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How Well Can Water Law Adapt to the Potential Stresses of Global Climate Change

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HOW WELL CAN WATER LAW ADAPT TO THE POTENTIAL STRESSES OF GLOBAL CLIMATE CHANGE?

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I. INTRODUCTION: CLIMATE CHANGE WILL STRESS BOTH REGIONS AND WATER LAW

A. AUF WIEDERSEHEN TO HYDRO STATIONARITY

In the coming decades, Global Climate Change (GCC) will impact hydrologic balances and thus water availability, use, and management in both arid and humid regions of the United States.² Many of the fundamental hydrologic assumptions underlying water allocation, water pollution control, and aquatic ecosystem conservation will fundamentally change. GCC will therefore stress both the laws of prior appropriation and riparian rights.³ Water law follows hydrology and assumes that regional water balances will remain relatively constant or “stationary” over time; however, this assumption is no longer viable.⁴ Water managers must now assume that existing hydrologic models are no longer reliable and in many cases lead to an underestimation of available supplies.⁵ The end of stationarity will

2. See, e.g., INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, CLIMATE CHANGE AND WATER 3-4 (Bryson Bates et al. eds., 2008); COMM. ON THE ENV'T & NATURAL RES., NAT'L SCI. & TECH. COUNCIL, SCIENTIFIC ASSESSMENT OF THE EFFECTS OF CLIMATE CHANGE ON THE UNITED STATES 12-13 (2008); COMM. ON STABILIZATION TARGETS FOR ATMOSPHERIC GREENHOUSE GAS CONCENTRATIONS, NAT'L RESEARCH COUNCIL, CLIMATE STABILIZATION TARGETS: EMISSIONS, CONCENTRATIONS, AND IMPACTS OVER DECADES TO MILLENNIA (forthcoming 2010) (concluding that each one degree Celsius rise will reduce rain in the southwest by 5-10%).

3. See, e.g., Robert H. Abrams & Noah D. Hall, *Framing Water Policy in a Carbon Affected and Carbon Constrained Environment*, 50 NAT. RESOURCES J. 3, 68-71 (2010), available at http://lawlibrary.unm.edu/nrj/50/1/02_Abrams_Hall.pdf; Robert W. Adler, *Climate Change and the Hegemony of State Water Law*, 29 STAN. ENVTL. L.J. 1, 10-18 (2010); Brian E. Gray, *Global Climate Change: Water Supply Risks and Water Management Opportunities*, 14 HASTINGS W.-NW J. ENVTL. L. & POL'Y 1453, 1454-55 (2008); Kathleen A. Miller, *Climate Change and Water in the West: Complexities, Uncertainties, and Strategies for Adaptation*, 27 J. LAND RESOURCES & ENVTL. L. 87, 91 (2007).

4. See Robin Kundis Craig, “Stationarity is Dead”—Long Live Transformation: Five Principles for Climate Change Adaptation Law, 34 HARV. ENVTL. L. REV. 9, 9-10 (2010); Robin Kundis Craig, *Climate Change, Regulatory Fragmentation, and Water Triage*, 79 U. COLO. L. REV. 825, 825-26 (2008).

5. NAT'L RES. COUNCIL, COLORADO RIVER BASIN WATER MANAGEMENT: EVALUATING AND ADJUSTING TO HYDROCLIMATIC VARIABILITY 73-92 (2007) (summarizing the studies of the potential impact of warmer temperatures in the Colorado River Basin). It observes that the most scenarios predict modest stream flow decreases but “[a]ny future decreases in the Colorado River stream flow . . . would be especially troubling because the quantity of water allocations under the Law of the River already exceeds the amount of the mean annual mean Colorado River Flows”), *id.* at 92.

create new conflicts between present right holders and future claimants and between consumptive and non-consumptive, especially environmental, uses. The hard question is how the law and those charged with applying it and managing water within its framework should react to this new, even more, uncertain world.

Climate change response strategies are divided into two separate categories: mitigation and adaptation. The first question is whether to place one's faith in mitigation or adaptation. Mitigation attempts to stabilize or roll back greenhouse gas emissions.⁶ Adaptation is defined as an action that either reduces "an area's vulnerability to the negative impacts of climate change" or enhances "its ability to capture any benefits."⁷ Adaptation proceeds from one of two assumptions, although the consequences are the same. First, the "real politick" assumption is that serious, as opposed to band-aid or feel-good, mitigation will not occur. The failure of the 2009 Copenhagen Summit⁸ and the failure of the United States Congress to enact any climate change or energy legislation even after the 2010 Gulf of Mexico oil spill confirm this assumption.⁹ Second, the "leap of faith" assumption is that mitigation strategies will be implemented, but the benefits will not kick in for at least a century and possibly a millennium¹⁰—a very Keynesian long run. Both assumptions lead to the conclusion that for the foreseeable future water managers have no choice but to take the various GCC risk scenarios as a given and ask

6. See Elizabeth C. Black, *Climate Change Adaptation: Local Solutions for a Global Problem*, 22 GEO. INT'L ENVTL. L. REV. 359, 360 (2010).

7. *Id.* at 362. (quoting NICHOLAS STERN, *THE ECONOMICS OF CLIMATE CHANGE* 458 (2007)). See also Alejandro E. Camacho, *Adapting Governance to Climate Change: Managing Uncertainty Through a Learning Infrastructure*, 59 EMORY L.J. 1, 17-23 (2010) (distinguishing between reactive and proactive, direct and indirect, and procedural and substantive measures).

8. See Tobias Rapp et al., *How China and India Sabotaged the UN Climate Summit*, DER SPIEGEL May 05, 2010, <http://www.spiegel.de/international/world/0,1518,692861,00.html>. See also GERMAN ADVISORY COUNCIL ON GLOBAL CHANGE [WBGU], POLICY PAPER NO. 6, CLIMATE POLICY POST-COPENHAGEN: A THREE-LEVEL STRATEGY FOR SUCCESS 5 (2010) ("[Copenhagen Accord,] even if honored in full . . . fall[s] short of what is required to limit the increase of the global mean temperature to 2 degrees Celsius . . .").

9. Frederic J. Frommer, *Gulf Spill Lacks Societal Punch of Santa Barbara*, ASSOCIATED PRESS, July 29, 2010, available at <http://abcnews.go.com/Business/wireStory?id=11275571>. Any predictions about the course of energy policy are extremely risky, but the contrast between the 1969 Santa Barbara oil spill, which triggered the modern environmental movement and the first generation of environmental legislation, and 2010 Gulf Oil Spill, which has triggered nothing nationally except a Presidential commission, is instructive. Of course, the 2010 Spill may have longer-term impacts.

10. Richard Monastersky, *A Burden Beyond Bearing*, 458 NATURE 1091, 1092 (2009); COMM. ON STABILIZATION TARGETS FOR ATMOSPHERIC GREENHOUSE GAS CONCENTRATIONS, NAT'L RESEARCH COUNCIL, *supra* note 2, at 1. The latest research suggests that we are reaching dangerous CO₂ concentrations more quickly than previous estimations and that the recovery time from reductions, should they actually occur, may be as much as a 1,000 years. See generally GARY BRAASCH, *EARTH UNDER FIRE: HOW GLOBAL WARMING IS CHANGING THE WORLD* (2007) (providing more information on Global warming recovery times).

how those potentially impacted can take steps to reduce the adverse impacts through changes in water use and management.¹¹ This article assumes that water users and managers have no choice but to adapt because the adverse impacts will manifest themselves long before mitigation kicks in if at all and focuses on the capacity of water quantity law to adapt to GCC, although it recognizes that lower net streamflows can also undermine pollution control standards and discharge permit conditions.

B. DO WE REALLY KNOW ANYTHING USEFUL?

Climate change is a scientific hypothesis. The science is a combination of sophisticated models augmented by the increasing scientific evidence that anthropocentric change is beginning to manifest itself in concrete ways around the world.¹² There is a relatively firm consensus that arid and semiarid regions risk the net loss of stream runoff as winter snowpack diminishes and spring and summer evaporation increases.¹³ In all regions, there is an increased risk of decreased production from thermal and hydroelectric power plants.¹⁴ As a result, federal and state carry-over storage projects may not be able to meet their contractual delivery obligations in growing, water-stressed areas.¹⁵ Predictions are cloudier for more humid areas, but there is little doubt that climate change will occur. Many areas in the East may experience intense bursts of increased runoff that will cause severe flood events, at the same time, these areas may also

11. Holly Doremus & Michael Hanemann, *The Challenges of Dynamic Water Management in the American West*, 26 UCLA J. ENVTL. L. & POL'Y 55, 56-57 (2008) (discussing and answering the critique that adaptation deflects attention away from mitigation); Orr Karassin, *Mind the Gap: Knowledge and Need in Regulating Adaptation to Climate Change*, 22 GEO. INT'L. ENVTL. L. REV. 383, 388 (2010) (offering a regulatory framework to guide adaptation and providing useful comparative examples of ongoing efforts).

12. Press Release, NASA, NASA Study Links Earth Impacts to Human-Caused Climate Change (May 14, 2008).

13. E.g., STEPHEN SAUNDERS ET AL., HOTTER AND DRIER: THE WEST'S CHANGED CLIMATE 6-7, 17 (2008); NAT'L RESEARCH COUNCIL, *supra* note 5, at 113; ADLER, *supra* note 3, at 10-17. In 2009, Colorado's peak snow melt occurred several weeks earlier than normal, which may be pose a problem for direct flow irrigators in western Colorado. Colleen O'Connor, *Colorado's Snowmelt's Early Flow May Be Issue*, DENVER POST, June 17, 2009, http://www.denverpost.com/ci_12604156.

14. Benjamin K. Sovacool, *Running on Empty: The Electricity-Water Nexus and the U.S. Electric Utility Sector*, 30 ENERGY L.J. 11, 11, 36, 50 (2009).

15. In 2008, the National Research Council convened a workshop on the future of water use in the Apalachicola-Chattahoochee-Flint and Alabama-Coosa-Tallapoosa River Basins, and participants were divided on the issue of whether all uses could be supplied in the future, although "[a]ttendees generally acknowledged that additional population growth would add further stresses to the water supply system." SUMMARY OF A WORKSHOP ON WATER ISSUES IN THE APALACHICOLA-CHATTAHOOCHEE-FLINT AND ALABAMA-COOSA-TALLAPOOSA (ACF-ACT) RIVER BASINS 5 (2009), *available at* <http://www.naesonline.org/images/NRCACF-ACTApril09.pdf>. See also OXFAM AMERICA, EXPOSED: SOCIAL VULNERABILITY AND CLIMATE CHANGE IN THE US SOUTHEAST 6-8 (2009), *available at* http://adapt.oxfamamerica.org/resources/Exposed_Report.pdf.

experience lower summer water flows in major, heavily used rivers.¹⁶ The Great Lakes is an example of a region that may face new stresses. A synthesis of the climate change literature for the Great Lakes concludes that:

Mean annual lake surface evaporation could increase by as much as 39% due to an increase in lake surface temperatures. This will present particular concern during summer and autumn, which are already characterized by low stream flow. Moreover, with increased evapotranspiration and decreased snowpack, less moisture will enter the soil and groundwater zones, and runoff will be even further decreased. Consequently, under future warmer and drier conditions, Great Lakes residents could become more vulnerable to water supply and demand mismatches.¹⁷

Most water managers have already absorbed the first lesson of GCC water scenarios. Water managers have taken the possibility of altered flows and more intense flood events very seriously, and GCC is now a relevant factor that all major state and federal planning studies consider.¹⁸ The question remains: Do we know enough to mandate new management strategies or change existing legal regimes? There is still great uncertainty. The problem starts with distinguishing GCC-induced change from the “normal” climate variability that was observed before anthropogenic greenhouse gas contributions reached their present dangerous levels. For example, between 2005 and 2007 the Southeast United States experienced a severe drought that stressed Atlanta’s water supply and destroyed billions of dollars worth of crops in Alabama and Georgia.¹⁹ However, Columbia University scientists have concluded that the stresses were the product of regional population growth and bad planning, not GCC.²⁰ To take more concrete steps, more must be known about the geographic scale, the timing, and the magnitude of the projected impacts of GCC.²¹ Likewise, 2009 was marked by wild

16. See Noah D. Hall & Bret B. Stuntz, *Climate Change and Great Lakes Water Resources: Avoiding Future Conflicts with Conservation*, 31 HAMLINE L. REV. 639, 645-48 (2008).

17. *Id.* at 645.

18. See BARRY NELSON ET AL., NATURAL RES. DEF. COUNCIL, IN HOT WATER: WATER MANAGEMENT STRATEGIES TO WEATHER THE EFFECTS OF GLOBAL WARMING 1-4 (2007); MICHAEL KIPARSKY & PETER H. GLEICK, PAC. INST. FOR STUDIES IN DEV., ENV’T, & SEC., CLIMATE CHANGE AND CALIFORNIA WATER RESOURCES: A SURVEY AND SUMMARY OF THE LITERATURE 4 (2003).

19. ‘Killer’ Southeast Drought Low on Scale, Says Study, EARTH INSTITUTE, Oct. 01, 2009, <http://www.earth.columbia.edu/articles/view/2541>; Forrest Laws, *Drought Devastates Alabama’s Tennessee Valley*, S.E. FARM PRESS, Nov. 9, 2007, <http://southeastfarmpress.com/drought-devastates-alabamas-tennessee-valley>.

20. Richard Seager et al., Drought in the Southeastern United States: Causes, Variability over the Last Millennium, and the Potential for Future Hydroclimate Change, 22 J. CLIMATE 5021, 5022-23 (2009).

21. See Jaime Anderson et al., Progress on Incorporating Climate into Management of California’s Water Resources, 87 CLIMATIC CHANGE S91, S106-08 (2008).

temperature swings: from record warmth in September for California and Nevada, to record lows in July for the eastern Great Plains and the Ohio Valley.²² But, in the latest assessment of the world's 2009 climate, the National Oceanic and Atmospheric Administrative Climate Attribution team concluded that, "[s]uch seasonal extremes most certainly were not the result of human-induced climate change."²³

C. HOW CAN WATER MANAGERS, LEGISLATURES AND JUDGES ADAPT?

Adaptation can take many forms, but water managers have settled on six primary strategies: (1) the greater use of integrated regional water management, including adaptive management,²⁴ to balance ground and surface water use and to incorporate environmental considerations into existing flow regimes; (2) the use of markets to reallocate water among competing uses, primarily transfers from irrigated agriculture to urban and environmental uses; (3) the promotion of more aggressive agricultural and urban water conservation; (4) the promotion of more water and energy efficient urban settlement patterns in water stressed areas by linking water, energy consumption, and land use planning and regulation;²⁵ (5) technological fixes such as desalination;²⁶ and (6) the capture of more runoff.²⁷

This list does not include changes in water law, but there are at least five possible water law adaptation scenarios. First, the existing law could adapt with no changes.²⁸ Second, the law could evolve over time, as it always has, as new conditions require the reevaluation of the utility of various doctrines, especially those that encourage inefficient use patterns.²⁹ Third, state legislatures could intervene to

22. M.P. Hoerling, Strong Seasonality in 2009 U.S. Temperatures, in 91 STATE OF THE CLIMATE IN 2009 (Special Supplement) S140, S140 (D.S. Arndt et al. eds., 2010).

23. *Id.* (emphasis added).

24. See Daniel Schramm & Akiva Fishman, *Legal Frameworks for Adaptive Natural Resource Management in a Changing Climate*, 22 GEO. INT'L ENVTL. L. REV. 491, 492, 504 (2010).

25. See Ileana Porras, *The City and International Law: In Pursuit of Sustainable Development*, 36 FORDHAM URB. L.J. 537, 588 (2009).

26. See Robin Kundis Craig, *Water Supply, Desalination, Climate Change, and Energy Policy*, 22 PAC. MCGEORGE GLOBAL BUS. & DEV. L.J. 225, 235-36 (2010).

27. California has a similar list. See STATE OF CAL. DEP'T OF WATER RES., MANAGING AN UNCERTAIN FUTURE: CLIMATE CHANGE ADAPTATION STRATEGIES FOR CALIFORNIA'S WATER 12 (2008), available at <http://www.water.ca.gov/publications/browse.cfm?letter=M>.

28. Sometimes, the common law can adapt to new technologies or other changed conditions by not changing. See, e.g., *Intel Corp. v. Hamidi*, 71 P.3d 296 (Cal. 2003). In *Intel*, the California Supreme Court refused to apply the common law tort of trespass to real property, which presumes damage from any entry on land in the possession of another, to mass emails by a former, disgruntled Intel employee sent through the company's system. *Id.* at 309. The court instead applied trespass to chattels, which requires a showing of actual damage to personal property, in part to preserve an open Internet. *Id.* at 302, 311.

29. At the beginning of the environmental movement, there was concern that

make more drastic changes in the law. Fourth, the federal government could exercise its constitutional power to preempt state law that Congress deems a barrier to adaptation. Fifth, other developments, such as laws designed to promote more sustainable urban growth, could, for example, exert indirect pressure on water law to harden its risk allocation function. As the rest of the article indicates, one can find examples of all these scenarios with the possible exception of federal preemption.

II. WATER LAW AS A PERFECT ADAPTIVE, RISK ALLOCATION SYSTEM?

The least costly adaptation strategy is to use the existing law of water rights to adapt. The case for this strategy is that due to the “natural” vagaries of climate risk, allocation is the central feature of all water rights. In theory, water law has always functioned as a shortage allocation system which assigns the risks of drought among users thus forcing those most at risk to adapt. Thus, water rights are of necessity correlative, because water is not always available in the desired quantities due to climate variation and is uniquely necessary for human and ecosystem survival. Thus, water rights have always been incomplete rather than complete property rights.³⁰ Water is simultaneously semi-exclusive, a shared and partially communal resource.³¹ Of necessity, each user’s right is subject to the rights of other similarly situated users on a stream or over an aquifer. No user has the power to exclude completely other users to the extent that a landowner can punish trespassers.³² The state has great discretion to establish the ground rules for the acquisition and exercise of water rights and to recognize private rights, as well as to subordinate them to public rights and public interest limitations.³³

The net conclusion is that water law has always provided users

courts would not recognize instream flow appropriations because there was no physical diversion. See, e.g., *In re Adjudication of the Existing Rights to the Use of All the Water*, 55 P.3d 396, 401-02 (Mont. 2002). However, courts have generally held that as long as the water is put to beneficial use, which includes minimum flow maintenance, and other users have notice of the right, there is no need for an “actual” or physical diversion. *Id.* at 406.

30. *In re Water Use Permit Applications*, 9 P.3d 409, 493 (Haw. 2000).

31. See Joseph W. Dellapenna, *Global Climate Disruption and Water Law Reform*, 15 WIDENER L. REV. 409, 418 (2010).

32. *Compare* *Jacque v. Steenberg Homes, Inc.*, 563 N.W.2d 154, 160, 164 (Wis. 1997) (court awarded one dollar in actual and 100,000 dollars in punitive damages for nominal trespass because “landowners should feel confident that wrongdoers who trespass . . . will be appropriately punished.”), *with* *Bd. of Cnty. Comm’rs v. Park Cnty. Sportsmen’s Ranch, LLP*, 45 P.3d 693, 696 (Colo. 2002) (aquifer recharge pursuant to plan of augmentation that passes beneath various overlying tracts before withdrawal is not a trespass).

33. See, e.g., *Park Cnty. Sportsmen’s Ranch*, 45 P.3d at 709-10. But see Scott Andrew Shepard, *The Unbearable Cost of Skipping the Check: Property Rights, Takings Compensation & Ecological Protection in the Western Water Law Context*, 17 N.Y.U. ENVTL. L.J. 1063, 1068 (2009).

clear notice of the risks of a reduction in the amount of water to which they will be entitled. The risks include reduced quantities because of a drought, the wasteful or non-beneficial use of water, and total or partial displacement by a “higher” or subsequent use, including public rights.³⁴ Thus, GCC can be characterized as simply another drought risk to which all users have always been subject. Users are therefore expected to adopt the most cost-effective adaptation strategy and will not be surprised if this requires making-do with less water than was previously available.³⁵ The rub is that water law has not been widely used for this function.³⁶ Until recently, nature and human intervention kept the risks of supply curtailment low and the expectation of full enjoyment of the right high. As a result, there are major psychological, political, institutional, and legal barriers to using the law to distribute the extreme risks of global climate change among large classes of water users in the common law of riparian rights, prior appropriation and regulated riparianism.

A. RIPARIAN RIGHTS

The common law of riparian rights, which prevails in the East and to a lesser extent in California and Nebraska, is a system that in theory, but not in practice, could be used to adapt to GCC. Ironically, the common law’s much criticized incoherence and lack of useful precedent pushes users toward adaptation because it creates a high level of risk to all right holders.³⁷ This uncertainty also could allow courts the flexibility to adjust quantities and uses among existing users in cases of GCC-induced shortages with minimal fear

34. In rare cases, the public trust may require the displacement of existing water rights, which impair trust values. *Nat’l Audubon Soc’y v. Super. Ct. of Alpine Cnty.*, 658 P.2d 709, 732 (Cal. 1983); *Accord In re Water Use Permit Applications*, 9 P.3d 409, 509 (Haw. 2000). In *Stop the Beach Renourishment, Inc. v. Fla. Dep’t of Env’tl. Prot.*, 130 S. Ct. 2592, 2596, 2599 (2010), the Supreme Court held, eight to zero, that a Florida statute that replaced the common law rule that littoral owners are entitled to coastal accretions with a statute that fixed erosion control lines and awarded any gain (or loss) seaward of the line to the state was not a taking. However, the four justice plurality opinion also suggested, but did not hold, that a judicial decision, such as the Florida Supreme Court opinion upholding the statutes, could be a judicial taking. Four justices disagreed with the principle or reasoned that the case was not an appropriate one to formulate a judicial takings doctrine. Justice Stevens, a Florida beachfront condominium owner, did not participate in the decision. Dwight Merriam, *Beach Decision Draws New Line in Sand*, CONN. LAW TRIBUNE, June 28, 2010, <http://www.ctlawtribune.com/getarticle.aspx?ID=37566>.

35. All “real” water allocation conflicts center on the fact that there is an insufficient amount of water to provide reliable supplies for all competing users, thus some alteration of the status quo is inevitable. See Dereje Zeleke Mekonnen, *The Nile Basin Cooperative Framework Agreement Negotiations and the Adoption of a ‘Water Security’ Paradigm: Flight into Obscurity or a Logical Cul-de-sac?*, 21 Eur. J. Int’l L. 421, 432-34 (2010). GCC simply drives home this point.

36. See also Adler, *supra* note 3, at 24.

37. See Joseph W. Dellapena, *Adapting Riparian Rights to the Twenty-First Century*, 106 W. Va. L. Rev. 539, 559-61 (2004). But see Dellapenna, *supra* note 31, at 430 (explaining that the conventional thinking is that the common law of riparian rights does not promote adaptation).

that the parties could successfully challenge these adjustments as a taking of property without due process of law.³⁸

From an environmental but not reallocation perspective, the early common law was adaptive, if inefficient, by neo-welfare economic standards. Riparian rights were originally limited solely to owners of riparian land, a term that remains incompletely defined in most states.³⁹ Reallocation was difficult because of the narrow class of water right holders and per se rules that prohibited the use of water on non-riparian land or on land outside the watershed; riparian users could enjoy non-watershed and non-riparian uses without a showing of injury,⁴⁰ although courts seldom applied these rules.⁴¹ However, this rigid law promoted flow maintenance, which will be an important element in the conservation of aquatic ecosystems impacted by GCC.⁴² The perceived inefficiencies in the common law led to major changes. Over time the common law was modified to allow water to be used where the demand is highest.⁴³ Courts and legislatures moved from using property rules to using tort rules in the name of efficiency and focused on the injuries, if any, that non-watershed and non-riparian uses cause.⁴⁴ The shift to tort rules has opened rivers to

38. For example, almost all courts have rejected constitutional challenges to switches from the common law of riparian rights to prior appropriation so long as the law protected actual use of water. See, e.g., *Knight v. Grimes*, 127 N.W.2d 708, 711-13 (S.D. 1964). Only Oklahoma has upheld a constitutional challenge to the elimination of unused riparian rights. See *Franco-Am. Charolaise, Ltd. v. Okla. Water Res. Bd.*, 855 P.2d 568, 576-77 (Okla. 1990). See also Joseph L. Sax, *The Constitution, Property Rights and the Future of Water Law*, 61 U. Colo. L. Rev. 257, 267-69 (1990) (discussing how water laws have been continuously revised over time for public benefit). But see *Shepard*, *supra* note 33, at 1134 (arguing that water rights should be treated as any other private good and subject to the terms of the Constitution's "Takings Clause").

39. All jurisdictions agree that the land must reach the high water mark of a stream during some part of the year, under ordinary flow conditions. See, e.g., *Turner v. James Canal Co.*, 99 P. 520, 523-26 (Cal. 1909); *In re Determination of the Ordinary High Water Mark & Outlet Elevation for Beaver Lake*, 466 N.W.2d 163, 166-67 (S.D. 1991). Under this standard, GCC might strip some land of its riparian status. Heretofore, the major issue has been the extent of riparian land. The source-of-the-title rule limits riparian land to the smallest tract of abutting land in a chain of title from a single track that was once riparian. Thus, riparian land can shrink over time. The unity-of-title allows reasonable additions of land to an original riparian tract. Some defend the latter as more suitable for the east. See William H. Farnham, *The Permissible Extent of Riparian Land*, 7 Land & Water L. Rev. 31, 58-61 (1972). However, the source-of-title rule, which was adopted in California to limit riparian rights, could be defended as better adapted to GCC adaptation because it promotes prior appropriation, which is a better climate adaptation law. See *infra* pp. 18-20.

40. See *Anaheim Union Water Co. v. Fuller*, 88 P. 978, 981 (Cal. 1907).

41. See, e.g., *Stratton v. Mt. Hermon Boys' School*, 103 N.E. 87, 89 (Mass. 1913) (stating that the diversion alone without evidence of damage did not warrant a recovery of even nominal damages).

42. See Lynda L. Butler, *Allocating Consumptive Water Rights in a Riparian Jurisdiction: Defining the Relationship Between Public and Private Interests*, 47 U. Pitt. L. Rev. 95, 107-08, 111-12 (1985).

43. A. DAN TARLOCK, *LAW OF WATER RIGHTS AND RESOURCES* § 3:89 (Marie-Joy Paredes & Susan Mauceri, eds., 2010).

44. See e.g., *Keys v. Romley*, 412 P.2d 529, 536 (Cal. 1966) (stating that reasonable

a wider class of users to promote the more efficient use of water but at the cost of increasing the uncertainty of rights. Originally, riparian rights were non-consumptive rights used to support mill power.⁴⁵ Each riparian had an equal right to the stream's natural flow, undiminished in quantity and quality.⁴⁶ Thus, the scope of the right was relatively easy to calculate. But, because the natural flow theory prevented all but run-of-the-river dams and most consumptive diversions,⁴⁷ the law promoted flow maintenance. Flow maintenance will be important element in the conservation of aquatic ecosystems impacted by GCC,⁴⁸ but this limitation was deemed unsuited for an emerging industrial, urban economy. Today, the natural flow theory has been replaced by the reasonable use theory that permits diversions and storage,⁴⁹ but the right to make these uses remains inchoate and uncertain.

The main source of uncertainty is the lack of protection for prior uses. All riparian landowners have an equal right to use the water.⁵⁰ Thus, in theory, courts can displace prior users to make room for subsequent or higher valued uses.⁵¹ This does not allow existing nor prospective users to have a high expectation that the amount of water they withdraw will remain constant over time. Uncertainty can either chill adaptation measures, such as water transfers, or encourage adaptation to reduce the uncertainty. In general, the firmer the right, the more adaptation is facilitated. Two major steps have been taken to create firm riparian rights. First, in 1979, the Restatement (Second) of Torts retained the common law's inchoate, open-ended balancing test, which allows courts to consider a wide range of factors to determine the reasonableness of a riparian proprietor's water use, but tweaked the factors in the name of certainty.⁵² Second, state agencies have issued regulated riparian permits that introduce a greater security of right into the common law.⁵³

850 of the Restatement of Torts sets out the factors to be

use under riparian doctrine is a rule of tort rather than a rule of property). See also RESTATEMENT (SECOND) OF TORTS ch. 41 (2010) (discussing interference with the use of water).

45. See Gregory J. Hobbs, Jr., *Colorado Water Law: An Historical Overview*, 1 U. DENV. WATER L. REV. 1, 3 (1997).

46. *Id.*

47. See *Herminghaus v. S. Cal. Edison Co.*, 252 P. 607, 612 (Cal. 1926) (holding that the natural flow theory prevented upstream dams that altered the flow used by downstream riparians). But see CAL. CONST. art. XIV, § 2 (amended 1974) (enshrining reasonable use into the state constitution).

48. See Lynda L. Butler, *Allocating Consumptive Water Rights in a Riparian Jurisdiction: Defining the Relationship Between Public and Private Interests*, 47 U. Pitt. L. Rev. 95, 115-16 (1985) (discussing the ecological impact of diversion).

49. See, e.g., *Red River Roller Mills v. Wright*, 15 N.W. 167, 168-69 (Minn. 1883).

50. E.g., *White v. Whitney MFG. Co.*, 38 S.E. 456, 460 (S.C. 1901).

51. See *Crum v. Craig*, No. CA09-1203, 2010 Ark. App. LEXIS 546, at *13-14 (Ark. Ct. App. June 23, 2010) (citing *Harris v. Brooks*, 283 S.W.2d 129 (Ark. 1955)).

52. See RESTATEMENT (SECOND) OF TORTS § 850A (1979).

53. See *infra* pp. 16-17 and note 5858.

considered in determining a reasonable use of water. The section provides a nine-factor test, and the relevant factors include: (1) the purpose of the use; (2) the suitability of the use to the water body; (3) the economic value of the use; (4) the social value of the use; (5) the extent and amount of harm it causes; (6) the practicality of avoiding harm by adjusting the use or method of use of one proprietor or the other; and (7) the protection of existing values of water uses.⁵⁴ The first six factors basically restate the balancing test developed by courts in the mid-nineteenth century. The seventh is new. The protection of prior uses is not, however, an express common law factor, but it was added to the test on the ground that it represents judicial practice because prior uses are seldom actually displaced and it promotes the more efficient use of water.⁵⁵

For all its faults, reasonable use balancing is a potentially adaptive doctrine. The Restatement was drafted in the 1960s and 1970s before climate change appeared on the environmental agenda, but GCC could be legitimately factored into the balancing test.⁵⁶ Courts could use the reasonable use theory to order pro rata cutbacks if GCC creates permanently lowered stream flows. Section 850 could allow courts to pick winners and losers among GCC-stressed uses, beyond those protected by the preference of domestic use, and to develop a wide range of cut back formulae. Still, it will be hard to use Section 850 balancing for this purpose because it was primarily designed to reduce the common law's uncertainty by protecting prior uses. Thus, flexibility has been curtailed in the name of creating firmer rights. Any GCC adaptation is therefore likely to occur through water transfers.

The second reform is regulated riparianism. Regulated riparianism partially displaces the common law of riparian rights by overlaying a permit system on it.⁵⁷ As occurs in Western states, a state agency issues water use permits that seek to introduce greater security of right into the common law.⁵⁸ Regulated riparian permits are potentially more adaptive compared to prior appropriation permits because legislation often gives state water administrators some flexibility to condition new uses, use public interest considerations in

54. RESTATEMENT (SECOND) OF TORTS § 850A (2010).

55. See J.H. Beusher, *Appropriation Water Law Elements in Riparian Doctrine States*, 10 BUFF. L. REV. 448, 451-52 (1961). See also *Edmondson v. Edwards*, 111 S.W.3d 906, 909-10 (Mo. Ct. App. 2003) (a modern application of priority in a riparian jurisdiction).

56. See Joseph W. Dellapenna, *Adapting the Law of Water Management to Global Climate Change and Other Hydropolitical Stresses*, 35 J. AM. WATER RESOURCES ASS'N 1301, 1308-10 (1999).

57. See Joseph W. Dellapenna, *Regulated Riparianism*, in 1 WATERS AND WATER RIGHTS § 9.03, 9-52 (Robert E. Beck & Amy K. Kelly eds., 2007 repl. vol.).

58. Permit systems are seldom comprehensive. See, e.g., VA. CODE ANN. § 62.1-243 to 246 (2010) (requiring permits for new withdrawals only in declared surface management areas, which can only be declared after withdrawals are likely to impair natural flows and associated instream values).

deciding among competing applicants, and refuse, in whole or part, to renew time-limited permits.⁵⁹ However, once a permit is issued, the state is unlikely to revoke it or issue inconsistent subsequent permits.⁶⁰ This hampers efforts to use the flexibility of regulated riparianism to adapt to GCC.⁶¹ In addition, permit systems do not always cover all withdrawals or use.⁶² On the plus side, permit rights can encourage transfers that promote market adaptation.⁶³

GCC will also impact aquifer recharge, but groundwater law is even less adaptive than the common law of surface use. In contrast to the common law of riparian rights, sharing rules were initially applied only to surface water.⁶⁴ Groundwater was allocated by a pure capture rule, which provides almost no incentives to adapt because there is little risk of curtailment of the privilege to pump.⁶⁵ In most states, the reasonable use rule has replaced pure capture,⁶⁶ although the right to pump without restriction still applies in a few states, most notably Texas.⁶⁷ Reasonable use does not substantially limit the right to capture; the owners overlying an aquifer can capture without restraint, but non-overlying owners cannot pump water if overlying owners are injured.⁶⁸ In practice, it functions primarily to force cities to pay farmers and small users for damages caused by high capacity municipal well fields that are drilled to export water to non-overlying areas.⁶⁹ The Restatement (Second) of Torts Section 858 goes further and provides a remedy for small overlying pumpers injured by large overlying pumpers,⁷⁰ but the expectations of continued pumping are high in almost all states.

B. PRIOR APPROPRIATION: A PERFECT ADAPTATION INSTITUTION- IN THEORY

Prior appropriation is a better adaptation candidate because it is a

59. *E.g.*, FLA. STAT. § 373.233 (2010).

60. *E.g.*, Harloff v. City of Sarasota, 575 So. 2d 1324-25 (Fla. Dist. Ct. App. 1991) (limiting the water allowance for a new applicant in order to protect prior municipal well field).

61. *See* Dellapenna, *supra* note 57, at §9.03(a)(5), 9-74 (describing intricate procedures necessary for obtaining a new permit).

62. VA. CODE ANN. § 62.1-243 (2010) (listing exceptions to Virginia's surface water withdrawal permits).

63. *See* Dellapenna, *supra* note 57, at § 9.03(d), 9-132.

64. *See generally* A. DAN TARLOCK, *Watercourses—Channel, Bed and Banks, and Flow*, 2010 L.WATER RIGHTS & RESOURCES § 3:22.

65. *Sipriano v. Great Springs Waters of Am.*, 1 S.W.3d 75, 75 (Tex. 1999); *see also* *Huber v. Merkel*, 94 N.W. 354, 357 (Wis. 1903).

66. *E.g.*, *Mich. Citizens for Water Conservation v. Nestle Waters N. Am., Inc.*, 709 N.W.2d 174, 197 (Mich. Ct. App. 2005), *rev'd on other grounds*, 737 N.W.2d 447 (Mich. 2007).

67. *Sipriano*, 1 S.W.3d at 75.

68. *See, e.g.*, *Wisconsin v. Michaels Pipeline Constr., Inc.*, 217 N.W.2d 339, 349-50 (Wis. 1974); *Meeker v. City of E. Orange*, 74 A. 379, 384-85 (N.J. 1909).

69. *See, e.g.*, *Michaels Pipeline Constr.*, 217 N.W.2d at 350.

70. RESTATEMENT (SECOND) OF TORTS § 858 (1979).

firm risk allocation scheme. Water law performs three basic functions: (1) it sets the ground rules for the acquisition of secure rights to use water; (2) it allocates scarce water resources between competing private and public uses and requires the internalization of some of the social costs of use because water performs a variety of essential societal functions; and (3) it distributes the pain of shortages among right holders. By these standards, prior appropriation could function as a complete GCC adaptation regime.⁷¹

Prior appropriation is already a risk allocation scheme, because it clearly assigns all risks of climate variability to junior users and eliminates the inchoate and inefficient features of the common law of riparian rights. According to the catechism, the law of prior appropriation allocates water in times of shortage by the strict enforcement of priority schedules, which provide fair notice to junior users of their potential risks. There is no pro rata sharing, as there is under the common law of riparian rights. The risk of shortage curtailment is assigned completely to the most recent right holders, who can be required to bear the full costs of senior calls.⁷² This seemingly harsh rule is a superior risk allocation system compared to either the common law of riparian rights or regulated riparianism; junior appropriators have strong incentives to use the market to reallocate water or to take other adaptive measures such as investment in more efficient water use technologies or temporary fallowing. Theoretically, two aspects of prior appropriation strengthen the incentives to adapt. First, the severance of water rights from land, which allows appropriators to use water anywhere they can within a state,⁷³ will strengthen adaptation incentives. The second aspect that will strengthen adaptation incentives is the beneficial use doctrine, that requires a water right be put to continuous, non-wasteful (beneficial) use,⁷⁴ or it will be lost through forfeiture or abandonment.⁷⁵

C. THEORY MEETS REALITY (AND MONEY) IN THE EAST AND WEST

There is a large disconnect between the theory and reality for at least three related reasons. First, water law, like all property, is designed to provide secure rights, but security creates the expectation of the perpetual maintenance of the status quo.⁷⁶ Thus, there will

71. Adler, *supra* note 3, at 25-26.

72. See, e.g., *Neb. ex rel. Cary v. Cochran*, 292 N.W. 239, 244-45 (Neb. 1940).

73. Ironically, many states have imposed statutes that prohibit or restrict the export of water across state lines. E.g., *Sporhase v. Neb. ex rel. Douglas*, 458 U.S. 941, 956-58 (1981). While export prohibitions are a presumptive unconstitutional discrimination against interstate commerce, statutes that prefer in-state users to out-of-state users for demonstrated conservation reasons may be constitutional. *Id.* at 958.

74. *State Dep't of Ecology v. Grimes*, 852 P.2d 1044, 1049 (Wash. 1993).

75. E.g., *Jenkins v. State Dep't of Water Res.*, 647 P.2d 1256, 1261 (Idaho 1982).

76. See Sarah Harding, *Perpetual Property*, 61 FLA. L. REV. 286 (2009).

always be resistance to forward adaptive planning. Change is not only surprising, but any change that reduces that amount of water previously available is potentially unconstitutional.⁷⁷ Second, the Federal government and states such as California, have nourished the "illusion" of perpetual security by investing millions of dollars in tax revenues and bond sales to construct the necessary carry-over storage to avoid disruptive calls.⁷⁸ Third, junior users often have put water to high valued uses compared to senior right holders. These junior users have every incentive to push back politically and legally when disruptive calls are threatened. In short, the continued protection of existing rights is potentially inconsistent with the proposed adaptation strategies which encourage increased flexibility in response to change, greater recognition of the risks of supply interruption, more cooperation among all users (whether it be from small watersheds or large regions), and real time water use management.⁷⁹

The net result of this disconnect between theory and reality, is that users do not expect that "real," pain-causing allocations will actually happen. The law of riparian rights is a "use and be sued" rule with low risks of a challenge by other similarly situated users. In the Eastern states, nature has provided sufficient ground and surface water to meet all competing demands; right holders seldom face serious risks of curtailment, except on very small streams. The expectation of supply disruption should be more widely accepted in the prior appropriation states, but ironically, the expectation of no supply disruption is as strong in the arid and semi-arid West as it is in the East. Priority administration does occur on small streams, but the Western states have worked hard to make sure that there are few calls.⁸⁰ The thrust of federal and state water policy from the conservation era until the 1970s was to minimize the risks of shortages by constructing large carry-over storage facilities.⁸¹ The West is now living off that legacy, although the amount of constructed carry-over storage may not provide the cushion that it has in the past. In addition to the dams and reservoirs which vein the West, formal and informal mechanisms also exist to share the burdens of shortages

77. See U.S. CONST. amend. V.

78. California's efforts to redress the historic imbalance between the northern California, where most of the water originates, and southern California, where most of the state's population lives, is well told in NORRIS HUNDLEY, JR., *THE GREAT THIRST: CALIFORNIANS AND WATER: A HISTORY* (Rev. Ed. 2001).

79. Stephen Draper, *The Impact of Climate Change on Interstate/International Water Sharing*, 11 WATER RESOURCES COMMITTEE NEWSL. (A.B.A., Chi., Ill.), Feb. 2009, at 5, 11, available at <http://www.abanet.org/enviro/committees/waterresources/newsletter/archives.html> (noting that interstate and international agreements that require fixed water delivery schedules "no longer appears to be viable for the future," and future agreements may include adjustable flow percentage entitlements with a "real time feed back loop that provides river stages . . . at various locations on the river on a regular basis." *Id.* at 11).

80. See Adler, *supra* note 3, at 24.

81. *Id.*

by pro rata rather than pro tanto delivery reductions.⁸²

D. JUNIOR PUSH BACK: A CASE STUDY IN RESISTANCE TO RISK ALLOCATION

The expectation that there will be limited enforcement of priorities means that existing users will resist the consequences of any curtailment of withdrawals in both riparian and appropriative states. Two examples are offered below. The first, from a regulated riparianism jurisdiction, illustrates how the introduction of a permit system can promote adaptation but may also impede it. The second, from a prior appropriation state, illustrates the lengths to which a state may go to avoid calls on junior appropriators and thus preserve the status quo, a result that may not produce the necessary GCC adaptation.

1. Regulated Riparianism

Regulated riparianism gives the state some flexibility to adjust to new conditions. Permits are not perpetual as they are in the West, but water use permits introduce a high degree of stability into any system. Thus, it will be hard to dislodge them even though the law permits the reassignment of rights as Georgia's response to a severe drought illustrates.⁸³ A severe, prolonged drought started in the Flint River Basin in 1998 and did not break until 2009.⁸⁴ The river is at the center of an on-going interstate dispute among Alabama, Florida, and Georgia concerning two river basins.⁸⁵ The nub of this dispute is that downstream Alabama and Florida challenge upstream Georgia's claims to the amount of stored water in a Corps of Engineers' reservoir necessary to keep Atlanta watered.⁸⁶ While the states were trying to negotiate an interstate compact, Georgia took the proactive step of dealing with the risks of intrastate and interstate shortages in a major downstream agricultural basin.⁸⁷ Georgia passed the Flint River Drought Protection Act which requires permits for ground surface diversions over 100,000 gallons per day.⁸⁸ In addition, when a drought is declared, the Director of the Environmental Protection

82. See Lawrence J. MacDonnell, *Out-of-Priority Water Use: Adding Flexibility to the Water Appropriation System*, 83 Neb. L. Rev. 485, 494-504 (2004).

83. *Apalachicola-Chattahoochee-Flint River System (ACF) Timeline of Action as of July 27, 2009*, FLA. DEP'T OF ENVTL. PROT. (Jul. 27, 2009), <http://www.dep.state.fl.us/mainpage/acf/timeline.htm>.

84. *Drought Status Eases to Mild; More Rain Expected Today*, GAINESVILLE TIMES (Georgia), May 5, 2009, <http://www.gainesvilletimes.com/archives/18449/>.

85. FLA. DEP'T OF ENVTL. PROT., *supra* note 83.

86. The literature on the controversy and the states' inability to resolve their competing claims through an interstate compact is vast. Robert Haskell Abrams, *Settlement of the ACF Controversy: Sisyphus at the Dawn of the 21st Century*, 31 HAMLINE L. REV. 679 (2008), is a good introduction.

87. *Id.* at 691.

88. GA. CODE ANN. § 12-5-540 *et seq.* (2010) (Flint River Drought Protection Act); GA. CODE ANN. § 12-5-31(a)(1)(A) (2010) (surface water).

Division of the Department of Natural Resources may set the number of acres that must be retired for the irrigation season.⁸⁹ This allowed Georgia to meet the minimum Flint River flows informally promised to Florida.⁹⁰ The costs of fallowing are borne by the public, and farmers bid the price per acre that they will accept to participate in the program.⁹¹ However, if the auction does not produce the target reduction, the Director can begin to revoke the most recent permits and “work chronologically backward with each order issued.”⁹²

The state initially issued agricultural use permits for groundwater based on the amounts used prior to 1988, but it realized that it had to tighten the permits based on the 1998 data.⁹³ Earlier data was not a reliable indicator to determine how much water the auctions actually saved, because the state did not know the amount of actual – let alone beneficial – prior use. After 2003, Georgia limits new permits to twenty-five-year terms and may renew existing permits at a lower capacity if they “would have unreasonable adverse effects upon other water uses.”⁹⁴ The reality is that the permit system entrenches large withdrawals. The 2001 auction withdrew about 33,000 acres from production.⁹⁵ The state calculated that the withdrawals increased the flow of the Flint by about 399 acre feet per day, but this figure has been questioned.⁹⁶ GCC could be factored into the Georgia permit system because permits over twenty-five years require a supply adequacy determination that must be periodically reviewed.⁹⁷ But, because the permits allow a user to withdraw as much water as they can use to grow any commodity, the permits will be hard to cancel;

89. GA. CODE ANN. § 12-5-547 (2010).

90. Pamela P. Holliday, *Fighting Over the Flint: Balancing Human Demands with Ecosystem Needs*, SHERPA GUIDES, http://www.sherpaguides.com/georgia/flint_river/water_resources/ (last visited Sept. 28, 2010).

91. See GA. CODE ANN. § 12-5-541 (2010); *id.* § 12-5-546.

92. *Id.* § 12-5-547.

93. *Id.* § 12-5-105. See generally ROBIN JOHN MCDOWELL, GA. ENVTL. PROT. DIV., STATUS OF THE FLINT RIVER REGIONAL WATER DEVELOPMENT AND CONSERVATION PLAN, 1-2 (2003), available at <http://www.uga.edu/water/GWRC/Papers/McDowellRob%20GWRC%20Paper%20revised.pdf>.

94. GA. CODE ANN. § 12-5-31(a)(3) (2010). See generally John L. Fortuna, *Water Rights, Public Resources, and Private Commodities: Examining the Current and Future Law Governing the Allocation of Georgia Water*, 38 GA. L. REV. 1009 (2004); Wilson G. Barmeyer, *The Problem of Reallocation in A Regulated Riparian System: Examining the Law in Georgia*, 40 GA. L. REV. 207 (2005).

95. Swagata “Ban” Banerjee et al., *Forecasting Irrigation Water Demand: A Case Study on the Flint River Basin in Georgia*, 39 J. AGRIC. & APPLIED ECON. 641, 642 (2007), available at <http://purl.umn.edu/37053>.

96. *Id.*

97. GA. CODE ANN. § 12-5-31(a), (g), (h) (2010); but see RONALD CUMMINGS ET AL., MANAGING AGRICULTURAL WATER USE DURING DROUGHT: AN ANALYSIS OF CONTEMPORARY POLICIES GOVERNING GEORGIA’S FLINT RIVER BASIN 32 (2007), available at http://www.h2opolicycenter.org/pdf_documents/water_workingpapers/WP2007-001_final.pdf (analyzing the EPD permit system and concluding that the rights of permittees are highly uncertain due to the Director’s considerable discretion in modification or renewal).

this impedes, if not frustrates, adaptation.⁹⁸ Furthermore, financial hardship or circumstances beyond the control of the user are cancellation defenses, and the Director of the Department of Natural Resources “shall give preference to existing use over an initial application,”⁹⁹ which also impedes adaptation incentives.

2. Prior Appropriation

Junior appropriators will not always accept the necessity for a call by senior appropriators. In many cases, junior appropriators have strong financial incentives to seek legal redress against a call or to negotiate a new sharing regime with seniors. The efforts of junior appropriators in Idaho’s Snake River Plain to resist priority calls illustrate the power of high valued junior users to modify the law of prior appropriation to their advantage.¹⁰⁰ Starting in 1993, senior appropriators began making calls on junior pumpers, but the state has, nimbly, tried to avoid shutting off junior users, who are mainly large groundwater pumpers.¹⁰¹ The issue came to a head in 2005 when two trout farms in the Magic Valley made a call, and rejected an initial offer from junior pumpers to 45,000 acre feet of replacement water.¹⁰² The Department of Water Resources eventually threatened to shut down pumps for 33,000 acres and several towns and industries in the Valley—the nation’s major source of potatoes for fast food chains.¹⁰³ Not surprisingly, the state tried to avoid this drastic and economically disruptive step by adopting new call rules, titled the Conjunctive Management of Surface and Ground Water Resources.¹⁰⁴ In brief, these rules allow the Director of the Idaho Department of Water Resources to apply a combination of two traditional doctrines to avoid calls. The first is the futile call doctrine, which is seldom applied, but allows a court or water master to reject a call by a senior if the junior’s curtailed use would not actually produce additional “wet water” at the senior’s point of diversion.¹⁰⁵ The second doctrine

98. Banerjee, *supra* note 95.

99. GA. CODE ANN. § 12-5-31(f) (2010).

100. Memorandum from the Surface Water Commission to Karl J. Dreher, Dir. Idaho Dep’t of Water Res. (Apr. 15, 2005) (on file with author).

101. Richard A. Slaughter & John D. Wiener, *Water, Adaptation, and Property Rights on the Snake and Klamath Rivers*, 43 J. AM. WATER RES. ASS’N 308, 316 (2007).

102. *Idaho Poised to Shut Down Hundreds of Groundwater Uses*, U.S. WATER NEWS ONLINE, June 2007, <http://www.uswaternews.com/archives/arcrights/7idahpois6.html>.

103. Matt Christensen, *The Consequences of Curtailment*, TIME-NEWS MAGICVALLEY.COM (Idaho), MAY 5, 2007, http://www.magicvalley.com/news/local/article_b273be4e-61b9-5827-9d95-68825b0028cf.html.

104. IDAHO ADMIN CODE 1. 37.03.11.001 (2010).

105. IDAHO ADMIN CODE 10. 37.03.11.010; *see also* In the leading case, *State ex rel. Cary v. Cochran*, 292 N.W. 239 (Neb. 1940), Nebraska ordered junior appropriators on the North Platte River to forego diversions because 700 cubic feet per second were required to deliver 162 cubic feet to senior appropriators at Kearney on the Platte because of carriage losses. *Cary*, 292 N.W. at 245. The Court rejected the

posits that a senior's means of diversion must be reasonable before a call will be honored.¹⁰⁶ Ironically, an early Supreme Court case involving the Snake River Plain announced the doctrine.¹⁰⁷ In an early irrigation era case, the Supreme Court held that the state could refuse a call by a senior, who claimed a large base flow of the Snake River to turn a water wheel to bring the amount of his right to the top of a gorge, against a junior irrigation district that constructed a dam across the river.¹⁰⁸ The Court questioned whether all the water needed to operate the wheel was in fact an appropriation, and squarely held that "[s]uch use also lacks one of the essential attributes of an appropriation; it is not reasonable."¹⁰⁹

Regarding these new call rules, the seniors initially succeeded in convincing a district court that the rules violated their constitutional right to divert, because they did not permit the timely administration of water rights and failed to include a presumption that any junior withdrawal in times of shortage is a per se interference with senior surface rights.¹¹⁰ But the Idaho Supreme Court reversed and reasoned that the Director of the Department of Water Resources needed the discretion to decide when to honor a call.¹¹¹ Thus, no presumption of interference was necessary because the rules contained sufficient standards and did not constitute a re-adjudication of decreed water rights.¹¹² The court also held that a contrary ruling would ignore "the constitutional requirement that priority over water be extended only to those using the water."¹¹³ In the end, rather than mandating the speedy delivery of water based on a strict enforcement of priorities, the court instead decided that it was more important to have the administrative agency charged with allocating this public resource make scientifically-informed decisions about the extent of injury to a senior users.¹¹⁴ In the course of the opinion, the Court observed that "[w]hile the Constitution, statutes and case law in Idaho set forth the principles of the prior appropriation doctrine, those principles are more easily stated than applied. These principles become especially more difficult, and harsh, in their application in times of drought."¹¹⁵ This candid but seldom voiced observation from a "hard core" prior appropriation court could be the basis for

arguments that the call was futile or that calls were subject to a reasonableness standard because allowing so much discretion in a water master would "destroy the very purpose of the doctrine of appropriation existent in this state." *Id.* at 247.

106. IDAHO ADMIN CODE 20. 37.03.11.020.

107. *Schodde v. Twin Falls Land & Water Co.*, 224 U.S. 107 (1912).

108. *Id.* at 115-16, 124-25.

109. *Id.* at 118.

110. *Am. Falls Reservoir Dist. No. 2 v. Idaho Dept. of Water Res.*, 154 P.3d 433, 445, 448 (Idaho 2007).

111. *Id.* at 446-47.

112. *Id.* at 449.

113. *Id.* at 447.

114. *Id.* at 446.

115. *Id.* at 440.

the development of a general doctrine where GCC demands that all diversions be reasonable and that senior appropriators must expect, within the parameters of the Fifth Amendment, some adjustment to the sources of their rights.

To resolve the Magic Valley conflict, junior users offered several mitigation plans to senior users. Also, in 2008, the Idaho Water Resource Board and the City of Twin Falls purchased Pristine Springs, which will provide ten cubic feet per second of mitigation water to the trout farm making calls, thus providing junior users with greater security in their out-of-priority water use.¹¹⁶ But, seniors continue to make calls. The Department of Water Resources avoided a shutdown in 2009 after it decided to stay its shutdown order and evaluate a new mitigation plan.¹¹⁷ Still, the conflict between senior and junior right holders continues.¹¹⁸

Idaho's experiences provide mixed lessons to water managers when broadly considered in the context of GCC adaptation. The Magic Valley story shows that when prior appropriation creates a class of losers and the economic stakes are high, there will be pressure for administrators to make crude cost-benefit analyses to ease the strictness of prior appropriation. This could promote adaptation in several ways. All users will face pressure to invest in the technology to use water more efficiently; extralegal stakeholder solutions will emerge to consider alternatives such as land retirement, set-aside pools, and shifting the cost of adaptation to state and federal tax payers. This may yield flexible, more efficient water use patterns necessary to any adaptation strategy, but it will rob prior appropriation of its ability to be used as a hard risk allocation system. Ultimately, it may simply result in a shift of water from senior to junior users, which does nothing to deal with more serious GCC-induced shortages.

III. BEYOND WATER RIGHTS

If state law cannot adapt to GCC, there are at least three important additional ways to secure the necessary re-allocations. The first strategy builds on the status of state water rights as property rights and uses the market to reallocate water. The second strategy either ushers in a new golden era of dam building or facilitates the reoperation of existing reservoirs in order to squeeze out more hydro

116. Randy Stapilus, *ID: Pristine Springs Buy*, RIDENBAUGH PRESS/WATER RIGHTS BLOG (Apr. 28, 2008, 4:46 PM), <http://ridenbaugh.com/waterrights/?p=569>.

117. See Jared S. Hopkins, *Water Users Dodge Bullet; Agency Won't Order Curtailment Monday*, TIME-NEWS MAGICVALLEY.COM (Idaho), Mar. 13, 2009, http://www.magicvalley.com/news/local/article_38a6462d-61b7-56e1-995f-2e455c694290.html.

118. See generally Randall C. Budge et al., *Ground Water & Surface Water Conjunctive Management Contentions, Delivery Call Litigation in Idaho: Ground Water Users' Perspective*, 64 THE WATER REPORT 1, 1-13 (2009) (describing the continuing "water wars" in Idaho).

capacity for agricultural or municipal and industrial uses. The third strategy is to preempt state water law and use the federal Commerce power to reallocate water. The first is happening, and the second and third have been proposed but face a wide variety of political and legal barriers.

A. MARKET ALLOCATION

The market can facilitate adaptation by two primary methods: (1) water transfers from lower to higher valued uses; and (2) water banking.

1. Water Marketing

The most promising GCC adaptation strategy is to use the market to reallocate water to more GCC-stressed uses. In general, these uses are primarily urban and environmental, and transfers will provide these right holders with an increased margin of safety during GCC-induced shortages.¹¹⁹ Transfers can be permanent, such as severing a water right from the land, or short term, such as following some land for an irrigation season. Economists have long criticized western water law as inefficient because senior rights are generally dedicated to low value agricultural uses instead of continually moving them to higher value, alternative uses;¹²⁰ GCC only strengthens this traditional critique of western water law. Appropriative water rights have always been transferable, but the rules are different compared to other commodities.

The major barrier to adaptation is the correlative and incomplete nature of water rights, which increase the transaction costs of transfers. Because water rights have correlative elements, they must be exercised with regard to their impact on other uses. The most concrete manifestation of their correlative and incomplete nature is the protection of junior appropriative rights.¹²¹ Unlike other property rights, which can be transferred without regard to the effect on neighboring property holders, an appropriative water right cannot be transferred unless there is no injury to junior water right holders.¹²²

As a result, the primary source of transfer transaction costs is the need for experts to determine the range of affected water right holders, the amount of water actually beneficially used by the sellers,¹²³ and the amount of return flow to which junior water right

119. See Jonathan H. Adler, *Water Marketing as an Adaptive Response to the Threat of Climate Change*, 31 HAMLINE L. REV. 729, 740-43 (2008).

120. See, E.g., Eric T. Freyfogle, *Context and Accommodation in Modern Property Law*, 41 STAN. L. REV. 1529, 1543-44 (1989).

121. See George A. Gould, *Water Rights Transfers and Third-Party Effects*, 23 LAND & WATER L. REV. 1, 13 (1988).

122. *Green v. Chaffee Ditch, Co.*, 371 P.2d 775, 783 (Colo. 1962).

123. See, e.g., *Farmers Highline Canal & Reservoir Co. v. City of Golden*, 975 P.2d

holders are legally entitled.¹²⁴ The junior protection rule does not bar transfers, but it does add to the cost of transfers. However, in addition to protecting the rights of other users, the third party rule also functions as a watershed protection rule. Thus, it is a basis to promote adaptation efforts to maintain minimum stream flows and conserve stressed aquatic ecosystems.

From this, it can be seen that water marketing occurs in both a legal and political environment that simultaneously encourages and constrains transfers. The politics of water have long proceeded from the premise that water is not just another commodity but instead, a resource with higher, transcendent values.¹²⁵ In arid regions, control of water means political power, and power is never surrendered with low transaction costs. There are three relevant parties in any transaction: (1) sellers, (2) other water right holders, and (3) third-party interests such as community claimants or environmental interests. The question for GCC adaptation is how responsive to market demand the system will be in the future?

Three water transfer reforms have been proposed to lower transaction costs and to counter the potential "chilling effect" of third-party protection rules: (1) transaction cost reduction through more streamlined procedures; (2) water conservation incentives such as the ability to transfer the saved water; and (3) water banking.¹²⁶ Water marketing advocates argue that streamlining existing administrative approval processes and eliminating disincentives to transfers are necessary. One of the major proposed examples of the latter reform is a legislative reversal of the presumption that saved water should return to the stream and be open to appropriation by other claimants.¹²⁷ Legislation in several states allows users to conserve water and transfer the saved water.¹²⁸ The same result was reached judicially in a widely noted Utah decision.¹²⁹ In that case, a senior flood irrigator switched to sprinkler irrigation with a twenty-five percent efficiency gain. The Court held that the senior "should be allowed to make the most efficient use of [water]" subject to two conditions: (1) the senior is limited to the original entitlement, and (2) that no irrigation runoff has reached the watercourse or an

189, 201 (Colo. 1999) (noting the importance of recording the historical beneficial use).

124. See *CF & I Steel Corp. v. Rooks*, 495 P.2d 1134, 1136 (Colo. 1972) (noting that junior appropriator produced no evidence to counter allegation that it would not be injured).

125. See *Green v. Chaffee Ditch, Co.*, 371 P.2d at 783-84. But see *Shepard*, *supra* note 34, at 1115-18.

126. See Lawrence J. MacDonnell & Teresa A. Rice, *Moving Agricultural Water to Cities: The Search for Smarter Approaches*, 14 HASTINGS W.-NW. J. ENVTL. L. & POL'Y 105, 150-52 (2008).

127. See, e.g., OR. REV. STAT. § 537.460(2) (2010).

128. E.g., *id.*; see Lawrence J. MacDonnell, *Transferring Water Uses in the West*, 43 OKLA. L. REV. 119, 122-23 (1990).

129. *Estate of Steed v. New Escalante Irrigation, Co.*, 846 P.2d 1223, 1228 (Utah 1992).

associated aquifer.¹³⁰

Transfer reforms have helped to stimulate water transfers, but the mere existence of water markets will not necessarily “unblock” large quantities of water. An early study of water transfers in six states concluded that – with the exception of lawyer-dominated Colorado – the current transaction costs of water transfers are not excessive.¹³¹ The real barriers are political not legal.¹³² A subsequent study found that transfers are increasing but most transfers are agriculture-to-agriculture or urban-to-urban.¹³³ Further, the study found that the bulk of the water transferred is through short-term leases rather than permanent sales.¹³⁴ To complicate matters, many water rights transfers remove water from agricultural use and dedicate the right to urban use. Those who object these transfers argue that “third party” interests such as rural sustainability and instream flow needs should also be considered in transfers, even though they are only based on junior water rights.¹³⁵ Water law provides no direct protection for third party interests, but these claims are increasingly being asserted both through litigation and the political process.¹³⁶ While the legal bases for third-party challenges to transfers vary from state to state,¹³⁷ the larger the transfer, the greater the need to consider third party impacts.¹³⁸

Riparian rights also may be transferred, but the risks of a transfer not yielding the expected amount of water are much higher compared to appropriative rights because of the inherent uncertainty of common law. Furthermore, the conveyance of a riparian right may not be a property right transfer at all. It could be characterized as nothing more than a grantor-grantee contract not to interfere with the exercise of the granted right, rather than a conveyance of a property right.¹³⁹ Although courts have held that riparian rights are property rights and may be severed from riparian land,¹⁴⁰ the cases are not, however, satisfactory precedent for GCC-adaptation because

130. *Id.* at 1228-29.

131. See LAWRENCE J. MACDONNELL, *THE WATER TRANSFER PROCESS AS A MANAGEMENT OPTION FOR MEETING CHANGING WATER DEMANDS* 53-56, 68 (1990).

132. See Barton H. Thompson, Jr., *Institutional Perspectives on Water Policy and Markets*, 81 CAL. L. REV. 671, 673-75 (1993).

133. Jedidiah Brewer, et al., *Transferring Water in the American West: 1987-2005*, 40 U. MICH. J.L. REFORM 1021, 1039 (2007).

134. *Id.* at 1045-46.

135. See NAT'L RESEARCH COUNCIL, *WATER TRANSFERS IN THE WEST: EFFICIENCY, EQUITY, AND THE ENVIRONMENT* 38, 71-72 (1992).

136. *Id.* at 71-72. See also A. DAN TARLOCK ET AL., *WATER RESOURCES MANAGEMENT* 319-43 (6th ed. 2009) (detailing legislative and common law applications of public interest).

137. *E.g.*, WYO. STAT. ANN. § 41-3-104(a) (2009) (economic loss to a community is a relevant factor in transfer review).

138. See NAT'L RESEARCH COUNCIL, *supra* note 135, at 39-40.

139. Dellapenna, *supra* note 57, § 7.04(a)(3)(B).

140. *E.g.*, *Conrad/Dommel, LLC v. W. Dev. Co.*, 815 A.2d 828, 846 (Md. Ct. Spec. App. 2003).

they primarily involve the severance of non-consumptive rights such as access and view.¹⁴¹ Transfers of consumptive rights face two major barriers, in addition to the traditional rule that riparian rights must be presumptively used within the watershed of a stream. First, the amount of an individual riparian's right is almost always inchoate.¹⁴² Second, a conveyance only binds the transferor(s);¹⁴³ other, non-joining riparians remain free to assert their rights to make a reasonable use against the transferee at any time.¹⁴⁴ Even the grantor may make a concurrent, but non-injurious use, despite the conveyance.¹⁴⁵ Thus, any transfer is still subject to cut-backs as other riparians assert their rights.

In addition to these constraints, transfers to non-riparian land or land outside of the watershed are still problematic because environmental review has gradually replaced the common law's per se rules. Today, it is not clear if a court would apply the riparian-non-riparian distinction or the watershed rule, or whether it would measure reasonableness according to the needs of the grantor or the grantee. As early as the 1930s, the Supreme Court refused to incorporate the watershed limitation into the law of equitable apportionment to allow transbasin diversions for urban growth.¹⁴⁶ Modern riparian law provides some support for inter-basin adaptive transfers. A leading case holds that severed riparian rights may be used on non-riparian land if there is no injury to other riparians.¹⁴⁷ Regulated riparianism also promotes adaptation because many states have eliminated the per se rules against inter-basin transfers and allow such transfers subject to administrative review.¹⁴⁸ But, this review provides new opportunities to oppose transfers.

2. Water Banking

Water banking is another route to tap underused water rights in times of shortage. Banking is currently used almost exclusively in prior appropriation states, but there is no per se reason why it could not be extended to riparian states, especially those with a functioning permit system. Banking is a temporary reallocation and works because in any given year, a water right holder, generally an agricultural user, may have excess water or may choose to forego

141. See Lynda L. Butler, *Allocating Consumptive Water Rights in a Riparian Jurisdiction: Defining the Relationship Between Public and Private Interests*, 47 U. PITT. L. REV. 95, 138-40 (1985).

142. Christopher L. Len, *Synthesis – A Brand New Water Law*, 8 U. DEN. WATER L. REV. 55, 82 (2004).

143. See *Portage Cnty. Bd. of Comm'rs v. City of Akron*, 846 N.E.2d 478, 492-93 (Ohio 2006).

144. *Id.*

145. See *Borough of Media v. Edgmont Golf Club, Inc.*, 288 A.2d 803, 804 (Pa. 1972).

146. See *Connecticut v. Massachusetts*, 282 U.S. 660, 670, 672-73 (1931).

147. *Pyle v. Gilbert*, 265 S.E.2d 584, 589 (Ga. 1980).

148. *E.g.*, VA. CODE ANN. § 62.1-248 (2010).

irrigation for a season. Water banking, therefore, seeks to counter the “use it or lose it” or “use as much as can” penalty by allowing irregular, short-term transfers which do not impair the tenure of the underlying right. But for that reason, advocates of banking have feared that abandonment or forfeiture rules, if applied, would chill any incentives to conserve water through water banking.

Despite this fear, several states now utilize water banking. Idaho pioneered water banking on the Snake River and California subsequently adopted water banking during the droughts of the late 1980s and early 1990s.¹⁴⁹ Generally, an agricultural user deposits its entire or partial entitlement into a bank in return for cash, and the water is sold to urban suppliers. Deposits are voluntary, but the experience of California with its 2008-2009 water bank illustrates the limits of water banks as GCC adaptive instruments.¹⁵⁰ The state assembled commitments for 400,000 acre-feet of water from Sacramento Valley farmers.¹⁵¹ Many farmers planned to use their Bureau of Reclamation entitlements, but held back on planned deposits because of the possibility that their contract deliveries would be cut to leave water in the river to conserve an endangered fish in the California Bay-Delta.¹⁵²

B. RUNOFF CAPTURE OR MANIPULATION

The United States has a large inventory of carry-over storage reservoirs. More could be constructed to buffer users against GCC-induced shortages, or more water could be squeezed out of existing reservoirs. This section explains why both these strategies are problematic.

1. The Big Dam Era Revived?

Climate change has rekindled interest in capturing more unallocated or regulated runoff through the construction of new storage reservoirs. In May of 2007, Governor Arnold Schwarzenegger called for the construction of two new hydroelectric dams to help meet the state’s ambitious greenhouse gas emission targets,¹⁵³ although the state’s near bankruptcy has temporarily taken

149. *History of the Water Supply Bank*, IDAHO WATER RES. BD., http://www.idwr.idaho.gov/WaterManagement/WaterRights/waterSupply/history_of_bank.htm (last visited Oct. 10, 2010); Ellen Hanak, *California’s Emerging Water Market: Should Counties Play a Role?*, CALIFORNIA COUNTRY MAGAZINE, Sept. 1, 2003, available at <http://www.ppic.org/main/commentary.asp?i=453>.

150. See *2009 Drought Water Bank Overview*, CAL. DEP’T OF WATER RES. (Sept. 2008), http://www.water.ca.gov/drought/docs/2009water_bank.pdf.

151. Kate Campbell, *Major Hurdles Loom for Any Water Transfers*, AGALERT, Apr. 1, 2009, available at <http://www.cfbf.com/agalert/index.cfm> (follow Ag Alert Archives “2009” hyperlink; then follow “Major Hurdles Loom for Any Water Transfers” hyperlink).

152. *Id.*

153. Bonner R. Cohen, *Global Warming Creates Need for New Dams: Schwarzenegger*, THE HEARTLAND INST. (May 1, 2007), available at

this option off the political agenda. The runoff capture options range from new and expanded conventional carry-over storage reservoirs, to more environmentally friendly alternatives such as offsite storage and the expanded conjunctive use of groundwater aquifers. For example, to meet new demands, some cities are looking to secure future water supplies by building off-stream storage facilities.¹⁵⁴ However, a return to dam building will not be easy because the "Reclamation" or "Big Dam Era" ended in the 1980s, and there are substantial political and legal barriers to reviving it.¹⁵⁵ The political problems stem from the loss of faith in the need for large dams.

During the first six decades of the twentieth century, the federal government immunized the Western and (to a lesser extent) Eastern states from most of the risks posed by climate variation. In the twentieth century, the federal government built large-scale water projects to backstop state water rights and prevent flood damage.¹⁵⁶ Proponents of comprehensive watershed and river basin planning promoted the efficient (non-wasteful) use of water through multiple-purpose water projects aimed at providing widespread benefits to the nation, or at least stimulating regional growth. The economic assumptions behind this model were always doubtful, and for several decades the idea that water resources development is necessary to sustain "underdeveloped regions" such as the West or parts of the Southeast no longer commands the widespread bipartisan political support that it once did.

So any return to large-scale dam building, or the reoperation of dams for more power and more consumptive water use, would require a political and legal reversal of the past fifty years; a possible but not yet probable scenario. Nonetheless, it is possible that GCC could create the political will for a new era of dam building, and thus the United States would join Africa, Asia, and Latin America in the construction of large new projects. Any effort to build a substantial number of carry-over storage reservoirs will face two major, related problems, one geographical and the other legal. First, most of the best sites for such reservoirs have been damned, or preserved as wild and scenic rivers. This leads to the legal problem. Before GCC passed from an unproven hypothesis to a widely accepted working assumption, the United States was transitioning to an era of water management characterized by the reallocation of existing supplies, and the sustainable management and restoration of previously

http://www.heartland.org/policybot/results/20949/Global_Warming_Creates_Need_for_New_Dams_Schwarzenegger.html.

154. See Tarrah Henrie, *Why Some Water Districts Decided to Dam It*, 7 WATER RESOURCES IMPACT 9, 9 (2005), available at

http://www.awra.org/impact/issues/0511imp_toc.pdf.

155. See, e.g., Peter M. Lavigne, *Dam(n) How Times Have Changed...* 29 WM. & MARY ENVTL. L. & POL'Y REV. 451, 461-64 (2005); see also Marc P. Reisner, *Deconstruction in the Arid West: Close of the Age of Dams*, 1 HASTINGS W.-NW. J. ENVTL. L. & POL'Y 1 (1994).

156. See Christine A. Klein, *On Dams and Democracy*, 78 OR. L. REV. 641, 671 (1999).

modified aquatic ecosystems.¹⁵⁷ Since the 1960s, water policy has evolved away from the dominant twentieth century paradigm of multiple-purpose development. The alteration of river hydrographs is gradually being replaced with a new, although less well articulated, paradigm—the normative river.¹⁵⁸ The goal is to use water more sustainably and to respect rivers' natural hydrographs within the constraints of existing firm entitlements.¹⁵⁹ This view has never been fully incorporated into legislation, as was the idea of multiple-purpose development, but it has been partially incorporated into federal and state laws such as the Clean Water and Endangered Species Acts.¹⁶⁰ For example, courts have ordered releases from dams to protected listed species, and have held that diversions can constitute a Section 9 taking.¹⁶¹

Even if more money was allocated to dam building, the United States does not have the institutional infrastructure to reverse course quickly. When Congress allocated more federal dollars to river restoration projects, the two major federal dam building agencies, the Bureau of Reclamation and the U.S. Army Corps of Engineers, responded by partially changing their missions from project construction to “management”—which increasingly means the restoration of stressed aquatic ecosystems.¹⁶² The U.S. Bureau of Reclamation has formally changed its mission from water development to water management, and budget priorities reflect this change.¹⁶³ The U.S. Army Corps of Engineers is undergoing a similar but more complex and uneven transition and is pinning its hopes for future survival on playing a large role in restoring the aquatic ecosystems that it previously modified.¹⁶⁴ At the current time,

157. See W. WATER POLICY REVIEW ADVISORY COMM'N, *WATER IN THE WEST: CHALLENGE FOR THE NEXT CENTURY*, 3-51 to 3-52 (1998), available at http://www.preventionweb.net/files/1785_VL102318.pdf.

158. See A. Dan Tarlock, *Water Law Reform in West Virginia: The Broader Context*, 106 W. VA. L. REV. 495, 501 (2004).

159. See generally Chris Bromley, *A Political and Legal Analysis of the Rise and Fall of Western Dams and Reclamation Projects*, 5 U. DEN. WATER L. REV. 204, 216-21 (2001); Klein, *supra* note 156, at 648-53.

160. See Craig, *supra* note 4 at 829-30.

161. TARLOCK ET AL., *supra* note 136, at 737-47.

162. See PARTNERSHIP AGREEMENT BETWEEN THE BUREAU OF RECLAMATION AND THE U.S. DEPARTMENT OF THE ARMY OFFICE OF THE ASSISTANT SECRETARY OF THE ARMY (CIVIL WORKS), Feb. 11, 2005, available at <http://www.usace.army.mil/CEMP/iis/Documents/BURREC-%20USACE%20Partnership%20Feb05.pdf>

163. See BUREAU OF RECLAMATION, *RECLAMATION'S STRATEGIC PLAN: A LONG-TERM FRAMEWORK FOR WATER RESOURCES MANAGEMENT, DEVELOPMENT AND PROTECTION 2-3* (1992); *Mission Statement*, BUREAU OF RECLAMATION, <http://www.usbr.gov/main/about/mission.html> (last updated June 12, 2009).

164. See *Goal 2: Engineering Sustainable Water Resources*, ARMY CORPS OF ENG'RS, <http://www.usace.army.mil/about/campaignplan/Pages/Goal2.aspx> (last visited Oct. 26, 2010); A. Dan Tarlock, *A First Look at a Modern Legal Regime for a "Post-Modern" United States Army Corps of Engineers*, 52 U. KAN. L. REV. 1285, 1287-88 (2004). See generally Lavigne, *supra* note 155, at 461-64.

however, the transition is incomplete. The United States has a fragmented regulatory system that protects flows on an ad hoc basis.¹⁶⁵ There are more problems. Dams are not environmentally benign. For example, dams, especially in the tropics, are methane emitters,¹⁶⁶ and the up and downstream water quality impacts of dams are largely unregulated.¹⁶⁷

Finally, the normative river's ultimate conclusion is dam removal not construction. Many dams, especially smaller ones, have exceeded their planned useful life or no longer perform their intended functions. At the present time, Maine has removed some small, marginal hydroelectric dams,¹⁶⁸ and a dam removal program on the Elwha River in Washington State is going forward with all deliberate speed.¹⁶⁹ More ambitious dam removal proposals include breaching four dams on the Upper Snake River to support salmon runs in the Columbia River basin,¹⁷⁰ removing O'Shaughnessy Dam north of

165. Craig, *supra* note 4, at 825.

166. THE WORLD COMM'N ON DAMS, CLIMATE CHANGE AND DAMS: AN ANALYSIS OF THE LINKAGES BETWEEN THE UNFCCC LEGAL REGIME AND DAMS 5-6 (2000) (calls for further study because the international climate change regime makes no provision for exploring the relationship between dams and climate change).

167. Initially, an influential District of Columbia Circuit Court of Appeals decision rejected the argument that dams were point sources. *Nat'l Wildlife Fed'n v. Gorsuch*, 693 F.2d 156, 175 (D.C. Cir. 1982). Section 401 of the Clean Water Act requires that federal licenses obtain a state certification that the operation of the project will not violate state water quality standards, 33 U.S.C. § 1341(a)(1) (2010), but power releases were not considered pollution discharges because nothing was added to the water. *Nat'l Wildlife*, 693 F.2d at 174-75.

168. A Maine conservation organization, the Penobscot River Restoration Trust, raised 25 million dollars to supplement a 15 million dollar federal grant to purchase and remove two hydroelectric dams at the lower end of the river and to build a fish run around a third. The hope is that fish will return to the watershed. The river was once a major source of economic development as logs were floated from the headwater forests to downstream paper mills, but much of the resulting pollution has now been cleaned up. Katie Zezima, *Maine Conservationists Reach Milestone in Plan to Buy 3 Dams*, N.Y. TIMES, Aug. 22, 2008, at A16.

169. The efforts to remove the dam were triggered by a major Supreme Court decision that recognized on and off reservation tribal fishing rights for several reservations in Washington State including one reservation located downstream of two dams on the salmon-rich Elwha River. *See generally* *Washington v. Wash. State Commercial Passenger Fishing Vessel Ass'n*, 443 U.S. 658, 679 (1979). In 1992, Congress authorized the removal of the two dams, Elwha River Ecosystem and Fisheries Restoration Act, Pub. L. No. 102-495, 106 Stat. 3173, 3176 (1992), and the federal government purchased the dams in 2000; removal is slated to start in 2012, Christopher Dunagan, *Dam Closer to Coming Down; Price for Removal Shoots Up*, KITSAP SUN, Feb. 6, 2008, <http://www.kitsapsun.com/news/2008/feb/06/dam-closer-to-coming-down-price-for-removal-up/>. The removal will be the largest removal to date, and environmentalists are setting their sights on some of the nation's biggest dams.

170. The efforts to restore Salmon runs on the Columbia and its tributaries is an epic tale and illustrates the role that dam removal can play in the future resolution of such conflicts. After a court suggested that the federal government study removing eleven dams on the Columbia and the Snake Rivers, the Clinton Administration began a study to assess the consequences of breaching four major dams on the Snake River. However, the Bush II Administration rejected the idea, although, a 2002 Rand Corporation Report found that four Lower Snake River could be removed with no disruption to the regional economy. *See* Kim Murphy, *If Salmon Can't be Saved, Snake*

Yosemite National Park,¹⁷¹ and even removing the mighty Glen Canyon Dam on the Colorado.¹⁷²

2. Reservoir Reoperation

Compared to dam building, existing reservoir reoperation is a more likely federal GCC adaptation strategy, but fish, rather than farmers and cities may benefit most from this adaptation. Large blocks of water are stored in federal and state reservoirs for various purposes. As conditions change due to GCC, reservoir operators could alter release patterns based on new data and adjust the uses to which the water has traditionally been put. Reservoir reoperation is already in place; reservoir operators are altering flow release patterns to benefit fish, not electricity consumers.¹⁷³ The evolution of the Federal Energy Regulatory Commission's (FERC's) jurisdiction illustrates this development.

The Federal Power Act of 1920 authorized fifty-year renewable licenses for private power hydroelectric projects.¹⁷⁴ As the original licenses reached their golden anniversary, Congress amended the Federal Power Act to partially correct the Federal Power Act's

River Dams May Have to Go, L.A. TIMES, May, 18, 2009, <http://latimesblogs.latimes.com/greenspace/2009/05/salmon-recovery-snake-river-dams-columbia-river-endangered-species.html>; CHRISTOPHER G. PERNIN ET AL., GENERATING ELECTRIC POWER IN THE PACIFIC NORTHWEST: IMPLICATIONS OF ALTERNATIVE TECHNOLOGIES 32 (2002).

171. O'Shaughnessy Dam in the Hetch Hetchy Valley in Yosemite National Park supplies the city of San Francisco with water and power. The decision to build the dam was one of the great natural resource fights of the Conservation Era and still resonates in California. It played a major role in splitting the conservation movement into the utilitarian, multi-use, and preservation wings. See RICHARD WHITE, "IT'S YOUR MISFORTUNE AND NONE OF MY OWN": A NEW HISTORY OF THE AMERICAN WEST 413 (1991). California environmentalists have long dreamed on restoring the valley to John Muir's vision of it as the "flow of nature." MICHAEL P. COHEN, THE PATHLESS WAY: JOHN MUIR AND THE AMERICAN WILDERNESS 330 (1984). See also SPRECK ROSEKRANS ET AL., PARADISE REGAINED: SOLUTIONS FOR RESTORING YOSEMITE'S HETCH HETCHY VALLEY (2004) (promoting a comprehensive effort to simulate a removal debate). In 1987, President Reagan's Secretary of the Interior, Donald Hodel, was the first high-ranking official to suggest removal. Environmentalists viewed the suggestion as a ploy to split green northern California. In 2007, the Bush II Administration proposed a \$7,000,000.00 removal feasibility study but Senator Diane Feinstein, the former mayor of San Francisco and Hetch Hetchy defender was not amused. See *Statement of Senator Dianne Feinstein on Proposals To Tear Down O'Shaughnessy Dam*, U.S. SENATOR DIANE FEINSTEIN, CALIFORNIA (May 18, 2005), <http://feinstein.senate.gov/05releases/r-hetchhetch2.htm>.

172. See Scott K. Miller, *Undamming Glen Canyon: Lunacy, Rationality, or Prophecy?* 19 STAN. ENVTL. L.J. 121 (2000) (addressing proposals to take down Glen Canyon Dam). The issues dam removal raise are beyond the subject of this paper. See generally THE HEINZ CENTER, DAM REMOVAL RESEARCH: STATUS AND PROSPECTS (William L. Graf ed., 2002).

173. See, e.g., Brian D. Richter & Gregory A. Thomas, *Restoring Environmental Flows by Modifying Dam Operations*, 12 ECOLOGY & SOC'Y no. 1 2007 at 11-13, available at www.ecologyandsociety.org/vol12/iss1/art12/ES-2007-2014.pdf.

174. 16 U.S.C. § 799 (2010).

marginalization of environmental protection.¹⁷⁵ The Electric Consumers Protection Act of 1986 requires that FERC give equal weight to the benefits of relicensing the project and to “the protection, mitigation of damage to, and enhancement of, fish and wildlife (including related spawning grounds and habitat).”¹⁷⁶ Hydro-rich states such as Oregon have a similar rigorous review process for new and re-licensed non-FERC facilities.¹⁷⁷ In addition, FERC’s discretion was curtailed by PUD No. 1 of Jefferson County v. Washington Department of Ecology, which held that Section 401 of the Clean Water Act¹⁷⁸, that requires state certification that all federal permits meet state water quality standards, includes state imposed minimum flows for fish protection and aesthetic enhancement.¹⁷⁹ Section 401 certification applies to both public utilities and state-operated hydroelectric facilities and FERC must accept the Section 401 conditions imposed by the state.¹⁸⁰ Thus, the section provides an opportunity for environmental NGOs to impose minimum flow or environmental flow release conditions on FERC licensees.¹⁸¹ Finally, some courts have interpreted Federal Power Act to give FERC the authority to deny a license renewal application and to order that a dam be decommissioned if it has become uneconomic.¹⁸²

Reservoir reoperation will often require new federal legislation, thus exposing any reoperation plan to the vagaries of politics. Most reservoirs, especially those run by the Corps of Engineers, are managed according to narrow Congressional mandates which leave the operating agency little discretion to adjust to new conditions, and

175. *Id.* § 797(e).

176. *Id.* The first case to construe the amendment held that FERC must either prepare a comprehensive plan for the river or require permittees to evaluate the cumulative adverse environment impacts of the project. *Nat’l Wildlife Fed’n v. Fed. Energy Regulatory Comm’n*, 801 F.2d 1505, 1514-15 (9th Cir. 1986).

177. Adell Amos, *Freshwater Conservation in the Context of Energy and Climate Policy: Assessing Progress and Identifying Challenges in Oregon and the Western United States*, 12 U. DENV. WATER L. REV. 1, 122-31 (2008).

178. 33 U.S.C. § 1341(a)(1).

179. PUD No. 1 of Jefferson Cnty. v. Wash. Dept. of Ecology, 511 U.S. 700, 722-23 (1994). *See also*, Daniel Pollak, *S.D. Warren and the Erosion of Federal Preeminence in Hydropower Regulation*, 34 *ECOLOGICAL L. Q.* 763, 792-93 (2007) (explaining that some subsequent cases have extended the reach of § 401).

180. *See* S.D. Warren Co. v. Me. Bd. of Envtl. Prot., 574 U.S. 370, 373, 386 (2006)

181. *See, e.g.*, CAL. STATE WATER RES. CONTROL BD., ORDER WQ 2009-0007, RECONSIDERATION OF WATER QUALITY CERTIFICATION FOR THE RE-OPERATION OF PYRAMID DAM FOR THE CALIFORNIA AQUEDUCT HYDROELECTRIC PROJECT FEDERAL ENERGY REGULATORY COMMISSION PROJECT NO. 2426, 37-38 (2009) (ruling that license requires state to operate project to stimulate natural flow conditions “to the extent operationally feasible” to protect the federally listed Arroyo Toad).

182. *City of Tacoma v. Fed. Energy Regulatory Comm’n*, 460 F. 3d 53, 74 (D.C. Cir. 006) (holding that FERC has the authority to deny a new license); *see also*, *Jackson Cnty. v. Fed. Energy Regulatory Comm’n*, 589 F.3d 1284, 1291 (D.C. Cir. 2009) (FERC reasonably accepted surrender of license and plan to remove dam and powerhouse and had no power to compel transfer of license to county).

each reservoir has a separate operating regime.¹⁸³ Furthermore, the master manuals and legislation governing these reservoirs stress predictable releases for project purposes rather than variable releases for new consumptive and non-consumptive uses.¹⁸⁴ As an example, the fate of an ad hoc attempt to deal with a drought in the Atlanta area illustrates the need for fundamental reform of the laws that control the operation of federal reservoirs if they are to be part of any GCC adaptation strategy.

The levels in Atlanta's primary water supply reservoir dropped during a prolonged drought, but downstream interests pressed for releases to serve agriculture, navigation, and environmental conservation.¹⁸⁵ A federally brokered settlement among the Corps of Engineers, the state of Georgia, water suppliers, and several downstream utilities unilaterally shifted 248,858 acre feet of Lake Lanier water to supply the Atlanta metro area.¹⁸⁶ The resulting higher water prices would have been used to compensate the utilities for lost generation capacity, but downstream interests successfully challenged the settlement.¹⁸⁷ A federal circuit court of appeals held that the settlement violated the Water Supply Act¹⁸⁸ because the statute required Congressional approval for major operation changes.¹⁸⁹ The proposed reallocation was such a change because it would constitute over twenty-two percent of the reservoir's storage capacity, which would be the largest Corps reallocation by volume taken without Congressional approval, and might increase to thirty-five percent capacity in light of future growth of the region.¹⁹⁰

Despite the difficulties facing legislative reform of the reoperation of existing reservoirs, any federal legislation could reinforce the preference for non-consumptive over consumptive uses, and thereby strengthen potential GCC-adaptation strategies. For example, the American Clean Energy Security Act of 2009, which died in Congress, would have imposed new water resource planning mandates on the federal governments and states.¹⁹¹ Federal agencies would have had to prepare plans to increase the resiliency and the adaptive capacity of aquatic ecosystems.¹⁹²

183. See NICOLE T. CARTER, CONG. RESEARCH SERV., R41002, USING ARMY CORPS OF ENGINEERS RESERVOIRS FOR MUNICIPAL AND INDUSTRIAL WATER SUPPLY: CURRENT ISSUES 6-7 (2010).

184. See, e.g., 146 CONG. REC. 17090 (2000).

185. See sources cited *supra*, note 19.

186. *In re Tri-State Water Rights Litigation*, No. 3:07-md-01, slip op. at 56 (M.D. Fla. July 17, 2009).

187. *Se. Fed. Power Customers, Inc. v. Harvey*, 400 F.3d 1, 2 (D.C. Cir. 2005).

188. 43 U.S.C. § 390b(d) (2010).

189. *Se. Fed. Power Customers, Inc. v. Geren*, 514 F.3d 1316, 1318 (D.C. Cir. 2008).

190. *Id.* at 1324.

191. American Clean Energy and Security Act, H.R. 2454, 111th Cong. §§ 216, 453 (2009).

192. *Id.* § 477.

C. FEDERAL PREEMPTION

Federal preemption is another possible adaptation strategy both to construct new reservoirs and to reoperate existing ones. Most seasoned observers of western water politics would rate this forever-off any political agenda. Legendary New Mexico State Engineer Steve Reynolds, once said that the 1922 Colorado River Compact would be renegotiated when "pigs fly."¹⁹³ Despite this, Professor Robert Adler bravely asserts that there is a case for rethinking the third rail of western water politics.¹⁹⁴ He argues that the traditional deference to state water law is based on the assumption that states can best manage the resources within their borders, and GCC erodes this assumption.¹⁹⁵ Regional water shortages can raise national issues such as food shortages, and these shortages will intensify interstate conflicts. Thus, there will be pressure to intervene more directly in interstate water disputes through oversight of interstate markets, to revive dam building,¹⁹⁶ and perhaps even to put large scale wet-dry region water transfers, which came to an end in 1968 with the passage of the Wild and Scenic Rivers Act,¹⁹⁷ back on the agenda. In that same year, Senator Henry Jackson of Washington State banned all planning for Columbia River-Southwest transfers for ten years as the price for his support of the Central Arizona Project and transfers of this scale have not been on the agenda since that time.¹⁹⁸ For example, in 2008, Congress consented to the Great lakes and St. Lawrence Basin Compact, which makes it almost impossible to transfer water outside the Great Lakes Basin.¹⁹⁹ It is more likely that federal intervention will occur indirectly, but the option is now on the table.

IV. WATER CONSERVATION

Water conservation is an important GCC adaptation strategy that

193. Comment from Steve Reynolds, state engineer of New Mexico, to Dan Tarlock, at the Colorado River Working Symposium (May 23-26, 1983) (on file with author). See generally NEW COURSES FOR THE COLORADO RIVER: MAJOR ISSUE FOR THE NEXT CENTURY (Gary D. Weatherford & F. Lee Brown eds., 1986).

194. Robert W. Adler, *Climate Change and the Hegemony of State Water Law*, 29 STAN. ENVTL. L.J. 1, 4-8 (2010).

195. *Id.* at 31-32.

196. *Id.* at 55-56.

197. See generally Dan Tarlock & Sarah B. Van de Wetering, *Western Growth and Sustainable Water Use: If There Are No "Natural Limits," Should We Worry About Water Supplies?*, 27 Pub. Land & Resources L. Rev. 33, 44-45 (2006).

198. See Charles Coate, "The Biggest Water Fight in American History": Stewart Udall and the Central Arizona Project, 37 J. SW. 79, 93 (1995); NAT'L WATER COMM'N, WATER POLICIES FOR THE FUTURE 331 (1973) (recommending that interstate, interbasin transfers be subject to compensation for losses suffered in the area of origin—a constraint that will chill most proposals).

199. There is a very limited exception for "straddling cities." Great Lakes-St. Lawrence River Basin Resources Compact, Pub. L. No. 110-342, §§ 4.8-4.9, 122 Stat. 3739, 3752-753 (2008).

has long been on the water-use reform agenda because more water for human consumption and environmental protection can be generated at relatively low costs compared to dam construction by changes in agricultural and urban use patterns and technologies. For urban users, water suppliers can either mandate or induce individual users to use less water. The options include long term strategies such as marginal rather than average cost pricing and the promotion of xeriscaping,²⁰⁰ as well as short-term use bans. Agricultural water conservation includes more efficient irrigation technology, short or long term land retirement, and less subsidized water pricing. However, conservation has been difficult in the West because of the perverse incentives created by prior appropriation, and there has been little incentive to practice it in the East.

In the West, there has long been a tension between the beneficial use rule, which penalizes the wasteful use of water, and the “use-it-or-lose-it” aspect of prior appropriation.²⁰¹ The former encourages the use of the maximum, continuous amount of water possible given the technology of the use. “Use-it-or-lose-it” potentially chills conservation because the amount of the right may be permanently reduced. States have adopted a variety of legislation to reduce this tension, and increasingly judicial decisions encourage conservation.²⁰² However, conservation efforts have generally been ad hoc and have not been tied to any measurable targets. This section examines two conservation initiatives which push the envelope. The first is California’s recent legislation that sets statewide water use reduction targets for both agricultural and urban users. The second is a growing cluster of state legislation and judicial decisions that require cities to base water supply decisions on realistic demand and availability projections. This legislation, modest as it is, along with GCC has rekindled a long running debate about the type of settlement appropriate for water-stressed regions and may help push arid areas toward more GCC appropriate settlement, vegetation and water use choices.

200. For example, Austin, Texas evolved from offering rebates to individual homeowners to mandatory standards for commercial buildings. Tony T. Gregg, Dan Strub & Drema Gross, *Water Efficiency in Austin, Texas, 1983- 2005: An Historical Perspective*, 99 J. AM. WATER WORKS ASS’N. 76, 78 (2007), available at <http://www.awwa.org/publications/AWWAJournalArticle.cfm?itemnumber=5127&showLogin=N>. Xeriscaping is also a common element of municipal climate action plans. See, e.g., GEN. PLAN ADVISORY COMM. (GPAC) CLIMATE ACTION PLAN SUBCOMM., CITY OF SAN CARLOS CLIMATE ACTION PLAN 36 (2009), available at http://www.cityofsancarlos.org/generalplanupdate/whats_new/_climate_action_plan__adopted.asp.

201. *Frick Farm Props. v. Kan. Dep’t of Agric.*, 216 P.3d 170, 175, 181 (Kan. 2009) (taking advantage of nature’s bounty and switching to non-irrigated crops may result in a finding of abandonment through non-use).

202. E.g., *State Dep’t of Ecology v. Grimes*, 121 Wash.2d 459, 475 (1993) (consistency with local custom not sole measure of beneficial use); *Kazan (In re Estate of Steed) v. New Escalante Irrigation Co.*, 846 P.2d 1223, 1225 (Utah 1992) (noting that downstream user has no resource against upstream user who switched from flood to pressurized sprinkler irrigation).

A. CALIFORNIA GETS SEMI-SERIOUS ABOUT CONSERVATION

California's most recent efforts to "balance" the sustainability of the fragile Sacramento-San Joaquin Delta ecosystem with the water demands of the San Joaquin Valley and southern California include the first statewide water conservation targets. In 2009, the state legislature passed Senate Bill One (SB1) which creates a highly structured science-based planning process and parallel stakeholder and consultation processes, and potentially contains many major changes in future water use.²⁰³ Agricultural and urban conservation are key components of the new ecosystem-consumption balance strategy.²⁰⁴ The legislation sets a target of a twenty percent per capita reduction in urban water use by 2020.²⁰⁵ Urban water suppliers must develop use targets to meet the 2020 goal.²⁰⁶ They can be met from a menu which includes: an eighty percent reduction in the supplier's baseline per capita use; residential and landscaping performance standards; the use of ninety-five percent of a hydrologic region's Water Conservation Plan target; or methods development by the Department of Water Resources which take into account, inter alia, climatic differences, population density, regional plant water needs and any community hardships that result from the measures.²⁰⁷ However, customers already connected to an existing water supply system on January 1, 2010, cannot be compelled to install new equipment.²⁰⁸

Agricultural users, including Central Valley Project suppliers, must, inter alia; (1) accurately measure the volume of delivered water, (2) adopt a pricing structure "based at least in part on quantity delivered, (3) facilitate alternative uses for lands with high water duties, and (4) facilitate the use of recycled water."²⁰⁹ They must also prepare agricultural water management plans tailored to their service areas.²¹⁰ For decades economists have urged that suppliers move from subsidized and/or average cost pricing to marginal cost pricing.²¹¹ California's legislation mandates a pricing structure that

203. The Sacramento-San Joaquin Delta Reform Act portion of the legislation, section 85000 et seq. codifies many of the previous goals and action recommendations developed during the now defunct Bay-Delta Process. CAL. EPA, DEVELOPMENT OF FLOW CRITERIA FOR THE SACRAMENTO-SAN JOAQUIN DELTA ECOSYSTEM (DRAFT) 1, 10 (2010). Section 29702 adopts a policy of reduced reliance on the Delta to meet the state's future water needs. Anne E. Melley, *Pollution and Conservation Laws*, 50 CAL. JURIS. 3D § 455 (2010). See generally Ellen Hanak et al., *Myths of California Water- Implications and Reality*, 16 HASTINGS W.-NW. J. ENVTL. L & POL'Y 3 (2010).

204. Hanak, *supra* note 203, at 25.

205. S.B. No. 7 § 10608.16 (Cal. 2009).

206. *Id.*

207. *Id.* § 10608.16.

208. *Id.* § 10608.26(d).

209. *Id.* § 10608.48.

210. *Id.* § 10826.

211. E.g., James E.T. Moncur & Yu-Si Fok, *Water Pricing and Cost Data: Getting the*

moves in this direction by encouraging: (1) more efficient farm use, (2) the conjunctive use of groundwater, (3) the reduction of problem drainage, and (4) the adjustment of prices to seasonable conditions.²¹²

B. TYING URBAN GROWTH TO AVAILABLE SUPPLIES

As supplies shrink, changed land use and water use patterns can be important elements of GCC adaptation. For example, higher densities and more green space for recharge might make limited supplies stretch farther. A report by American Rivers and other water and environmental non-governmental organizations, documents how urban sprawl reduces aquifer recharge by paving over recharge areas.²¹³ An important first step in planning for GCC is linking water supply and land use planning. For decades, water, municipal, and public utility law have not provided incentives for cities to link water and growth. Water and land use planners have worked at different levels of government with little reason to talk to one another,²¹⁴ and cities have long operated on the assumption that, as water suppliers, they had a legal duty to anticipate future growth and assemble the necessary supplies to accommodate this growth.²¹⁵

Not only was there no incentive for cities to ask hard questions about how much growth a region's water balance might support, it was assumed illegal to even ask the question because water suppliers had a duty to accommodate unlimited growth. Water law supported the notion that the only option was to accommodate market driven growth because public utility law,²¹⁶ the common law of riparian rights, prior appropriation, and the law of groundwater capture combine to create a de facto "super preference" for growth accommodation.²¹⁷ To take one example, western courts developed doctrines to allow western cities to acquire and hold water rights for

Right Numbers, 92 J. CONTEMP. WATER RESOURCES EDUC, 35, 35-37 (1993).

212. S.B. No. 7 § 10608.48(c)(4) (Cal. 2009).

213. AM. RIVERS ET AL., *Paving Our Way to Water Shortages: How Sprawl Aggravates the Effects of Drought* 1 (2002), <http://www.smartgrowthamerica.org/waterandsprawl.html>; see also Sid Perkins, *Paved Paradise: Impervious Surfaces Affect a Region's Hydrology, Ecosystems—Even Its Climate*, 166 SOC'Y. FOR SCI. & PUB. 152, 152 (2004) available at <http://www.sciencenews.org/articles/20040904/bob8.asp>.

214. The historic disconnect between water and land use planning is explored in A. Dan Tarlock & Lora A. Lucero, *Connecting Land, Water, and Growth*, 34 URB. LAW. 971, 972-73 (2002); see generally Lora Lucero & A. Dan Tarlock, *Water Supply and Urban Growth in New Mexico: Same Old, Same Old, Or a New Era?*, 43 NAT. RESOURCES J. 803, 804 (2003).

215. *Lukrawka v. Spring Valley Water Co.*, 146 P. 640, 646 (Cal. 1915).

216. See Dan Tarlock & Sarah B. Van de Wetering, *Western Growth and Sustainable Water Use: If There Are No "Natural Limits," Should We Worry About Water Supplies?*, 27 PUB. LAND & RESOURCES L. REV. 33, 54, 58 (2006).

217. See A. Dan Tarlock & Sarah B. Van de Wetering, *Growth Management and Western Water Law: From Urban Oases to Archipelagos*, 5 HASTINGS W. NW. J. ENVTL. L. & POL'Y 173 (1999); A. Dan Tarlock, *We Are All Water Lawyers Now: Water Law's Potential But Limited Impact on Urban Growth Management*, in WET GROWTH: SHOULD WATER LAW CONTROL LAND USE 73-81 (Craig Anthony Arnold ed. 2005).

anticipated growth by largely exempting them from the central antimonopoly principle of prior appropriation: water rights cannot be held for speculative purposes.²¹⁸ The progressive growth²¹⁹ and growing cities doctrines²²⁰ allow a city to perfect a water right to the amount of water that they will need to meet reasonably anticipated future growth.

Several recent developments make it impossible for cities to ignore the link between adequate water supplies and land use development.²²¹ The water budgets for most rapidly growing areas are relatively fixed, and thus growth can only come at the expense of reallocating existing supplies.²²² GCC only reinforces the need to ensure that existing and future residents have secure supplies of water. In light of regional GCC impact projections, there should be greater integration of local water supply demands to the watershed of origin, and for greater adaptation cooperation among water supply agencies.²²³ States have at least five options to link water and land use policies: (1) continuing unlimited growth accommodation; (2) capping growth; (3) shifting the burden of supply acquisition to local governments and developers; (4) adopting aggressive, technological, and managerial water conservation initiatives such as information provision, xeriscaping requirements, marginal cost pricing, desalinization and the use of greywater;²²⁴ and (5) constraining growth to match available and projected supplies. The first option is still the de facto preferred option; the second is seldom considered or used,²²⁵ but the last three options are being implemented in various

218. See, e.g., *City of Thornton v. Bijou Irrigation Co.*, 926 P.2d 1, 37-38 (Colo. 1996).

219. E.g., *id.*; *City & Cnty. of Denver v. N. Colo. Water Conservancy Dist.*, 276 P.2d 992, 997 (Colo. 1954); *City & Cnty of Denver v. Sheriff*, 96 P.2d 836, 842 (Colo. 1939). See also *Reynolds v. City of Roswell*, 654 P.2d 537, 540 (N.M. 1982); *Wash. Dep't of Ecology v. Theodoratus*, 957 P.2d 1241, 1257-58 (Wash. 1998) (Sanders, J., dissenting); Janis E. Carpenter, *Water for Growing Communities: Refining Tradition in the Pacific Northwest*, 27 ENVTL. L. 127, 127 (1997); Malcolm Lindsey, *Legal Problems in City Water Supply*, 22 ROCKY MNTN. L. REV. 356, 356 (1950); Dennis J. Herman, *Sometimes There's Nothing Left to Give: The Justification for Denying Water Service to New Customers to Control Growth*, 44 STAN. L. REV. 429, 431 (1992).

220. E.g., *St. Onge v. Blakeley*, 245 P. 532, 539 (Mont. 1926); *N.M. ex rel. State Eng'r v. Crider*, 431 P.2d 45, 48-49 (N.M. 1967).

221. See, e.g., WESTERN GOVERNORS' ASS'N, *WATER NEEDS AND STRATEGIES FOR A SUSTAINABLE FUTURE: NEXT STEPS* 2-3 (2008), available at http://www.owrb.ok.gov/supply/ocwp/pdf_ocwp/WGAwater08.pdf.

222. NAT'L RESEARCH COUNCIL, *COLORADO RIVER BASIN WATER MANAGEMENT: EVALUATING AND ADJUSTING TO HYDROCLIMATIC VARIABILITY* 153 (2007).

223. See Patricia Mulroy, *Diving in the Deep End: Help Water Agencies Address Climate Change*, in OPPORTUNITY 08 (Brookings Inst., Wash., D.C.), Oct. 18, 2008, at 8, 12 available at

http://www.brookings.edu/papers/2008/0207_climate_change_mulroy_opp08.aspx.

224. See James Flanigan, *Keeping Water Pure is Suddenly in Demand*, N.Y. TIMES, June 19,

<http://www.nytimes.com/2008/06/19/business/smallbusiness/19edge.html>.

(noting that California has plans for 16 new desalination plants).

225. An influential Florida case found a growth cap imposed by a wealthy coastal

areas around the West and elsewhere.

1. Judicial Change

Courts have a limited but important role to play in strengthening the link in addition to enforcing linkage legislation. Recent judicial cases encourage a greater linkage between land use and water supply planning. Decisions in Colorado,²²⁶ Hawaii,²²⁷ and Washington State²²⁸ have shown some willingness to apply anti-speculative and the

community arbitrary. *City of Boca Raton v. Boca Villas Corp.*, 371 So. 2d 154, 157 (Fla. Dist. Ct. App. 1979). *But see City of Hollywood v. Hollywood, Inc.*, 432 So. 2d 1332, 1334-1336 (Fla. Dist. Ct. App. 1983) (upholding a 3,000-unit density cap for small strip of land on the Atlantic coastline); *Home Builders Ass'n v. Cape Cod Comm'n*, 808 N.E.2d 315, 321 (Mass. 2004) (ruling that a building permit cap was valid to protect the sole source aquifer for a town on Cape Cod); *cf. In re Bay-Delta Programmatic Envtl. Impact Report Coordinated Proceedings*, 184 P.3d 709, 721 (Cal. 2008) (illustrating a failed attempt to put issues such as climate change and growth limits into the planning mix). In a challenge to the *Bay Delta* programmatic EIA, an intermediate appellate court remanded the assessment because "CALFED appears not to have considered, as an alternative, smaller water exports from the Bay-Delta region which might, in turn, lead to smaller population growth due to the unavailability of water to support such growth." *Id.* This alternative had been considered in the early stages of the process but the use of water markets and land retirement was quickly rejected because any serious consideration of them exacerbated rather than reduced the ecosystem conservation-water supply conflicts that CALFED was formed to address. The California Supreme Court held that the final PEIS/R justified the exclusion of export restrictions because it would compromise the objective of water supply. *Id.* at 725.

226. *See Pagosa Area Water & Sanitation Dist. v. Trout Unlimited*, 170 P.3d 307, 313 (Colo. 2007).

227. Hawaii has applied the public trust doctrine to subordinate municipal claims to instream flow needs. *See generally In re Kukui (Molokai), Inc.*, 174 P.3d 320, 329 (Haw. 2007); *In re Wai'ola O Moloka'i, Inc.*, 83 P.3d 664, 691-92 (Haw. 2004); *In re Water Use Permit Applications*, 9 P.3d 409 (Haw. 2000). *See also* David L. Callies & Calvert G. Chipchase, *Water Regulation, Land Use, and the Environment*, 30 U. HAW L. REV. 49, 94 (2007) (criticizing the decisions for giving a strong but not absolute preference to non-economic uses of water and reducing, "nearly to the point of extinction" private water rights). *But see* Robin Kundis Craig, *Adapting to Climate Change: The Potential Role of State Common-Law Public Trust Doctrines*, 34 VT. L. REV. 781, 838-40 (2010) (noting that public trust doctrine supports adaptation to climate change and the Hawaii Supreme Court decisions demonstrate the doctrine's evolutionary and adaptive potential).

228. *Wash. Dep't of Ecology v. Theodoratus*, 957 P.2d 1241, 1245 (Wash. 1998); WASH. REV. CODE § 90.03.330(3) (2003) (beneficial use rather than capacity of a private municipal water system is the measure of the water right rather than the physical capacity of the system). However, the legislature reversed the decision, and the state now requires that municipal suppliers develop plans with new conservation standards and take actions that are consistent with local land use plans its service area. WASH. REV. CODE § 90.03.386 (2004). The legislation was challenged as a violation of separation of powers and due process. Transcript of Proceedings, *Lummi Nation v. Washington*, NO. 06-2-40103-4SEA, (Wash. Super. Ct. June 11, 2008),

available at
<http://www.ecy.wa.gov/programs/wr/rights/Images/pdf/muni/LUMMI0611.pdf>.
Id. at 13. In his oral opinion, Judge Jim Rodgers ruled that the legislature had enacted "retroactive statutes that unconstitutionally attempt to reinstate water rights that were invalidated [in *Theodoratus*]" because a legislature cannot redetermine adjudicative facts. *Id.* at 7. The most significant part

public trust doctrines to municipal water supply planning to require more accurate urban need projections and to modify public utility law to allow new land-water supply linkage. The Colorado Supreme Court has gone the farthest in tightening the standards for future municipal water right claims and requiring the incorporation of GCC scenarios. It twice rejected an application from a small city in southwestern Colorado for a conditional water right because the city had not adequately demonstrated a need for the water.²²⁹ A water court awarded two small districts serving Pagosa Springs a conditional water right for 29,000 acre feet, and return flows, of water with the right to continuously refill a reservoir based on a one hundred-year planning horizon.²³⁰ In *Pagosa I*, the Supreme Court, per Justice Hobbs, remanded the decision because of the water court's failure to make sufficient findings concerning the area's future growth projections.²³¹ Justice Hobbs reasoned that municipalities' statutory exemption from the need to have a vested legal interest in the lands served does not immunize governmental water supply agencies from the state's anti-speculative doctrines.²³² Cities must have considerable latitude to plan for future growth, but a supplier must still demonstrate three elements to make a non-speculative appropriation: (1) a "reasonable water supply planning period"; (2) the "substantial population projections" based on a normal growth rate for the planning period; and (3) the amount of available unappropriated water that is reasonably necessary for the reasonably anticipated governmental needs for the planning period, above its current supply.²³³ Governmental applicants must also demonstrate that it will put the water to actual beneficial use within a reasonable period of time.²³⁴

On remand, the Water Court declined to take new evidence and instead entered a new proposed degree awarding the District 23,500 acre feet of storage rights and reduced the planning horizon to 2055.²³⁵ The Colorado Supreme Court agreed that the Water Court properly reduced the planning horizon to 2055 but held that the District had still not carried its burden to show they had a non-

of the ruling was that legislature's extension of municipal water supply status to those serving fifteen or more units also violated the state's separation of powers doctrine because it was an attempt to overrule *Theodoratus* retroactively. See *id.* at 12-13. See generally Jeff B. Kray, *Municipal Water Law: Washington's Landmark Law Faces Challenges*, 44 WATER REPORT 1, 7 Oct. 2007, available at <http://www.thewaterreport.com/Issues%2041%20to%2044.html>.

229. *Pagosa Area (Pagosa I)*, 170 P.3d at 318; *Pagosa Area Water & Sanitation Dist. v. Trout Unlimited (Pagosa II)*, 219 P.3d 774, 781 (Colo. 2009).

230. *Pagosa I*, 170 P.3d at 309.

231. *Id.* at 309-10.

232. *Id.* at 315 (citing *City of Thornton v. Bijou Irrigation Co.*, 926 P.2d 1 (Colo. 1996)).

233. *Id.* at 309-10.

234. *Id.* at 310.

235. *Pagosa Area Water & Sanitation Dist. v. Trout Unlimited (Pagosa II)*, 219 P.3d 774, 776-77 (Colo. 2009).

speculative intent to put the water to beneficial use given the wide variation in area population projections between the District's projections and a state study.²³⁶ The city argued that the municipal conditional water appropriations are legislative or quasi-legislative acts immune from judicial review,²³⁷ but the court rejected the argument.²³⁸ Although the case may be limited to smaller cities with unrealistic growth projections, but it serves as warning to all cities that they must provide reliable growth projections to justify new water rights applications for future need.²³⁹

Courts in California and other states have modified the duty to serve rule to allow cities to subordinate utility service to land use decisions.²⁴⁰ The duty to serve rests on basic principles of fairness and estoppel, and it was designed primarily to protect those who had entered into a service relationship with a common carrier or were within the service area of a public utility but were denied service when the carrier or the utility was able or should have been able to provide service.²⁴¹ There is no need to make public water and sewer suppliers serve poorly cited or premature growth. Recent decisions recognize that cities need the discretion to defer development until the necessary water services are in place.²⁴² Cities also have the power to deny subdivision approvals for new subdivisions with water and sewer service that are inconsistent with a county's land use plan.²⁴³

236. *Id.* at 785.

237. *Id.* at 788.

238. *Id.*

239. For an alarmist reading of the case which suggests that *Pagosa I* and *Pagosa II* may be creating future Mesa Verdes see Casey S. Funk & Daniel J. Arnold, *Pagosa- The Great and Growing Cities Doctrine Imperiled: An Objective Look From a Biased Perspective*, 13 U. DENV. WATER L. REV. 283, 318-319 (2010).

240. *See infra* note 255.

241. A. Dan Tarlock & Sarah B. Van de Wetering, *Western Growth and Sustainable Water Use: If There Are No "Natural Limits" Should We Worry About Water Supplies?* 27 PUB. LAND & RESOURCES L. REV. 33, 58-59 (2006).

242. *See* Dateline Builders, Inc. v. City of Santa Rosa, 194 Cal. Rptr. 258, 266 (Cal. Ct. App. 1983); *Moore v. City Council of Harrodsburg*, 105 S.W. 926, 926 (Ky. 1907) ("In the absence of fraud, corruption, or arbitrary action, the judgment of the city officials as to [extension of water service] is beyond judicial control.").

243. In *Serpa v. County of Washoe*, 901 P.2d 690, 691-92 (Nev. 1995), the court held that Washoe County (Reno) can prohibit five acre or less subdivisions "until a new water source is available," and the county's action did not impair state water rights because the power to define rational growth "includes the ability of a county government to determine water availability for itself." *Schofield v. Spokane County*, 980 P.2d 277, 281 (Wash. Ct. App. 1999) holds that a county has the power to deny rezoning for riparian land because no central sewer system existed to serve the proposed ranchettes. A state order to a financially strapped city to improve its antiquated sewage system was sufficient reason to terminate previously extraterritorial service in *City of Attalla v. Dean Sausage Co.*, 889 So.2d 559, 571 (Ala. Civ. App. 2003). *See also* *State ex rel. Gilbert v. Cincinnati*, 928 N.E.2d 706, 712 (Ohio, 2010) (no taking when city refused to extend sewer service because municipalities not obligated to construct sewers).

2. Legislation

The most important GCC adaptation development is legislation that imposes duties on cities and developers to guarantee residents reliable, long term, drought “resistant” supplies. These “show me” statutes do not fundamentally challenge the idea that climate and water balances should not be a limit on growth. Arizona and California now view the existence of an adequate, long-term, drought-proof supply of water as an urban consumer entitlement.²⁴⁴ The statutes inform public water suppliers and major developers that water supply assessments can no longer be based on hydrologically weak assumptions about supply availability.²⁴⁵ Instead, they must be based on realistic assessments of what water will be available under worst-case conditions, which include serious droughts caused by GCC.²⁴⁶ The statutes have been characterized as consumer protection statutes.²⁴⁷ This is an accurate description of their purpose, but they are likely to have impacts beyond their immediate goal of assuring new and existing urban water users long-term dependable supplies. They will increasingly produce water supply assessments that expose the long risks of supply interruption, and will force some areas to take more aggressive steps to balance growth with supply.

Arizona enacted its statute as part of the price for construction of the federally-funded Central Arizona Project.²⁴⁸ The state had to agree to stop mining its aquifers to support urban growth and in 1980 adopted the Groundwater Management Act.²⁴⁹ The Act imposes a duty on all new developments in the four groundwater basins included within the designated Active Management Areas (AMAs) to establish “that an applicant will have sufficient supplies of water that will be continuously available for 100 years.”²⁵⁰ The rules have a number of major weaknesses. They initially set off a municipal race to acquire new supplies in northern rural counties, and they did not apply to rapidly growing communities outside of one of the four designated AMAs.²⁵¹ In 2009, the legislature took a very tentative step to address the problem of subdivisions with risky water supplies. Any person can now request that a public or private water supplier, including those using surface or Colorado River water, outside of an

244. Tarlock & Van de Wetering, *supra* note 241, at 62.

245. Tarlock & Van de Wetering, *supra* note 241, at 65.

246. Tarlock & Van de Wetering, *supra* note 241, at 65.

247. Lincoln L. Davies, *Just a Big, “Hot Fuss”? Assessing the Value of Connecting Suburban Sprawl, Land Use, and Water Rights Through Assured Supply Laws*, 34 *ECOLOGY L.Q.* 1217, 1231-32 (2007).

248. ARIZ. MUN. WATER USERS ASS’N, WATER POLICY RESOLUTIONS ADOPTED BY THE AMWUA BOARD OF DIRECTORS, at Issue A (2010) available at, <http://www.amwua.org/pdfs/Final%20Combined%20Files%20for%202010.pdf>

249. *Id.*

250. ARIZ. ADMIN. CODE § R12-15-717(A) (2010).

251. See Susanna Eden et al., *Agricultural Water to Municipal Use* 58 WATER REPORT 9, 12-13 (2008), available at <https://cals.arizona.edu/azwater/files/finalathchapter4.pdf>.

AMA to “provide a written statement describing the water supply status of real property within the service area.”²⁵²

California’s assured water supply statute grew out of a “green” water supply agency’s refusal to extend service to a new development outside its service area.²⁵³ The law only applies to developments over 500 units and certain industrial facilities.²⁵⁴ The legislation defines a sufficient supply as the total supply available during “normal, single-dry, and multiple-dry years within a 20-year projection.”²⁵⁵ To calculate this, the supplier must include a number of contingencies such as the availability of water from water supply projects, “federal, state, and local water initiatives such as CALFED, and water conservation.”²⁵⁶ Water suppliers must prepare Urban Water Management plans.²⁵⁷ Subsequent water supply assessments must either be consistent with these plans or meet the available water supply criteria and may trigger a duty to acquire additional water supplies.²⁵⁸

These duties will be enforced primarily under the California Environmental Quality Act.²⁵⁹ Courts have shown a willingness to invalidate “unrealistic” supply projections,²⁶⁰ and cities are starting to deny or delay development permits.²⁶¹ Remanding impact

252. ARIZ. ADMIN. CODE § 45-108.06.

253. See generally A. Dan Tarlock, *How California Local Governments Became Both Water Suppliers and Planners*, 4 GOLDEN GATE U. ENVTL. L.J. 7, 23-25 (2010).

254. *Id.* at 24.

255. CAL. GOV’T CODE § 66473.7(a)(2) (West 2009).

256. *Id.* § 66473.7(a)(2)(D). CALFED is a partnership of 25 California State and Federal government agencies.

257. See CAL. WATER CODE § 10910(c) (West 2010).

258. *Id.* § 10911.

259. CAL. CODE REGS. tit. 14, § 15155 (2007).

260. See *Vineyard Area Citizens for Responsible Growth, Inc. v. City of Rancho Cordova*, 150 P.3d 709, 720-21 (Cal. 2007). See also *Santa Clarita Org. for Planning the Env’t v. Cnty. of Los Angeles*, 68 Cal. Rptr. 3d 449, 457-58 (Cal. Ct. App. 2007); *In re Bay-Delta Programmatic Envtl. Impact Report Coordinated Proceedings*, 184 P.3d 707, 726-27 (Cal. 2008) (challenging the programmatic impact statement for the Bay Delta because it failed to identify a specific source of water to protect the quality of the Delta environment and reaffirming the duty to identify the sources of specific supply for site-specific projects (although the court held that the EIR’s region by region analysis of potential sources was sufficient for a programmatic analysis which allowed for tiering and distinguished the Bay-Delta programmatic EIR from the site specific EIR in *Vineyard*)).

261. *Proposed Inland Empire Distribution Center Delayed Due to Potentially Inadequate Water Supply*, LEGAL NEWS: ENVTL. STORMWATER (Foley & Lardner LLP, Chicago, Ill.), Feb. 1, 2008, at 2, available at http://www.foley.com/publications/pub_detail.aspx?pubid=4742 (“The Eastern Municipal Water District (EMWD) has decided to delay approval of a water supply assessment for the proposed Skechers U.S.A., Inc., distribution facility in Rancho Belago in the Inland Empire because it could not promise to deliver water to serve the proposed development.”). See also *MONTEREY PENINSULA WATER MGNT. DIST. BD., MPWMD APPLICATION NO. 20080915MBS-L4, ADOPTION OF FINDINGS OF DENIAL OF APPLICATION TO AMEND CALIFORNIA AMERICAN WATER DISTRIBUTION SYSTEM*, (2009), <http://www.mpwmd.dst.ca.us/asd/boardpacket/2009/20090326/14/item14.htm> (denying permit for ninety acre feet per year to serve ecoresort because State

assessments for better documentation and analysis will not, in and of itself, promote GCC adaptation. However, it is a short step from requiring a more realistic assessment of available water supplies to requiring that municipalities factor the increased risks likely to result from climate change and to display the range of adaptation strategies that they are considering. And that precedent already exists. California and other states are already factoring these into state water planning and water project operation scenarios, and this is now a legal duty. A Fish and Wildlife Service Biological Opinion for California Bay Delta Smelt was invalidated, in part, because the Service based the opinion on the continuation of historic flow patterns rather than reduced ones caused by climate change.²⁶²

Colorado followed the lead of Arizona and California with a more modest linkage law. Colo. Rev. Stat. 29-20-301,²⁶³ adopted in 2008, conditions the approval of new residential developments on a finding that the developer has secured an adequate water supply.²⁶⁴ The duty is triggered by a development, which includes a new water use for "fifty single-family equivalents, or fewer, as determined by the local government."²⁶⁵ An adequate supply is defined as one that is sufficient for the build-out of the proposed development, including "reasonable conservation measures and water demand management to account for hydrologic variability."²⁶⁶ This definition, however, is broad enough to include a reasonable range of global climate change scenarios. A developer who proposes to supply the development itself must submit a detailed report from a professional engineer or water supply expert that identifies, inter alia, the physical source of supply and estimated yield "under various hydrologic conditions."²⁶⁷ If a water supply entity will furnish the water, a shorter letter by a professional engineer or water supply expert will suffice.²⁶⁸ It is unlikely that Colorado courts will play a significant role in enforcing the statute. The legislature has attempted to immunize adequacy

Water Resources Control Board order required that proposed source of supply, a well near the Monterey River, would have to be shut down during high flow season to maximum basin storage for dry season.).

262. Natural Res. Def. Council v. Kempthorne, No. 1:05-cv-1207 OWW TAG, 2007 WL 1623826, at *1 (E.D. Cal. June 1, 2007). See generally Robin Kundis Craig, *Climate Change, Regulatory Fragmentation, and Water Triage*, 79 U. COLO. L. REV. 825, 825-26 (2008).

263. COLO. REV. STAT. § 29-20-301 (2008).

264. *Id.* § 29-20-303(1). The approval can be attached to the standard land use instruments, rezonings, planned unit development approvals, conditional uses and subdivision maps, at either the preliminary or final approval stage. *Id.* § 29-20-103(1). Local governments get only one bite at the apple unless water demands or supply materially change during the approval process. *Id.* § 29-20-303(1). Cf. Moss v. Cnty. of Humboldt, 76 Cal. Rptr. 3d 428, 443-46 (Cal. Ct. App. 2008) (requiring supplemental environmental review to analyze project's impact on water shortages downstream).

265. COLO. REV. STAT. § 29-20-103(1) (2008).

266. *Id.* § 29-20-302(1).

267. *Id.* § 29-20-304(1).

268. *Id.* § 29-30-304(2).

decisions from judicial review and to limit the burden on permit applicants. Approval is based on the local government's "sole discretion," and the record is limited to the previously mentioned reports and letters and whether the developer has paid the necessary fees to the water supplier.²⁶⁹ The local government also has the discretion to ask for other information that it deems relevant.²⁷⁰

Linkage laws exist in other states and municipalities. Florida's concurrency legislation requires that comprehensive land use plans have a water supply element,²⁷¹ and local governments cannot issue certificates of occupancy without an adequate water supply in place.²⁷² Wonderfully dry Santa Fe, New Mexico has gone further and has adopted an urban water balance account, in which future growth is limited to the maintenance of the balance,²⁷³ and is coming close to making water availability the primary determinant of growth.²⁷⁴ The city first restricted new water connections outside city limits unless the customer had a valid, preexisting agreement for water service.²⁷⁵ Next, the city's Water Budget Administrative Ordinance, enacted in 2003, required all new projects within the city to offset a project's water budget by retrofitting existing toilets with high-efficiency units.²⁷⁶ The 2005 Water Rights Transfer Ordinance requires new large construction projects to transfer water rights to the city prior to issuing building permits.²⁷⁷

VI. CONCLUSION

In addition to untested legal regimes, efforts to address GCC must confront many barriers. The most significant of these is the growing gap between what a vast majority of the scientific community believes is happening and must be done, and public opinion. In the United States, support for climate change action began to ebb in 2009 as skepticism about its occurrence began to increase.²⁷⁸ Even though a majority of Americans believe that climate change is a serious problem, the percentage of those who see it as a very serious problem is the third lowest in the world; only China and Russia report lower

269. *Id.* § 29-30-305(1).

270. *Id.* § 29-30-305(1)(d).

271. FLA. STAT. § 163.3167(13) (2010).

272. *Id.* § 163.3180(2)(a). See also Christine A. Klein, Mary Jane Angelo & Richard Hamann, *Modernizing Water Law: The Example of Florida*, 61 FLA. L. REV. 403, 448-55 (2009).

273. Tarlock & Van de Wetering, *supra* note 217, at 65.

274. See Kyle Harwood, *The Evolution of Wet Growth Regulations: City of Santa Fe*, 7 WATER RESOURCES IMPACT 1, 5 (2005).

275. *Id.* at 6.

276. *Id.*

277. *Id.*

278. Barry G. Rabe & Christopher P. Borick, *The Climate of Belief: American Public Opinion on Climate Change*, ISSUES IN GOVERNANCE STUDIES (Brookings Inst., Wash., D.C.), Jan. 2010, at 2-7, available at http://www.brookings.edu/~media/Files/rc/papers/2010/01_climate_rabe_borick/01_climate_rabe_borick.pdf.

poll numbers.²⁷⁹ This feeds into the next barrier. To address climate change, actions must be taken that take effect, if ever, far in the future, but the general population and politicians can only effectively concentrate on the very short term.²⁸⁰ As the late Prime Minister of England, Harold Wilson, said: "A week is a long time in politics."²⁸¹ These two factors, combined with intense resistance by large sectors of the hydrocarbon energy industry, have led to the complete failure of any national mitigation program. This failure puts the entire burden on adaptation, but the question arises: Will these factors also stymie effective adaptation? The lessons of addressing sustainable development, both positive and negative, are instructive.

In the late 1990s, sustainable development emerged as a possible fundamental principle of environmental law. Despite the principle's ambiguity, Professor J.B. Ruhl argued that it would evolve into hard law through a seven-step process.²⁸² Its emergence as widely accepted norm would ultimately make opposition untenable. Who would openly advocate unsustainable development? At this point, non-action would no longer be tenable and would be seen as a "significant deficiency."²⁸³ Governments would next establish the norm as a policy goal and begin to apply it to prohibit unsustainable actions.²⁸⁴ The final stage would be the emergence of "measurable, rationalized, routine" legal standards.²⁸⁵ GCC presents more complex evolutionary problems because all policy responses are science-driven to a greater extent than sustainable development, which is hybrid ethical-economic construct.²⁸⁶ Still, it is possible to posit an analogous progression from the articulation of the scientific case for action, an intense period of denial and debate, to the triumph of the scientific imperative of adaptation that leads to a widespread public demand, or at least acceptance of the need, for effective action. At this point, adaptation strategies and duties would be incorporated into water planning first as an additional justification for an action and then as

279. WORLD BANK, PUBLIC ATTITUDES TOWARD CLIMATE CHANGE: FINDINGS FROM A MULTI-COUNTRY POLL 52 (2010), available at http://siteresources.worldbank.org/INTWDR2010/Resources/CC_Poll_Report_July_01_2010.pdf.

280. See Richard J. Lazarus, *Super Wicked Problems and Climate Change: Restraining the Present to Liberate the Future*, 94 CORNELL L. REV. 1153, 1173-79 (2009).

281. See, e.g., Daniel Tarschys, *Time Horizons in Budgeting*, 2 OECD J. BUDGETING 77, 78 (2002) available at <http://www.oecd.org/dataoecd/1/42/43506311.pdf>.

282. J.B. Ruhl, *The Seven Degrees of Relevance: Why Should Real-World Environmental Attorneys Care Now About Sustainable Development Policy?*, 8 DUKE ENVTL. L. & POL'Y F. 273, 277-93 (1998).

283. *Id.* at 283.

284. *Id.* at 284-85.

285. *Id.* at 289-90.

286. Klaus Bosselmann, *Ecological Justice and Law*, in ENVIRONMENTAL LAW FOR SUSTAINABILITY 129, 150 (Benjamin J. Richardson & Stepan Wood eds., 2006) ("The famous Brundtland definition contains two ethical elements that are widely accepted as being essential to the idea of sustainable development: concern for the poor . . . and concern for the future . . .").

hard stand-alone duties. A long period of experimentation and evaluation would follow as new scientific evidence developed. During this period, new climate change-driven water law rules might emerge.

The lesson of sustainable development illustrates that the path to this objective will be twisty and rocky. At the federal level, sustainable development has stalled at the level where it is mentioned but seldom actually applied.²⁸⁷ However, the idea has taken root in many industries, services, and lower levels of government, especially municipalities.²⁸⁸ With respect to water and GCC adaptation, it has proven harder to move to the no-tenable-opposition stage. The general mitigation debate cannot seem to leave the denial and debate stage, but this stasis may not impact adaptation because the water community, especially in the West, seems to have accepted the idea that GCC will impact water, that these impacts will often be negative, and thus some response is necessary. Water officials, planners, users, and NGOs are including possible climate change scenarios in a variety of state and local plans. The federal water agencies such as the Bureau of Reclamation and the Corps of Engineers are considering the impact of climate change on the operation of their projects.²⁸⁹ GCC is also increasingly being cited as an additional justification for legislation²⁹⁰ and judicial decisions.²⁹¹ The question now is, what is the next stage? At this point, we do not have the technical capability to make firm forecasts at the small geographical scales relevant to

287. See ENVTL. LAW INST., AGENDA FOR A SUSTAINABLE AMERICA 15 (John Dernbach ed., 2009) (“[T]he United States is not on the verge of actually becoming sustainable.”).

288. See Jonathan D. Weiss, *Local Governance and Sustainability: Major Progress, Significant Challenges*, in AGENDA FOR SUSTAINABLE DEVELOPMENT 43, 43 (John Dernbach ed., 2009); Ira Robert Feldman, *Business and Industry: Transitioning to Sustainability*, in AGENDA FOR SUSTAINABLE DEVELOPMENT 71, 71 (John Dernbach ed., 2009).

289. Omnibus Public Land Management Act of 2009, Pub. L. No. 111-11, §§ 9502-9503, 146 Stat. 1, 342 (requiring that the Bureau of Reclamation assess the projected climate change impacts on eight Reclamation functions in eight major river basins in which the Bureau operates). *Id.* §§ 9506, 9508 (requiring the Bureau to describe the risks on its water delivery and management functions posed by global climate change by 2011 and to submit a comprehensive national water availability assessment report to Congress by 2012). *Id.* § 9507 (requiring the United States Geological Survey to implement an enhanced stream flow measurement system incorporating the suggestions of a 2004 National Research Council White Paper). See generally NAT'L RESEARCH COUNCIL, RIVER SCIENCE AT THE U.S. GEOLOGICAL SURVEY 106-08 (2007) available at, <http://www.nap.edu/catalog/11773.html>.

290. See Great Lakes-St. Lawrence River Basin Water Resources Compact, Pub. L. 110-342, 122 Stat. 3739 (2008) (approving an interstate compact among the eight Great Lakes basin states, which makes it extremely difficult to divert water outside the basin). See also A. Dan Tarlock, *The International Joint Commission and Great Lakes Diversions: Indirectly Extending the Reach of the Boundary Waters Treaty*, 54 WAYNE L. REV. 1671, 1688-89 (2008) (stating one of the justifications for the Compact offered in an influential International Joint Commission was that projected climate change-induced lake level fluctuations counseled against disturbing the status quo).

291. Climate change supports the need for the accurate municipal growth projections that form the basis for conditional appropriations. See *Pagosa Area Water & Sanitation Dist. v. Trout Unlimited*, 170 P.3d 307, 316 (Colo. 2007).

water managers, although projects are getting finer.²⁹² Until water managers and users can make more accurate projects, we will remain in the “low hanging fruit” stage. Climate change will be used as an additional justification for actions that conserve water, support aquatic ecosystem maintenance, or support more water efficient growth patterns.

As the negative impacts of GCC begin to kick in, water law is likely to move in two inconsistent directions depending on the geographical and political context of the dispute. The first direction is more litigation. Courts will be asked to revisit many fundamental doctrines of water law as they grapple with challenges to the status quo. The second direction is more out-of-the-box solutions that involve consensual modifications of existing doctrines.²⁹³ It is premature to predict the balance between legislative and judicial responses to the pressures of adaptation, but none of the elements identified in this survey of the common law of riparian and prior appropriation are insurmountable barriers to GCC adaptation. Since it emerged as a discrete area of law in the second half of the nineteenth century, water use patterns have substantially changed. Water law has, albeit imperfectly, been able to adapt to these changes or has not blocked the necessary legislative and negotiated adjustments.

292. See, e.g., *Evaluating Sustainability of Projected Water Demands in 2050 Under Climate Change Scenarios*, GIS & SCI. (July 21, 2010, 12:43 PM), <http://gisandscience.com/2010/07/21/evaluating-sustainability-of-projected-water-demands-in-2050-under-climate-change-scenarios/> (discussing a recent Natural Resources Defense Council study which predicts that one-third of all counties in the lower 48 states will face higher risks of water shortages by mid-century as the result of global warming and some 400 of these counties will face extremely high risks of water shortages).

293. See David H. Getches & A. Dan Tarlock, *Water Law and Management: An Urbanizing and Greener West Copes with New Challenges*, in *THE EVOLUTION OF NATURAL RESOURCES LAW AND POLICY* 316-17 (Lawrence J. MacDonnell & Sarah F. Bates eds., 2010).

