern them have become increasingly inefficient and harder to justify").

[388] *E.g.* Thompson, *Joseph Sax's Scholarship*, *supra* note 303, at 378.

[389] *See, e.g.,* CONGRESSIONAL BUDGET OFFICE, *supra* note 48, at Summary p.1 ("Properly done, reform could improve economic efficiency in allocating water among commercial uses, provide more water for public purposes such as the environment or Native American tribes, and could address equity concerns regarding the portion of project costs that the public must pay.").

[390] *See* HANAK, *supra* note 167 (describing moderate increases in water transfers); State Water Resource Control Board Cases, 136 Cal. App. 4th 674, 806 n.54 (2006) (affirming that water rights are contingent upon government determinations of environmental need).

[391] *See supra* note 382 (describing federal contract renewals). Pursuant to the Monterey Amendments litigation settlement, DWR and the state contractors no longer describe their full contractual allocations as "entitlements," but those amounts are only slightly changed. *See* Settlement Agreement, May 5, 2003, at A-2, *available at* http://www.montereyamendments.water.ca.gov/docs/Monterey_Settlement_Agreement_20030715.pdf (describing removal of the word "entitlement").

[392] *See* Environmental Working Group, *supra* note 160.

[393] Freyfogle, *supra* note 203, at 43.

[394] *See, e.g., supra* notes 302, 306 (quoting letters and press releases from the California Farm Water Coalition). While the public trust doctrine has sometimes provided crucial environmental protection,

appropriative system through federally-mandated agriculture-to-urban reallocations have met judicial rejection.[395] Finally, water transfers, though increasing, remain restrained by the foundational legal principle that water rights are highly contextual and place-specific.[396] Consequently, the modernized system postulated by reformers, in which economic principles and environmental protection become foundational principles guiding appropriation, and water can move, through voluntary transfers or governmental fiat, to meet evolving needs, exists only sporadically.[397] That absence of significant reform has important implications for programs, like CALFED, that theoretically depend upon adaptation; with flexibility as much an aspiration as a reality, approaches relying upon institutional dexterity to sidestep tensions among consumption, protection, and reliability will likely remain fragile.

CALFED's water management struggles thus illustrate the difficulties caused by a conceptual framework that emphasizes both consumption and protection while not addressing the consequent costs to reliability. Despite their many innovations, the CALFED agencies endangered their success by premising their response to the Bay-Delta's ills on the assumption that they could reliably increase both consumption and protection, and that through ample funding and regulatory innovation they could finesse whatever conflicts arose. That assumption followed convention; the CALFED agencies were by no means unique in attempting to keep restraints on consumption as minimal as potentially possible, and in leaving little buffer or margin for error in their system. But they were managing a dynamic and poorly understood system, and when natural variability or unpredictability strikes, as it perhaps already has done and inevitably will do again, a management scheme premised on such an approach will prove fragile. Partly

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and while reasonable use challenges occasionally have succeeded, to date those are exceptional outcomes. *See* Thomas, *supra* note 10, at 28 ("in practice courts have hesitated to declare any use of water unreasonable").

[395] In 2002, the Secretary of the Interior attempted to compel Imperial Irrigation District, a major agricultural user, to reduce its Colorado River water use in favor of Metropolitan Water District, a major urban supplier. IID sued the federal government, and won. *See* 68 FED. REG. 22,738 (Bureau of Reclamation, April 29, 2003).

[396] *See* Central Delta Water Agency v. State Water Resources Control Board, 124 Cal. App. 4th 245 (2004) (rejecting the SWRCB's approval of a private water banking/marketing project).

[397] Metropolitan Water District, the water supplier for much of southern California, has probably been more successful than any other agency at using marketing and innovations to increase the reliability of its water supply. *See* ENVISIONING FUTURES, *supra* note 2, at 97 (describing MWD's efforts).

because of that fragility, an ambitious program that needed to succeed, and that had many tools to achieve success, now appears now to be lurching toward failure.

V. TOWARD MORE ROBUST SOLUTIONS

The CALFED process addressed a classic environmental dilemma: people often want more of a resource, aspire to use it more reliably, demand protection of ecological systems dependant upon that resource, and are reluctant to change the rules that exacerbate conflicts among those goals. Similar underlying tensions emerge from debates over energy consumption, fisheries management, or timber harvests, to provide just a few examples. Growing populations and economies often place all of those resources under increasing demand, but consuming those resources can create adverse environmental consequences, and major economic, social, and political problems can arise if consumption patterns abruptly change.[398] Just as with California's waters, environmental dynamism and uncertainty ensure that resource availability is likely to vary, and thus resource managers, like the CALFED agencies, must develop solutions likely to last in a changing world. Because of these underlying similarities, the CALFED process, despite its political and ecological intricacies, provides a useful example for understanding many environmental crises.

CALFED's response to that challenge illustrates that when law and policy mandate environmental protection yet encourage more consumption, and users demand steady, predictable allocations—all against a backdrop of environmental variability and change—only brilliant management or engineering, plush funding, and good luck will stave off incessant conflict. Its troubles demonstrate the utility of a conceptual model that does not promote such conflict, and instead responds to the tensions between protection, consumption, and reliability. Absent utilization of such a model, managers will likely continue proposing solutions with little margin for error, not realizing that the resulting management failures are predictable outcomes rather than anomalies, and legislators or agencies may continue promoting consumption even where resources are scarce. CALFED's troubles also illustrate why preserving margins of error is not

[398] *See, e.g., id*. at 105; Shi-Ling Hsu, *Fairness Versus Efficiency in Environmental Law*, 31 ECOLOGY L.Q. 303, 333 (2004) (quoting former senator Slade Gorton's description of the effects of timber harvest cutbacks upon logging towns); Bill McEwen, *Comment: No Place to Call Home on the West Side*, FRESNO BEE, October 26, 2004 (describing the farmworker dislocation following agricultural land retirement).

excessive caution or overregulation; instead, it is a reasonable if not indispensable technique to preserve the reliability upon which both resource users and environmental systems often depend.

Recognizing tensions, though important, is just a first step; sustainable management of scarce and dynamic resources also requires actual tradeoffs. And just as it can explain tensions fostered by existing frameworks, a reliability-based conceptual model can inform those tradeoffs. It explains the dangers—not only environmental, but also economic—posed by encouraging consumption of scarce resources, for it predicts that such encouragement will be antithetical to reliability. Similarly, it demonstrates the practical importance of restraining our expectations for both consumption and protection, when both options exists, and reserving some slack in our natural systems. And when environmental protection requirements are minimally flexible—as is frequently the hallmark of environmental controversies, for controversy often starts with a species or ecological system in crisis—a reliability-focused conceptual framework acknowledges that consumption levels and reliability are inversely proportional. If protection cannot give, and neither institutional adaptability nor engineering solutions can resolve those basic tensions, either consumption or reliability often must, and decreasing consumption can offer huge reliability benefits.

California's water management crises provide a case study in such environmental inflexibility, and illustrate how such tradeoffs might be made. Because existing law demands more protection, and because eventually those laws may be fully enforced, efforts to increase consumption or reliability at environmental expense are likely to prove tenuous.[399] Moreover, changing those laws would not be a simple or popular proposition. The public health,[400] recreational,[401] and economic[402] benefits they create weigh against

[399] The history of timber harvesting in the Pacific Northwest provides a cautionary tale for any resource users counting on political muscle to trump legal mandates. Logging interests appear to have assumed that regardless of what federal environmental laws said, their industry was politically unstoppable. That assumption ultimately proved wrong, and a series of injunctions led to drastic changes in national forest management. *See generally* YAFFEE, *supra* note 31 (describing this history).

[400] *See* 2005 WATER PLAN, *supra* note 102, at V.2 p. 7-2 ("[i]mproved water quality can directly improve the health of Californians, thereby improving the state's standard of living and reducing the burden and costs on the state's healthcare system").

[401] *See* CALIFORNIA STATE PARKS PLANNING DIVISION, RESOURCES DEPARTMENT, PUBLIC OPINIONS AND ATTITUDES ON OUTDOOR RECREATION IN CALIFORNIA 26-27 (2003) (showing data on recreational activities); *id.* at 46 (showing that poll participants who fished placed a $25.90/day value on

reductions in protection, and provide a strong foundation for their electoral support.[403] If less easily-quantifiable values like the psychological importance of a healthy environment[404] are added to the equation, environmental protection of water resources seems a very good investment.[405]

The laws protecting California's water also reflect widely-shared normative judgments. The premises of the public trust and reasonable use doctrines—that water is a public resource, in which individual users hold only contingent rights—are now ingrained in our legal system, and reflect the shared intuition that a river never can entirely lose its public character.[406] Environmental statutes stem from a similar philosophical fount; they reflect widely-shared perceptions that while some environmental exploitation is allowable or even desirable, no exploiter has a right to exterminate species or pollute without constraint.[407] To limit those principles, and render environmental protection conditional on non-interference with, or payment to, private users, would deprive the public of theoretically-venerable rights it has recently shown little inclination to cede, and would represent a multi-billion-dollar relinquishment of property rights presently defined as public. Perhaps not surprisingly, popular support for environmental protection laws remains robust, and the laws that protect California's waters are unlikely to weaken.[408]

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that activity); 2005 WATER PLAN, *supra* note 102, at V.2 pp. 24-1 to 24-3 ("In 2002, about 150 million adult participation-days were spent in recreation activities directly dependant on water…. total economic output from freshwater fishing exceeded $3 billion" in 2001).

[402] *See, e.g.*, Glen Martin, *Council Opts for Limits on Wild Salmon Catch 'No fishing' Option Thrown Back—Final Ruling Expected by May*, SAN FRANCISCO CHRONICLE, April 7, 2006 (discussing the economic impact of fishing limits partly caused by environmental problems on the Klamath River).

[403] *See* 2005 WATER PLAN, *supra* note 102, at V.1 p. 4-26 (describing the economic value of water resources); *see* Thomas, *supra* note 10, at 10-12 (explaining the value of aquatic biodiversity).

[404] *See, e.g.,* 2005 WATER PLAN, *supra* note 102, at V.1 3-4 (describing the tourism value of aquatic ecosystems); *id.* at V.2 p. 24-2 ("Water-dependent recreation prompts long-term investments while creating jobs in concessions, hotels, restaurants, and retail stores.").

[405] Some studies attempt to quantify those values, but their measurement technique—asking people what they would pay for preservation—is controversial and produces variable results. Nevertheless, in its 1997 review of Reclamation's water policies, the Congressional Budget Office noted that estimated non-use values "are two orders of magnitude greater than the estimates for use values." CONGRESSIONAL BUDGET OFFICE, *supra* note 48, at 54.

[406] *See* New Jersey v. New York, 283 U.S. 336, 342 (1931) ("A river is more than an amenity, it is a treasure."); Thomas, *supra* note 10, at 12-13 (describing this theory of prior public ownership—and the ways in which existing law conflicts with it).

[407] *See* Thomas, *supra* note 10, at 11-12 (describing the ethical foundations for biodiversity protection requirements).

[408] *See supra* note 383 and accompanying text (summarizing polling results); *see also* PUBLIC POLICY INSTITUTE OF CALIFORNIA, CALIFORNIA 2025, *supra* note 281, at 20 (Californians "favor relying on conservation of the current water supply rather than building new dams and water storage systems").

That support leaves baseline requirements for environmental protection somewhat inflexible, and, absent solutions capable of removing zero-sum conflicts, provides water managers with stark choices between prioritizing reliability or consumption.

Though not equivalently legally protected, supply reliability has tremendous practical importance.[409] Widely fluctuating water supplies can negate the ability of farmers to plan and sustain predictable crops. Urban use is similarly limited in its short-term flexibility; though urban residents do accept severe short-term cutbacks in times of drought, their suppliers have little ability to cut users off entirely and cannot sustain draconian rationing without severe discontent.[410] Wide fluctuations also encourage costly miscalculations, as planners optimistically assume better-year water supplies will be the norm.[411] Most users do have some ability to accommodate variability; some growers can fallow low-value crops, urban rationing does occur, and reservoirs and aquifers provide insurance,[412] but as the range or suddenness of variability grows, costs are likely to mount.[413] A reliable but, on the average, smaller water source thus can be more valuable than a larger but erratic supply or a source subject to potentially drastic cutoffs.[414] For those reasons, it is easy to understand why water users would want to graft more certainty into the laws governing California water rights, and why they would fear legal principles, like public trust and reasonable use, that theoretically place

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409 See generally Diamond, supra note 79, at 155 (attributing difficulties faced by past societies in the southwest to unpreparedness for environmental change).

[410] *See* COOLEY ET AL., *supra* note 167, at 46 (describing urban water suppliers' efforts to maximize reliability). Even aquatic species, though adapted to some level of variability, also can be threatened by it, particularly if their populations already are depleted and therefore vulnerable.

[411] *See* Thompson, *Tragically Difficult*, *supra* note 67, at 264-65 (discussing propensities for miscalculation in the face of uncertainty).

[412] Some agencies use a "portfolio" approach to water supply, in which they hedge uncertainty by holding multiple rights, or by backing up surface water supplies with groundwater, surface water stored in subsurface banks, or desalinated seawater. *See, e.g.,* San Diego County Water Authority, An Overview, at http://www.sdcwa.org/about/ sdcwa-overview-2003.pdf#search=%22%22metropolitan%20water%20district%22%20%26%20 portfolio%22 (describing efforts to achieve "[r]eliability through [d]iversification"). Those strategies ameliorate but do not resolve uncertainty problems. Groundwater provides a short-term hedge, but in longer droughts groundwater supplies also can be rapidly depleted, and California's overall groundwater use currently is not sustainable. *See* CALIFORNIA WATER PLAN UPDATE, *supra* note 102, at V.1 p. 3-14. Users of multiple water supplies may weather localized shortfalls, but in a statewide drought such hedging may be no more effective than using index funds to insure against a general stock market downturn. And while desalination might someday be a failsafe, for the foreseeable future California isn't likely to have enough desalination plants on line to provide that security. *See* COOLEY ET AL., *supra* note 179.

[413] *See* ENVISIONING FUTURES, *supra* note 2, at 105 (contrasting the costs of slow and rapid adjustment).

[414] *See id.*

discretion for implementing that inherent flexibility in government hands.[415] Similarly, reliability's benefits caution against any assumption that resource users will knowingly accept reduced delivery reliability as the quid pro quo that allows increased consumption. California's troubles instead suggest that legal doctrines schemes and management solutions premised on flexibility and adaptation always have offered a partially false promise.[416]

If something must give—that is, if adaptive systems, ample funding, or clever engineering cannot make these underlying tensions disappear—that leaves consumption, and resource consumption, although valuable, often is more amenable to limitations than reliability or protection. While California must consume lots of water, and benefits in many ways from doing so, those benefits do not require consuming as much water as California does at present, let alone more.[417] California's urban water use remains highly uneven in its efficiency, and millions of acre-feet could be saved every year through more aggressive urban conservation and recycling.[418] Similarly, agricultural water use presents enormous and relatively low-cost opportunities for use reductions. Much of California's agricultural water nurtures high-water-demand, low-value crops, and studies have found that when charged water prices approaching market levels, growers will shift production to higher efficiency, higher value crops.[419] Huge volumes of water also irrigate fields facing toxic drainage problems, which state and federal taxpayers probably will ultimately pay to solve, and decreasing or eliminating deliveries to those lands could save hundreds of thousands of acre-feet.[420]

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[415] *See* United States v. California State Water Resources Control Board, 182 Cal. App. 3d 82, 106 ("all water rights are subject to governmental regulation"); Thomas, *supra* note 10, at 27, 40 (noting the inherent unpredictability of the reasonable use and public trust doctrines).

[416] *See supra* notes 288-315 and accompanying text.

[417] *See supra* notes 177-181 and accompanying text; PETER GLEICK ET AL., CALIFORNIA WATER 2030: AN EFFICIENT FUTURE 5 (2005).

[418] *See* HANAK, *supra* note 167; GLEICK ET AL., *supra* note 179.

[419] *See* GLEICK ET AL, AN EFFICIENT FUTURE, *supra* note 417, at 26-30, 34-36 (modeling agricultural demand under high-efficiency scenarios); Hanemann, *supra* note 144, at 83; *e.g.* David Goldhamer and Elias Fereres, *The Promise of Regulated Deficit Irrigation in California's Orchards and Vineyards*, *in* 2005 WATER PLAN, *supra* note 102, at V.4 p. 4-210 (estimating that growers of vine and orchard crops could save between 1 and 1.5 million acre-feet annually, without impacting economic yield, by using regulated deficit irrigation)..

[420] *See* California Department of Water Resources, *Agricultural Drainage Reduction and Reuse Program*, *at* http://www.owue.water.ca.gov/agdrain/index.cfm (last checked June 12, 2006) (describing the amount of acres impacted); Mike Taugher, *State Plans to Retire Half of Water District's Farms*, CONTRA COSTA TIMES, June 20, 2006.

Water consumption also creates substantial collateral costs. Someone must pay for delivery infrastructure, and sometimes must pay again to mitigate the environmental impacts of deliveries. Often that someone is the taxpayer; much water delivery in California is subsidized, and environmental mitigation and restoration projects typically are publicly funded.[421] Using less water also can substantially reduce energy demand, an important outcome in a state trying to control climate change and ozone pollution and still not far from rolling blackouts.[422] Similarly, if less water is used, less wastewater requires treatment and disposal.[423] Consequently, using less water can benefit both consumers and government; as with almost any other natural resource, efficient use can bring economic rewards.[424]

Consumption reductions are by no means without costs. As with many natural resources, water use does generate economic benefits. No matter how aggressively they conserve, homes still require water, and California faces chronic housing shortages.[425] By allowing more lands to be cultivated, increased water supplies can increase agricultural activity, providing jobs, lowering prices, and boosting rural economies. Water use is essential to industry; making a computer chip, for example, requires lots of water.[426] Land-based recreation similarly necessitates irrigation; the public parks and golf courses that so many Californians value and use would appear drastically different if landscaping hoses ran dry. Those needs, and many others, preclude consumption reductions from constituting an easy fix, and the unavoidable challenges of restraining use of a common-access resource—California's hundreds of water-supply agencies are generally vigorous advocates for increased exploitation of water supplies—will only add

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[421] *See* Environmental Working Group, *supra* note 160 (describing subsidies).

[422] *See* 2005 WATER PLAN, *supra* note 102, at V.1 p. 3-15 (noting that water management consumes "approximately 20 percent of the state's total electricity, 30 percent of the natural gas, and 88 million gallons of diesel"); NATURAL RESOURCES DEFENSE COUNCIL AND THE PACIFIC INSTITUTE, ENERGY DOWN THE DRAIN: THE HIDDEN COSTS OF CALIFORNIA'S WATER SUPPLY (2004).

[423] *See* CONGRESSIONAL BUDGET OFFICE, *supra* note 48, at 25 ("Conservation programs, however, generally help reduce problems with water quality.").

[424] Water use efficiency's benefits also "include better water quality and more water in streams and rivers… . Water use efficiency can also reduce peak demand, curb runoff from landscape irrigation, and reduce green waste caused by inefficient watering of landscapes." 2005 WATER PLAN, *supra* note 102, at V.2 p. 22-4.

[425] Affordable housing, which generally occupies smaller footprints, tends to require less water. *See* 2005 WATER PLAN, *supra* note 102, at V.1 p. 4-24 ("Larger residential parcels tend to consume more water per capita than do smaller parcels.").

[426] *See* Lower Colorado River Water Authority, *High Tech Dependent on Plenty of Clean Water*, April 2005, *available at* http://www.lcra.org/featurestory/2005/hightechwater.html.

to the political difficulties inherent in a policy of restraint. Nevertheless, tradeoffs must be made somehow, and consumption reductions offer a promising place to start.

VII. CONCLUSION

In a recent chronicle of the impending consequences of climate change, Elizabeth Kolbert tells a brief but revealing anecdote about western water management. She quotes David Rind, a climate scientist at the Goddard Institute for Space Studies, describing reactions to model results predicting that climate change could cause severe future droughts: "'I gave a talk based on these drought indices out in California to water-resource managers…. And they said, 'well, if that happens, forget it.' There's just no way they could deal with that.'"[427]

Kolbert did not tell this story to fault the water managers; her criticism instead was directed at Bush Administration's decision to respond to climate change solely through adaptation, not prevention.[428] But those managers' attitude toward managing a different future—a future that will only be made more difficult if western water managers continue to promote increased water consumption—suggests the inadequate paradigms informing much environmental management. The scenario they deemed unmanageable was just an extreme, but possible, version of the probably-recurring reality of our future, particularly if we cannot slow climate change.[429] Some resources will remain abundant, and we may find ways to replace others, but problems with variable, scarce resources, which presumably will remain protected by popular preferences and legal mandates limiting environmental degradation, are likely to recur over and over again. Whether the resource is water, energy,[430] fisheries,[431] forests,[432] clean air,[433] coastal wetlands, or something else, we are inescapably in a world where management schemes must address dynamism and scarcity, no matter how difficult that task may be.

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[427] *See* ELIZABETH KOLBERT, FIELD NOTES FROM A CATASTROPHE: MAN, NATURE, AND CLIMATE CHANGE 109 (2006).

[428] *See id.* at 108.

[429] *See, e.g.,* BOTKIN, *supra* note 86 (discussing the ubiquity of environmental variation); DIAMOND, *supra* note 79, at 155 (describing the consequences of past societies' inabilities to adjust to climate variability); OUR CHANGING CLIMATE, *supra* note 32.

[430] *See* Canine, *supra* note 29 (describing the California energy crisis).

[431] *See supra* note 75.

[432] *See, e.g.,* YAFFEE, *supra* note 31 (describing logging controversies in the Pacific Northwest).

[433] *See, e.g.,* Fine and Owen, *supra* note 50, at 938-70 (discussing air quality planning in the San Joaquin Valley).

The CALFED experience illustrates that our present conceptual frameworks are ill-suited for that job. If any environmental crisis gave traditional approaches the chance to shine, it was this one; the levels of expertise, political attention, and funding brought to bear in the CALFED process were far beyond those normally available to environmental managers, and the resulting policies were genuinely creative. But CALFED's decision-making, by discounting the basic tensions between consumption, protection, and reliability, and placing faith in regulatory brilliance, ample funding, and benign environmental conditions, laid the foundations for solutions that would prove fragile in the face of change. That fragility already appears to be creating costs, and in the next drought it could prove devastating. That experience amply demonstrates the need for a better way of understanding and solving environmental problems.

By integrating the relationships between consumption, protection, and reliability, this article's proposed conceptual framework can facilitate better understanding, and can help environmental managers achieve more lasting solutions. By acknowledging inherent tensions, and by demonstrating that when protection requirements are inflexible, increases in consumption typically have direct reliability costs, it explains the necessity of tradeoffs. It similarly explains the reliability risks inherent in assuming that environmental limits are fixed and determinable, and that consuming to those limits is desirable and safe. And it illustrates how maintaining margins for error, and reducing consumptive footprints, can keep management schemes robust, and resource allocations reliable, even as environmental conditions change.