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The Colorado River and the Inevitability of Institutional Change

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The Colorado River and the Inevitability of Institutional Change[1]

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I. INTRODUCTION

The Colorado River is one of the most thoroughly studied, debated, and contested natural resources in the world, and for good reason. For residents of the seven basin states and northwestern Mexico, it is both an economic lifeline and a cultural marker, massively engineered to provide a steady flow of water and hydropower for cities, farms and industry, while retaining enough wildness to showcase a stunning diversity of physical, environmental, and recreational amenities. By almost any standard, it is the jewel of the American Southwest—and it is in trouble. The primary focus of the struggles and investments, from a political, legal, economic and engineering nature, has been to utilize the river as a water supply source, even when this has meant sacrificing other values and uses. But the ability of the river to fulfill this central function is increasingly doubtful and, for a variety of reasons, is likely to become further compromised should we continue along the current management pathway.

There are several related fundamental problems in the Colorado: (1) the complex body of laws and agreements known as the Law of the River promises more water than has ever existed; (2) the shortfall between allocated water and real water is projected to grow in the coming decades; and (3) the distribution of the inevitable shortage is fraught with interstate inequities, legal ambiguities, and

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1. This article is largely an amalgam of two white papers, namely: The Colo. River Governance Initiative of the U. of Colo., *Rethinking the Future of the Colorado River* (Dec. 2010) (available at http://www.rlch.org/archive/wp-content/uploads/2010/12/CRGI-Interim-Report.pdf); and Ctr. for Nat. Resources & Envtl. Policy at the U. of Mont. & Carpe Diem West, *Thinking Like a River Basin: Leaders' Perspectives on Options and Opportunities in Colorado River Management* (Apr. 2011) (available at http://www.carpediemwest.org/colorado-report).

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management uncertainties. Perhaps more fundamentally, these problems have, to this point, overwhelmed the governance arrangements in the basin. Historically, political leaders have lacked incentives to acknowledge—let alone tackle—such sensitive issues. Meanwhile, recourse to interstate litigation is near-universally panned as a costly, uncertain, and likely inadequate solution.[3] The hard reality of rapidly declining reservoirs, however, has pushed basin leaders to increasingly look for processes and ideas to resolve these longstanding problems.

II. WATER ALLOCATION AND UTILIZATION

A. *An Overview of the Law of the River*

The Colorado River and its tributaries originate from snowmelt high in the Rocky Mountains. The river flows southwest through the states of Colorado, Wyoming, Utah, New Mexico, Nevada, Arizona, and California, and then, for a short distance, across the international border into Mexico.[4] Along its path, the Colorado is controlled by approximately two-dozen significant storage and diversion projects, including Lake Powell (formed by Glen Canyon Dam) and Lake Mead (formed by Hoover Dam). These reservoirs have transformed the region and the river in countless ways, including altering the Colorado from an unpredictable and sediment-heavy warm-water river to an elaborate plumbing system that helps to supply 30 million people with cold, clear water.[5]

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3. Ctr. for Nat. Resources & Envtl. Policy at the U. of Mont. & Carpe Diem West, *Thinking Like a River Basin: Leaders' Perspectives on Options and Opportunities in Colorado River Management* (Apr. 2011) (available at http://www.carpediemwest.org/colorado-report) [hereinafter "CNREP"].

4. *See e.g.* Peter Gleick, *The World's Water: A Biennial Report on Freshwater Resources* (Island Press 2002); Dale Pontius, *Colorado River Basin Study: Final Report* (1997).

5. U.S. Bureau of Reclamation, *Colorado River Basin Supply and Demand Study: Basin Study Program* 1 (2009) (available at http://www.usbr.gov/WaterSMART/docs/Colorado%20River.pdf); *See e.g.* Robert Adler, *Restoring the Environment and Restoring Democracy: Lessons from the Colorado River*, 25 Va. Envtl. L.J. 55 (2007); Steven Carothers & Bryan Brown, *The Colorado River through the Grand Canyon: Natural History and Human Change* (U. Ariz. Press 1991).

The Law of the River governs allocation, use, and management of the Colorado River.[6] By some accounts, the law features at least 50 key elements,[7] including interstate compacts, treaties (with Mexico and Indian tribes), Congressional legislation, and numerous court decisions. The seminal document within the Law of the River is the Colorado River Compact (the "Compact"), signed in 1922.[8] The seven basin states are legally bound by the Compact's quantitative apportionments, which are allocated in perpetuity.[9] Despite the intentions of its drafters, the Compact has spurred highly contentious litigation and numerous supplemental agreements. Additionally, as discussed later, numerous ambiguities and omissions remain in the Law of the River.

The primary purposes of the Compact were the division of the river's flow between the states of the Upper Basin (Colorado,

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6. The Law of the River is the subject of a vast body of literature. Legal overviews are provided by many authors. *See generally* David Getches et al., *The Law of the Colorado River: Coping with Severe Sustained Drought,* 31 J. Am. Water Res. Assn. 825 (1995); James Lochhead, *An Upper Basin Perspective on California's Claim to Water from the Colorado River – Part I: The Law of the River*, 4 U. Denver Water L. Rev. 290 (2001); James Lochhead, *An Upper Basin Perspective on California's Claims to the Colorado River Part II: The Development, Implementation and Collapse of California's Plan to Live within its Basic Apportionment*, 6 U. Denver Water L. Rev. 318 (2003). Excellent historical reviews of key events and institutional innovations are provided by many authors. *See generally* Norris Hundley, Jr., *Dividing the Waters: A Century of Controversy between the United States and Mexico* (U. Cal. Press 1966); Norris Hundley, Jr., *Water and the West: The Colorado River Compact and the Politics of Water in the American West* (2d ed., U. Cal Press 2009); Norris Hundley, Jr., *The Great Thirst: Californians and Water* (2d rev. ed., U. Cal. Press 2001); Marc Resiner, *Cadillac Desert: The American West and Its Disappearing Water* (Penguin Group 1986); Philip L. Fradkin, *A River No More: the Colorado River and the West* (U. Cal. Press 1981).

7. James Lawrence Powell, *Dead Pool: Lake Powell, Global Warming, and the Future of Water in the West* 230 (U. Cal. Press 2008).

8. Colorado River Compact, Colo. Rev. Stat. Ann. §§ 37-61-101 to 37-61-104 (West 2010) [hereinafter "Compact"].

9. For a history of the Compact negotiations, *see generally* Hundley, *Water and the West: The Colorado River Compact and the Politics of Water in the American West*, *supra* n. 6; Daniel Tyler, *Silver Fox of the Rockies: Delphus E. Carpenter and Western Water Compacts* (U. Okla. Press 2003).

Wyoming, Utah, and New Mexico) and Lower Basin (Arizona, California, and Nevada),[10] the elimination of current and future interstate disputes, and the promotion of orderly river development and management.[11] Some of the key provisions include:

- Article III(a) allocates 7.5 million acre-feet ("MAF") per year of consumptive use to each Basin, while Article III(b) allows the Lower Basin to increase its consumptive use by an additional 1 MAF/year.[12]
- Article III(c) provides for administration of any later apportionment to Mexico (Similarly, Article VII anticipates, but does not otherwise address, future apportionments to Indian tribes.).[13]
- Article III(d) calls for a minimum flow volume at Lee Ferry (the dividing point between the two basins) of 75 MAF for any period of ten consecutive years.[14]
- Article VIII describes water rights already being exercised at the time of the agreement (so-called Present Perfected Rights) as being "unimpaired" by the Compact apportionment.[15]

Congress ratified the Compact as part of the Boulder Canyon Project Act of 1928.[16] In addition to the Compact, the Act authorized the construction of the Boulder (now Hoover) Dam and All-American Canal and provided the three-state division of the Lower Basin apportionment.[17] As later confirmed by the U.S. Supreme Court in *Arizona v. California*, the apportionment annually provides 4.4 MAF of water to California, 2.8 MAF to Arizona, and 0.3 MAF

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10. The Compact uses the terms "Division" and "Basin" to distinguish between the two groups of states. "Basin" encompasses drainage areas, while "division" is limited to political jurisdictions. However, for the purpose of this article, the terms will be used synonymously. Compact, *supra* n. 8, at art. II.

11. Compact, *supra* n. 8, at art. 1.

12. *Id.* at art. III.

13. *Id.* at art. III, VII.

14. *Id.* at art. III(d).

15. *Id.* at art. VIII.

16. Boulder Canyon Project Act, 43 U.S.C. § 617 (2006).

17. Compact, *supra* n. 8, art. I, art. IV(a).

to Nevada.[18] The 1944 Treaty with Mexico provides the downstream nation with a minimum apportionment of 1.5 MAF annually.[19] The broad contours of the interstate apportionment were finalized in 1948 in the Upper Colorado River Basin Compact, which allocates the Upper Basin apportionment by percentages: 51.75% for Colorado, 23% for Utah, 11.25% for New Mexico, and 14% for Wyoming.[20] As tribal rights are quantified in court cases (*see e.g. Arizona v. California*[21]) and negotiated settlements,[22] tribes subtract their allocation from the state in which their reservation is located.

The Law of the River also includes several acts of Congress relating to water project authorization and operation. Examples include the Colorado River Storage Project Act of 1956,[23] which provided an Upper Basin development plan and authorized the construction of Glen Canyon Dam (Lake Powell), and the Colorado River Basin Project Act of 1968,[24] which authorized several projects, including the Central Arizona Project ("CAP"), and provided a framework for long-range reservoir operations. In 2007, the basin states agreed to the "Colorado River Interim Guidelines for Lower Basin Shortages and Coordinated Operations for Lake Powell and

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18. *Ariz. v. Cal.*, 373 U.S. 546, 576–578 (1963).

19. *Treaty with Mexico Respecting Utilization of the Waters of the Colorado and Tijuana Rivers and of the Rio Grande*, 59 Stat. 1219, 1237 (Nov. 14, 1944) T.S. No. 994 (effective Nov. 8, 1945).

20. Additionally, 50,000 acre-feet is allocated to users in northeastern Arizona. Upper Colorado River Basin Compact, Colo. Rev. Stat. Ann. § 37-62-101.

21. *Ariz. v. Cal.*, 547 U.S. 150, 157–159 (2006). Tribal rights quantified in *Arizona v. California* include: the Chemehuevi Indian Reservation (11,340 AF), the Cocopah Indian Reservation (9,707 AF), the Fort Yuma Indian Reservation (77,966 AF), and the Colorado River Indian Reservation (719,248 AF). *Id.*

22. Press Release, Navajo Nation Council, *Navajo Nation Council Approves Northeastern Arizona Indian Water Rights Settlement* (Nov. 4, 2010). The Navajo Nation's Colorado River settlement provides for: (1) 31,000 AF of water from the mainstem of the Colorado River; (2) any unclaimed flows from the little Colorado River; and (3) nearly unlimited access to two underground aquifers. *Id.*

23. Colorado River Basin Storage Project Act of 1956, 43 U.S.C. §§ 620(A)–(O) (2006).

24. Colorado River Basin Project Act, 43 U.S.C. §§ 1501–1556 (2006).

Lake Mead" (the "Interim Guidelines"), which update the approach to reservoir operations during shortage conditions and feature a schedule of Lower Basin curtailments when insufficient storage exists in Lake Mead to support 7.5 MAF of Lower Basin consumption from the mainstem.[25] Under the Interim Guidelines, curtailments are to be enacted in stages based on reservoir elevations,[26] and would primarily target water delivered by the CAP, which is junior to the California apportionment, and other Arizona uses of mainstem water (as stated in the Colorado River Basin Project Act).[27] The guidelines remain in effect until 2025 for water supply determinations and 2026 for reservoir operations.[28]

B. *Mismatch of Supplies and Demands*

Estimating average annual flows on the Colorado River is a complex and controversial undertaking. Early gauges were inaccurate, not all major tributaries are monitored, and estimating "natural" flows at Lee Ferry (the official measuring point) requires subtracting or "backing out" upstream depletions.[29] These technical issues, combined with unusually wet years preceding the Compact, led negotiators to overestimate flows and, thus, over-allocate the resource.[30] Article III(a) of the Compact, combined with the

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25. Bureau of Reclamation, *Colorado River Interim Guidelines for Lower Basin Shortages and the Coordinated Operations for Lake Powell and Lake Mead*, Record of Decision (Dec. 13, 2007).

26. *Id.* at 34.

27. *Id.* at 25.

28. *Id.* at 4. A variety of other statutes and agreements, covering issues such as environmental protection and intrastate water management, are omitted from this cursory Law of the River review. The focus of this article is primarily the large-scale allocation of water between the Upper and Lower Basins, and to a lesser extent, between the States comprising each sub-Basin.

29. Eric Kuhn, *The Colorado River: The Story of a Quest for Certainty on a Diminishing River (Roundtable Ed.)* 68 (Colo. River Water Conserv. Bd. 2007).

30. Records used by Compact negotiators suggested an annual Lee Ferry flow of at least 16.8 MAF, although the Reclamation Service (Bureau of Reclamation) suggested a more conservative estimate of 16.4 MAF. However, once the Compact was signed and the process of state-by-state ratification began, it became evident that several negotiators believed the 16.4 MAF/year was overly conservative, and many negotiators internally operated on assumptions of larger flows. For example, in Utah, R.E. Caldwell told the state legislature that the annual

Mexican Treaty, collectively allocate 16.5 MAF/year of consumptive use of Colorado River water among users in the seven basin states and Mexico, a total that increases to 17.5 MAF/year when Article III(b) is included. The conventional interpretation of the Supreme Court's decision in *Arizona v. California* is that this "basic apportionment" is for water from the mainstem and tributaries above Lee Ferry.[31] Lower Basin tributaries, such as the Gila River, are exempt.[32] The river, however, provides significantly less than the Compact apportions. The best estimate of long-term river yields comes by way of paleo reconstructions—i.e., estimates of past flows based primarily on tree-ring studies. These studies look back as far as 762 A.D. and suggest an annual average of 14.7 MAF.[33] This is only slightly dryer than measured 20th century flows of 15.2 MAF.[34]

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yield exceeded 20 MAF; in Colorado, Delph Carpenter offered an estimate of 20.5 MAF; in Wyoming, Frank Emerson argued that the river yields 22 MAF. Hundley, *Water and the West: The Colorado River Compact and the Politics of Water in the American West*, *supra* n. 6, at 217 (Utah), 222 (Colo.), and 220 (Wyo.).

31. Some compact scholars have indicated that Art. III(b) water was included to account for the lower basin tributaries. However, the Supreme Court in *Arizona v. California* held that these lower basin tributaries are not included in the Compact's apportionment but are instead reserved for Arizona and Nevada's exclusive use. For further discussion, see Section III(B) – Issue 3 of this paper.

32. *Ariz. v. Cal.*, 373 U.S. at 569; *see also* John Carlson, *The Colorado River Compact: A Breeding Ground for International, National, and Interstate Controversies* (Nat. Resources Law Ctr., U. Colo. Sch. of Law 1989). This issue is discussed further in Section III(B) – Issue 3.

33. Woodhouse et al. used reconstruction models that suggested a long-term mean (1520–1961) of 14.7 or 14.3 MAF, depending on the model. Meko et al. looked further back (A.D. 762–2005) and confirmed previous analyses that long-term river yields are lower than observed gauge data. In addition, Meko et al. also found the most severe drought to be in the mid-1100s, characterized by a decrease of more than 15% of mean annual flow averaged over 25 years. Woodhouse et al., *Updated Streamflow Reconstructions for the Upper Colorado River Basin,* 42 Water Resources Research W05415 (2006); David M. Meko et al., *Medieval Drought in the Upper Colorado River Basin*, 34 Geophys. Res. Ltr. L10705 (2007). *See also* National Academy of Sciences, *Colorado River Basin Water Management: Evaluating and Adjusting to Hydroclimatic Variability* 5 (2007).

34. U.S. Bureau of Reclamation, *Tree-ring Reconstructions of Streamflow and Climate and their Application to Colorado River Basin Water Management* 44 (2008).

For planning purposes, approximately15 MAF is a commonly used estimate.[35]

Flows in the first decade of the 21st century have disappointed water managers throughout the basin, averaging slightly over 12 MAF/year.[36] Of particular concern is the notion that these flows may not merely be a drought that will eventually ease, but may be the leading edge of the climate changes that are predicted for this basin.[37] Although many people view climate change as a relatively new phenomenon and area of study in the Colorado River Basin, scientists hypothesized as early as 1983 hypothesized that anthropogenic emissions of greenhouse gasses will increase temperatures and aridity in the Colorado Basin.[38] Today, this viewpoint dominates the academic literature.[39] In a review of the 19 global circulation models

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35. Douglas Kenney et al., *Rethinking the Future of the Colorado River* 16 (Nat. Resources Law Ctr. 2010).

36. Upper Colorado River Commission, *Sixty-First Annual Report of the Upper Colorado River Commission* 21 (2009).

37. U.S. Bureau of Reclamation, *Appendix U: Climate Technical Work Group Report, in* Final Environmental Impact Statement (2007).

38. Roger E. Revelle & Paul E. Waggoner, *Effects of Carbon Dioxide-Induced Climatic Change on Water Supplies on the Western United States, in* Changing Climate (Carbon Dioxide Assessment Comm. 1983).

39. For a comprehensive review, *see* U.S. Bureau of Reclamation, *Appendix U: Climate Technical Work Group Report, in* Final Environmental Impact Statement (2007). Other relevant studies include: Tim Barnett et al., *The Effects of Climate Change on Water Resources in the West*, 62 Climatic Change 1 (2004); Bryson C. Bates et al., *Climate Change and Water* (IPCC 2008); Niklas Christensen & Dennis P. Lettenmaier, *A Mutlimodel Ensemble Approach to Assessment of Climate Change Impacts on the Hydrology and Water Resources of the Colorado River Basin*, 3 Hydro. Earth Syst. Sci. Discuss. 3727 (2007); Niklas Christensen et al., *The Effects of Climate Change on the Hydrology and Water Resources of the Colorado River Basin*, 62 Climatic Change 337 (2004); Martin P. Hoerling & Jon Eisheid, *Past Peak Water in the Southwest*, 6 Southwest Hydrology 18 (2007); Gregory McCabe & David Wolock, *Warming May Create Substantial Water Supply Shortages in the Colorado River Basin*, 34 Geophys. Res. Ltr. L22708 (2007); W. Paul Miller & Thomas C. Piechota, *Regional Analysis of Trend and Step Changes Observed in Hydroclimatic Variables around the Colorado River Basin*, 9 J. of Hydrometreology 1020 (2008); P. Christopher D. Milly et al., *Global Patterns of Trends in Streamflow and Water Availability in a Changing Climate*, 438 Nature 347 (2005); Linda Nash & Peter Gleick, *The Colorado River Basin and Climatic Change: The Sensitivity of Streamflow and Water Supply to Variations, in Temperature and Precipitation* 121 (1991); Richard Seager et al., *Model Projections of an Imminent Transition to a More Arid Climate in*

("GCMs") used in the Third Assessment Report of the Intergovernmental Panel on Climate Change ("IPCC"), Seager et al. noted that "there is a broad consensus amongst climate models that this region will dry significantly in the 21st century and that the transition to a more arid climate should already be underway."[40] In fact, 18 of the 19 GCMs project a dryer climate by 2021-2040.[41]

While the consensus of the scientific literature is that the average flow of the Colorado will decline over the rest of the century (and perhaps beyond), considerable uncertainty remains regarding the magnitude and speed of the decline. Despite these uncertainties, the majority of climate change research suggests declines between 10-30% by the middle of the century.[42] Applying these percentages to an assumed average of 15 MAF/year translates to an average flow of 13.5 to 10.5 MAF/year. Additionally, these reductions in average flows are expected to be accompanied by an increase in the frequency and duration of droughts.[43]

The combined impact of reduced flows and increased droughts is particularly disconcerting and is a major thread of current research on the Colorado River.[44] Also of concern is the sensitivity of storage levels in the basin to these changes. Numerous studies have found that even small reductions in Colorado River flow can

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Southwestern North America, 10 Science 1181 (2007); and Charles Stockton & William Boggess, *Geohydrological Implications of Climate Change on Water Resource Development* (1979).

40. Seager, *supra* n. 39, at 1181.

41. *Id.*

42. Tim Barnett & David Pierce, *Sustainable Water Deliveries from the Colorado River in a Changing Climate*, 160 Proceedings of the Natl. Acad. of Sci. 7334 (2009). Other researchers cite similar numbers. *See e.g.* Seager, *supra* n. 39; United States Geological Survey ("USGS"), *Effects of Climate Change and Land Use on Water Resources in the Upper Colorado River Basin* 2 (2011). Projected flow declines by mid-century are largely shaped by greenhouse gas emissions that have already occurred, thereby resulting in relatively consistent output among models and researchers. For longer term projections, the GCM output is highly dependent on assumptions of future emissions. Widely different emission assumptions lead to widely different projections in flow.

43. Jonathan Overpeck & Bradley Udall, *Dry Times Ahead*, 328 Science 1642 (2010). *See e.g.* Hoerling, *supra* n. 39; McCabe, *supra* n. 39.

44. *Id.* at 1642–1643.

have significant and immediate impacts on storage levels.[45] For example, modeling by Christensen et al. for the time periods 2010-39, 2040-69, and 2070-98 suggested runoff declines of 14%, 18%, and 17%, respectively, with corresponding declines in reservoir storage of 36%, 32% and 40%.[46] Certainly the current drought illustrates the vulnerability of reservoir storage. From 1998 to 2010, combined storage in Lakes Powell and Mead dropped by more than 22 MAF,[47] leading to the "bathtub rings" that symbolize the current crisis.

The mismatch of supplies and demands, however, is not merely a climatic or hydrologic phenomenon, but is also closely associated with water demands.[48] Ironically, the onset of drought conditions near the start of the 21st century largely obscured the fact that, at roughly the same time, demands on the mainstem from Upper and Lower Basin deliveries (and associated reservoir evaporation losses) consistently topped 15 MAF.[49] And despite the fact that *average* demands on the system already equal (if not exceed) *average* (non-drought) supplies, projections call for additional consumption upstream.[50] The current Upper Basin depletion schedules call for an increase from 4.0 to 6.1 MAF/year from 2005 to 2055.[51]

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45. *See e.g.* U.S. Bureau of Reclamation, *supra* n. 39; Christensen, *supra* n. 39; Christensen & Lettenmaier, *supra* n. 39; Bureau of Reclamation Climate Technical Work Group, Harding et al., *Hydrologic Impacts on the Human-Made River: The Colorado River Network Model, in* Coping with Severe Sustained Drought in the Southwestern United States, Phase II Report (1995); Nash and Gleick, *supra* n. 39.

46. Christensen, *supra* n. 39, at 353.

47. Kenney, *supra* n. 35, at 65.

48. *Id.* at 4–5.

49. U.S. Bureau of Reclamation, *Colorado River System Consumptive Uses and Losses Report: 1996–2000* (2004).

50. U.S. Bureau of Reclamation, *supra* n. 25, at Appendix C.

51. This information was provided by the Bureau of Reclamation but is currently being revisited (but not likely modified) as part of an ongoing effort called the Colorado River Basin Water Supply and Demand Study (or simply the "Basin Study"), which is a two year effort led jointly by the Bureau of Reclamation and the basin states. The $2 million study is examining water supply and demand imbalances in the basin between now and 2060, and will include a review of potential adaption and mitigation strategies to address those imbalances. The Basin Study will be complemented by another study conducted by the USGS called the Colorado River Basin Geographic Focus Study. The USGS study will be

III. THE COLLISION OF LAW AND HYDROLOGY

Current levels of consumption in the basin are likely unsustainable. Considering projected demands alongside climatic and hydrologic projections suggests a collision of law and hydrology may be inevitable. After all, none of the Colorado River states (or Mexico) currently use more water than they are allocated under the Law of the River and, furthermore, none are projected to do so under any of the depletion schedules used for planning purposes.[52] The problem, thus, is not simply one of legal enforcement but rather of inferring priorities and curtailment schedules from documents that were not established for that explicit purpose. As noted below, the most commonly postulated legal interpretations are apt to work to the detriment of the Upper Basin states.

A. *The Upper Basin Climate Change Squeeze*

The so-called "Upper Basin climate change squeeze" refers to the observation that the Upper Basin apportionment is essentially the last priority on the river.[53] As average flow volumes decline, this apportionment likely bears the full brunt of the "squeeze" of reduced water availability.[54] The legal arguments that lead to this conclusion are explored in more detail in the following section. For now, it is sufficient to state that the Compact and, to a lesser extent, the Treaty with Mexico, combine to make the Upper Basin apportionment the

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conducted over a three-year period and will attempt to identify how much water is demanded from the Colorado River Basin, including water to support ecosystems. For additional information, see the Basin Study website and Department of Interior press release: *See* Bureau of Reclamation, *Colorado River Basin Water Supply and Demand Study* (last updated Feb. 2011) (available at http://www.usbr.gov/lc/region/programs/crbstudy.html); U.S. Dept. of the Int., *Secretary Salazar Launches New Regional Climate Science Center and Water Census at Meeting of Colorado River Basin Water Leaders* (Oct. 20, 2010) (available at http://www.doi.gov/news/pressreleases/Secretary-Salazar-Launches-New-Regional-Climate-Science-Center-and-Water-Census-at-Meeting-of-Colorado-River-Basin-Water-Leaders.cfm).

52. U.S. Bureau of Reclamation, *supra* n. 25, at Appendix C, D.

53. Kenney, *supra* n. 35, at 13.

54. *Id.*

lowest priority on the river, even though the Compact was initially pursued as a mechanism to ensure that the priority system was not implemented across state lines.[55]

The Upper Basin apportionment of 7.5 MAF described in Article III(d) of the Compact has long been understood to be unrealistic, forcing Upper Basin planners to reluctantly assume a "practical" apportionment no higher than 6 MAF.[56] Given climate change estimates, even this figure now seems unrealistically high.[57] Analysis done by the Colorado River Governance Initiative ("CRGI") suggests that, given typical (but certainly debatable) legal assumptions, and the 10 to 30% flow reductions by mid-century[58] that are expected to accompany climate change, water availability for the Upper Basin could drop to roughly 5.3 to 2.3 MAF/year, respectively.[59] Provisional data provided by the Bureau of Reclamation suggests current Upper Basin consumption levels of roughly 4.3 MAF,[60] which according to the CRGI analysis, is roughly what the Upper Basin could expect under a 12.5 MAF Lee Ferry flow scenario (a 17% reduction from 15 MAF).[61] In other

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55. In *Wyoming v. Colorado*, decided during the Compact negotiations, the Court held that the rule of prior appropriation applied to interstate stream allocations between two prior appropriation states. 259 U.S. 419, 470 (1922). Lower Basin states were delighted that prior appropriation would apply interstate, because many of their diversions had the earliest priority dates. Meanwhile, Upper Basin states were concerned that *Wyoming v. Colorado* would leave their right to develop water in the future unprotected as well as discourage the Lower Basin from compromising in the Compact. Hundley, *Water and the West: The Colorado River Compact and the Politics of Water in the American West*, *supra* n. 6, at 177–180.

56. Among the first prominent studies to articulate a reduced Upper Basin apportionment was the report by Tipton and Kalbach Inc. (1965). That report examined a variety of different scenarios based on different Upper Basin storage capacities, delivery requirements, and evaporative losses, and estimated Upper Basin water availability to range from 4.7 to 6.3 MAF. Scott Tipton, *Water Supplies of the Colorado River: Available for Use by the States of the Upper Division and for Use from the Main Stem by the States of Arizona, California, and Nevada in the Lower Basin* 18–21 (Tipton and Kalmbach, Inc. 1965).

57. Barnett, *supra* n. 42, at 4–5.

58. *Id.*

59. Kenney, *supra* n. 35, at 17.

60. U.S. Bureau of Reclamation, *Provisional Upper Colorado River Basin Consumptive Uses and Losses Report: 2006–2010* iv14 (2010).

61. Kenney, *supra* n. 35, at 17.

words, a relatively modest climate change scenario suggests that in 40 years, the practical (useable) Upper Basin apportionment would equal roughly half of its use a decade ago at the turn of the century. The more extreme flow reduction scenario (30%) restricts the Upper Basin to about 2.3 MAF,[62] roughly equivalent to estimates of the Upper Basin's Present Perfected Rights ("PPRs")—i.e., the amount of water consumed in the region in the 1920s.[63] It is difficult to imagine restricting the Upper Basin to this level of use without significant political and legal wrangling.

B. *Omissions and Ambiguities in the Law of the River*

The above analysis hinges on one possible interpretation of the Law of the River, which not only features troubling contradictions and inconsistencies, but numerous omissions and ambiguities that provide potentially fertile ground for legal disputes. Five issues are reviewed below, as they have particular salience to the interbasin apportionment:

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62. *Id.*

63. For a contemporaneous estimate of use in the Upper and Lower Basins, *see* Colorado River Commission, *Record and Minutes of the Sixth Meeting of the Colorado River Commission* 69–70 (Jan. 30, 1922) [hereinafter "1 Record"]. There remains some debate as to the magnitude of Present Perfected Rights ("PPRs"). Part of the problem is the inadequacy of consumption records from the 1920s. However, there is also a legal issue; namely, are PPRs those with a priority date prior to the signing of the Colorado River Compact (Nov. 24, 1922), or prior to the effective date of its ratification in the Boulder Canyon Project Act (June 25, 1929)? The Upper Colorado Basin Compact (1948) states that rights in the Upper Basin must have been perfected prior to November 24, 1922. Upper Colorado Basin Compact, *supra* n. 20, at art. IV(c). However, the Supreme Court in *Arizona v. California*, held that the PPRs in the Lower Basin include water appropriated prior to the adoption of the Boulder Canyon Project Act on June 25, 1929. 547 U.S. at 154. Two Upper Basin states, New Mexico and Utah, share Lower Basin tributaries, and were thus involved in the *Arizona v. California* litigation. For those states, it is unclear if their PPRs are determined by the 1922 or the 1929 dates.

- ISSUE 3: Deliveries to Mexico
- ISSUE 4: Administration of Compact Calls
- ISSUE 5: Compact Rescission or Reformation

ISSUE 1: The Upper Basin Delivery Obligation

The common categorization of the Upper Basin apportionment as being the last priority on the river is a delicate issue, but is based largely on the workings of Article III(d). This section requires "the States of the Upper Division [to] not cause the flow of the river at Lee Ferry to be depleted below an aggregate of 75,000,000 acre-feet for any period of ten consecutive years."[64] At issue is whether the prohibition on the states of the Upper Division from depleting flows below 75 MAF/10 years operates as a delivery requirement or if it acts as an obligation not to deplete flows. A delivery obligation would make water rights held by the Lower Basin senior to those held by the Upper Basin. An obligation not to deplete may have the same effect on priority, which then begs the question as to whether these are practicably different.

From the language of the Compact and other Law of the River components, most commentators adopted the working assumption that Article III(d) operates as a *de facto* delivery requirement in favor of the Lower Division states, not just a division of available water.[65] Language in the Compact confines the behavior of the Upper Division states. The Compact states that the Upper Basin "will not cause the flow . . . to be depleted"[66] and "shall not

64. Compact, *supra* n. 8, at art. III(d).

65. There is a significant literature reviewing how the Law of the River prioritizes allocations. For example, *see* Lawrence MacDonnell et al., *Coping with Severe, Sustained Drought in the Southwestern United States* (1995); Edward W. Clyde, *Present Conflicts on the Colorado River*, 32 Rocky Mtn. L. Rev. 534, 535–536 (1960); Douglas Grant, *Interstate Water Allocation: When the Virtue of Permanence Becomes the Vice of Inflexibility*, 74 U. Colo. L. Rev. 105, 114–121 (2003); John U. Carlson & Alan E. Boles, Jr., *Contrary Views of the Law of the Colorado River: An Examination of Rivalries Between the Upper and Lower Basins*, 32 Rocky Mt. Min. L. Inst. 21–7 (1986); and Glenn Saunders, *Reflections on Sixty Years of Water Law Practice*, 2 U. Denver Water L. Rev. 1, 22–23 (1998). As noted, most categorize the Upper Basin as having a delivery obligation (and thus a junior priority) to the Lower Basin.

66. Compact, *supra* n. 8, at art. III(d).

withhold water. . . ."[67] from the Lower Basin. Furthermore, Congressional testimony of Herbert Hoover, the federal representative in the Compact negotiations, noted that "in the improbable event of a deficiency, the lower basin has the first call on the water up to a total of 75,000,000 acre-feet each 10 years."[68] The Upper Colorado River Basin Compact ("UCRBC") uses both the "not to deplete" and "delivery obligation" language, but ultimately seems to accept the delivery obligation interpretation.[69] Additionally, rules promulgated under federal legislation about reservoir operations emphasize a delivery obligation.[70] Several academic studies also emphasize the delivery requirement. For example, a two-phase study, entitled "Coping with Severe and Sustained Drought in the Southwestern United States," stated that "only after the full Lower Division obligation has been met can the Upper Division begin to satisfy" post-1922 demands in a time of drought.[71]

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67. *Id.* at art. III(e).

68. 64 Cong. Rec. 2710 (1923); *see also* H.R. Doc. 717, 80th Cong., 2d Sess. A125 (1948). Kuhn, *supra* n. 29, at 169–170 (Colo. River Water Conserv. Bd. 2007); Carlson & Boles, *supra* n. 66, at 51–56. However, Hoover's testimony must be considered in context. Hoover was responding to questions from an Arizona congressman, Carl Hayden. At the time, Arizona had not ratified the compact and hostilities were developing in Arizona towards it. Hoover was well aware of the hostility and had gone out of his way to campaign for its ratification. Hoover's testimony, then, may be less supportive of the delivery obligation requirement when considering the context in which it was made. *Id.* at 21–38.

69. The UCRBC uses the obligation not to "deplete" when describing the Yampa, but speaks of obligations to "deliver" water when referring to the Colorado mainstem. Upper Colorado River Compact, *supra* n. 20, at art. IV, art. XIII.

70. Dept. of Int., *Criteria for Coordinated Long-Range Operation of Colorado River Reservoirs Pursuant to the Colorado River Basin Project Act of September 30, 1968* (1970); *see* Colorado River Basin Project Act, *supra* n. 24, at § 602(b).

71. William Lord et al., *Managing the Colorado River in a Severe Sustained Drought: An Evaluation of Institutional Options*, 31 Water Res. Bulletin 939, 943 (1995); *see also* David Wegner, *Environmental Restoration: Challenges for the New Millennium: Looking Towards the Future: The Time has Come to Restore Glen Canyon*, 42 Ariz. L. Rev. 239 (2000); and David Getches, *Colorado River Governance: Sharing Federal Authority as an Incentive to Create a New Institution*, 68 U. Colo. L. Rev. 573 (1997).

Despite this body of evidence supporting the "delivery obligation" interpretation, the Compact does not use delivery obligation terminology, and this fact may be increasingly important in an era of climate change. For example, one analyst argues that if flows are reduced by a "natural force" such as climate change rather than by Upper Basin consumption, then mitigating that decline in flows is not the responsibility of the Upper Basin; it was not the Upper Basin that depleted the flows.[72] As discussed below, the delivery obligation argument could potentially be married to the debate about whether the Commissioners intended the Compact to provide an "equitable" and/or an "equal" division of water; under either interpretation, it can be argued that the Upper Basin should not bear the full brunt of climate change flow reductions.

ISSUE 2: The Interbasin Apportionment

The purpose of the Colorado River Compact is to "provide for the equitable division and apportionment of the use of the waters of the Colorado River System."[73] But does "equitable" mean "equal?" The language of Article III(a) would suggest it does: "There is hereby apportioned from the Colorado River System in perpetuity to the Upper Basin and to the Lower Basin, respectively, the exclusive beneficial consumptive use of 7,500,000 acre-feet of water per annum, which shall include all water necessary for the supply of any rights which now may exist."[74] Yet, if the Upper Basin apportionment is, due to a de facto delivery obligation, junior to the Lower Basin, it is expected to lag far behind that of the Lower Basin. Reconciling Article III(a) and III(d) is likely to be a point of frustration, if not litigation, under even modest climate change scenarios.[75]

In determining whether the Commissioners intended to "equally" divide the river, it is necessary to review the Compact negotiations, and to remember that they took place against a background of Supreme Court litigation that framed the Compact

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72. Kuhn, *supra* n. 29, at 78.
73. Compact, *supra* n. 8, at art. 1.
74. *Id.* at art. III(a).
75. *See* Carlson & Boles, *supra* n. 66, at 21–32.

allocations.[76] In *Kansas v. Colorado*, the Court first announced the doctrine of "equitable apportionment,"[77] explaining that the underlying rule is "equality of right,"[78] not equality of apportionment.[79] Accordingly, during the Compact negotiations, reference to "equitable apportionment" did not necessarily mean division of the Colorado River into equal amounts. Rather, the Commissioners would consider the rights of each state equally and ensure that the ensuing allocation was just and fair.

At the time of Compact negotiation, the Commissioners projected that future water needs of each Basin would be roughly equal.[80] This fact, when balanced against the negotiating leverage of each party, prompted Delph Carpenter of Colorado to propose an equal division between the basins[81]. Specifically, he suggested that each division receive 8.7 MAF per year from the Colorado River water, with the Lower Basin apportionment including water from their tributaries.[82] An equal division would preserve the right of the Upper Basin to develop in the future, but also provide the Lower Basin with ample current supplies.[83] Carpenter hoped his formula would establish "a permanent and perpetual status" between the

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76. *See* Hundley, *Water and the West: The Colorado River Compact and the Politics of Water in the American West*, *supra* n. 6, at 180.

77. *Kan. v. Colo.*, 206 U.S. 46, 98 (1907) (Each state is on the same level in the legal system as the other state, and has the same powers and rights under the Constitution and interstate disputes are settled in such a manner that recognizes "the equal rights of both and at the same time establish[es] justice between them").

78. *Id.* at 97.

79. *Id.* at 97–98.

80. The Upper Basin's present and future needs from the mainstem were approximately 6.3 to 6.8 MAF per year, while the Lower Basin required between 5.1 to 6.1 MAF per year. *See* 1 Record, *supra* n. 64, Sess. No. 6, at 70-79; 1 Record, *supra* n. 64, Sess. No. 11, at 61; 1 Record, *supra* n. 64, Sess. No. 12, at 11; 1 Record, *supra* n. 64, Sess. No. 14, at 40-41; 1 Record, *supra* n. 64, Sess. No. 15, at 29-30; 1 Record, *supra* n. 64, Sess. No. 16, at 21-24; 1 Record, *supra* n. 64, Sess. No. 17, at 7; 2 Record, *supra* n. 64, Sess. No. 20, at 62.

81. 1 Record, *supra* n. 64, Sess. No. 11, at 20.

82. *Id.* at 14–23. This means the Upper Basin would deliver 6.264 MAF per year at Lee Ferry.

83. 1 Record, *supra* n. 64, Sess. No. 24, at 233.

basins.[84] Response to his proposal was largely, but not universally, positive.[85] The most vehement opponent was W.S. Norviel from Arizona, who thought the Lower Basin should receive half of the mainstem water plus exclusive use of the Lower Basin tributaries.[86] Back and forth negotiations ensued.[87] The negotiations seemed to stall as the Lower Basin, led by Norviel, insisted on receiving 82 MAF every ten years, while the Upper Basin refused to deliver more than 65 MAF every ten years.[88]

In the face of the impasse, Herbert Hoover presented a memo compiling the basic principles of the Compact, which stated, "appropriations may be made in either division with equality of right as between them, up to a total of 7,500,000 acre-feet per annum, for each division."[89] Furthermore, Hoover proposed that in any future compact revisions, "an increasing amount of water to one division will carry automatically an increase in the rights of the other basin."[90] Hoover's statements, coupled with those of other negotiators, indicate that the Basins intended to share the flow equally.[91] Equal

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84. Hundley, *Water and the West: The Colorado River Compact and the Politics of Water in the American West*, *supra* n. 6, at 185; *see also* Ltr. From Delph Carpenter to Frank Emerson (Aug. 19, 1922), in *Papers of the Wyoming State Engineer*.

85. While the commissioners of California and Nevada opposed some details, they supported the basic equal apportionment scheme. McClure from California considered the proposal to be a "fair basis for discussion." 1 Record, *supra* n. 64, Sess. No. 12 at 22–23.

86. 1 Record, *supra* n. 64, Sess. No. 16 at 25; 1 Record, *supra* n. 64, Sess. No. 17 at 2–6, 10–25.

87. Hundley, *Water and the West: The Colorado River Compact and the Politics of Water in the American West*, *supra* n. 6, at 191–195.

88. The proposed delivery of 82,000,000 MAF every ten years constituted a much higher delivery than the Upper Basin was willing to make due to concern that in low flow years it would be unable to meet the delivery without curtailing its own users. Stephen Davis from New Mexico pointed out that "taking the measured flow for the lowest ten years for which we have a record...it is apparent...that...any such guaranty would have been violated." 1 Record, *supra* n. 64, Sess. No. 17 at 2. *See also* Hundley, *Water and the West: The Colorado River Compact and the Politics of Water in the American West*, *supra* n. 6, at 191–195.

89. 1 Record, *supra* n. 64, Sess. No. 17, at 23.

90. 1 Record, *supra* n. 64, Sess. No. 18, at 32.

91. Hundley, *Water and the West: The Colorado River Compact and the Politics of Water in the American West*, *supra* n. 6, at 195–99; Carlson & Boles, *supra* n. 66, at 48.

allocations would carry equal priorities. However, this exact language did not end up in the final draft.

Other language in the Compact further supports the concept of equal shares. The inclusion of Article III(b) (providing the Lower Basin with an additional 1 MAF as available), as the sole exception to equal division, implies that the commissioners intended to equally divide the Colorado River System between the Basins.[92] Additionally (and as discussed later), in Article III(c), the burden of Mexican delivery when surplus water proves inadequate is to be "equally borne by the Upper Basin and the Lower Basin, and whenever necessary the States of the Upper Division shall deliver....water to supply one-half of the deficiency."[93] The language emphasizes that drafters intended each Basin to bear the Mexican burden equally during non-surplus conditions, in accordance with the basic concept of equal allocation of the Colorado River. But this language is largely offset by other Compact elements that revert back to the "equitable apportionment" terminology, which suggests the intention was not equality of allocations, but is simply a recognition of the states' equal rights to the Colorado River (as articulated in *Kansas v. Colorado*[94]). The equal rights interpretation is reinforced by Articles III(f) and III(g) concerning future appropriations of unallocated waters.[95]

In summary, it is unclear if the Commissioners intended "equitable" to mean "equal," and if so, what remedies might be available to address the growing imbalance in the allocation between

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92. Carlson & Boles, *supra* n. 66, at ch. 21, 46, 50–52. Article III(b) was included to provide an additional 1.0 MAF to the Lower Basin to offset the inclusion of its tributaries in the Compact allocations. Hundley, *Water and the West: The Colorado River Compact and the Politics of Water in the American West*, *supra* n. 6, at 198–203.

93. Compact, *supra* n. 8, at art. III(c).

94. *Kan. v. Colo.*, 206 U.S. 46, 98 (1907).

95. Article III(f) provides for "further equitable apportionment of the beneficial uses of the waters of the Colorado River System unapportioned by paragraphs (a), (b), and (c) may be made in the manner provided in paragraph (g)..." Article III (g) provides that future representatives making apportionments should "divide and apportion equitably between the Upper Basin and Lower Basin." Compact, *supra* n. 8, at art. III(f)–(g).

the Upper and Lower Basins. What is clear is that this issue will only grow in importance, and that the resolution of this issue could potentially involve significant, protracted litigation.

ISSUE 3: Deliveries to Mexico

As provided by Article X of the 1944 Treaty with Mexico, the United States must annually deliver to Mexico 1.5 MAF (or 1.7 MAF in surplus years).[96] This obligation is clear and uncontroversial in years where there is an abundance of water; however, during scarcity, numerous legal ambiguities exist.[97] Two are of particular concern and are discussed below: the Upper Basin's delivery obligation to Mexico, and the definition of extraordinary drought.

The Upper Basin's Mexican Treaty Obligation

According to the Colorado River Compact, deliveries to Mexico are to be made from water that is "surplus over and above the aggregate of the quantities specified in paragraphs (a) and (b); and if such surplus shall prove insufficient for this purpose, then, the burden of such a deficiency shall be equally borne by the Upper Basin and the Lower Basin."[98] When there is no "surplus" water, the Upper Basin must bear one half of the deficiency—up 750,000 AF per year.[99] When combined with the Article III(d) *de facto* delivery obligation to the Lower Basin, the Upper Basin delivers a minimum of 8.23 MAF/year at Lee Ferry, and perhaps more if compensation for transit losses is required.[100] In periods of scarcity, this could

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96. *Treaty with Mexico*, *supra* n. 19. Several important minutes (amendments) have been made that somewhat modify this agreement, but are omitted from this discussion.

97. Norris Hundley, Jr., *Dividing the Waters: A Century of Controversy Between the United States and Mexico* (Berkeley and Los Angeles, 1966).

98. Compact, *supra* n. 8, at art. III(c).

99. *Id.* at art. III(c).

100. The 8.23 MAF/year figure is a prominent element of river management, and is the typical minimum release from Lake Powell. *See e.g.* Bureau of Reclamation, *supra* n. 25 at 15. Presumably, it is comprised of 7.5 MAF, which is the average annual delivery requirement from Article III(d), and 750,000 AF for the Upper Basin's potential share (as discussed above) of the Mexican obligation. This totals 8.25 MAF; the actual release from Lake Powell is

result in curtailment of both Upper and Lower Basin users. Given this fact, the definition of surplus is critically important. In short, Lower Basin interests typically contend that there is no surplus and the Upper Basin's annual share of the Mexican treaty delivery obligation is therefore, at least, one-half of the total obligation of 1.5 MAF.[101] The Upper Basin States believe that surplus water exists in the Lower Basin and therefore they are not required to release any water to meet the Mexican treaty obligation.[102]

Determining the existence of surplus water is tied to the status of the Lower Basin tributaries under the Compact.[103] Specifically, the issue is whether or not the Lower Basin tributaries are part of the Compact apportionment, or whether they are separate.[104] The tributaries are included in the Compact's definition of "Colorado River System"[105] and the inclusion of the extra 1 MAF in the Lower Basin apportionment (in Article III(b)) was viewed as compensation to the Lower Basin for including the tributaries in the apportionment.[106] However, while the Supreme Court in *Arizona v. California* recognized that tributary inclusion was the original intent of Compact negotiators, it noted that subsequent legislative history and the alternative proposals that eventually culminated in the Boulder Canyon Project Act "consistently provided for division of the mainstream only, reserving the tributaries to each State's exclusive use."[107]

20,000 AF lower, which is accounted for by inflows from the Paria River, which is downstream of Lake Powell but before the official Lee Ferry point.

101. Carlson, *supra* n. 32, at 12–13 (quoting Report to Congress of Comptroller General (May 4, 1979)).

102. *Id.*

103. *Id.* at 14–15.

104. *Id.*

105. Compact, *supra* n. 8, at art. II(a).

106. Hundley, *Water and the West: The Colorado River Compact and the Politics of Water in the American West*, *supra* n. 6, at 197–201. Article III(b) was inserted to placate Norviel of Arizona who unsuccessfully argued against the inclusion of tributaries in the Compact. 1 Record, *supra* n. 64, Sess. No. 19, at 4-8; 1 Record, *supra* n. 64, Sess. No. 21, at 15; and 1 Record, *supra* n. 64, Sess. No. 23, at 3.

107. *Ariz. v. Cal.*, 373 U.S. at 569. The Court held that the Boulder Canyon Project Act effectively enacted a congressional apportionment of mainstem

The Court's decision to disregard the tributaries is an ongoing concern in the Upper Basin.[108] Particularly, the Upper Basin contends that, once the 1 MAF threshold of Lower Basin tributary use is surpassed, then the remainder of those tributary flows is "surplus" water that, first and foremost, should be used to satisfy the Mexican obligation.[109] The Lower Basin, meanwhile, contends that all Lower Basin tributary use—even that in excess of 1 MAF—is exempt from the Compact apportionment, and thus both the Upper and Lower Basins should split the Mexican apportionment out of mainstem apportionments.[110] The distinction is important, as the Bureau of Reclamation estimates that Lower Basin tributary flows, while poorly measured, average at least 2.5 MAF/year (and are perhaps as high as 4.5 MAF).[111]

Since the definition of "surplus" does not include tributary flow, the Upper Basin must bear a larger portion of Mexican deliveries than initially expected.[112] The Upper Basin's burden increases further if the Lower Basin's argument is correct. The Lower Basin argues that the Upper Basin must also compensate for transit losses occurring between Lee Ferry and the Mexican boundary.[113] However, this does not appear to be the Compact negotiators' intention;[114] the Compact states only that the Upper Basin shall deliver water to Lee Ferry.[115]

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river water "based on congressional intent and the Act's delegation of authority to the Secretary of the Interior to allocate and distribute water through contracts." Lochhead, *supra* n. 6, at 311.

108. This issue is discussed by several commentators, including Carlson, *supra* n. 32, and Getches, *supra* n. 6.

109. Carlson & Boles, *supra* n. 66, at 21–58; Carlson, supra n. 32, at 14–15; *see* Kuhn, *supra* n. 29, at 78–83.

110. Carlson & Boles, *supra* n. 66, at 21–29; *see also* Hundley, *Water and the West: The Colorado River Compact and the Politics of Water in the American West*, *supra* n. 6, at 309.

111. Carlson, *supra* n. 32 at 14. Lower Basin tributary consumptive use was 5.2 MAF in 1981, but the 5 year average for this period (1981–1985) was only 4.4 MAF. U.S. Bureau of Reclamation, *Colorado River System Consumptive Uses and Losses Report: 1986–1990* 25 (1998).

112. *See* Carlson, *supra* n. 32, at 11.

113. *Id.* at 12–13, 20–21.

114. 1 Record, *supra* n. 64, Sess. No. 16, at 26; 1 Record, *supra* n. 64, Sess. No. 20, at 60.

115. Carlson, *supra* n. 32, at 20–21.

What is Extraordinary Drought?

Further complicating the issue is the observation that, while the Mexican Treaty obligation generally controls the river's delivery priority,[116] Article X of the Treaty provides that:

> "[In] the event of extraordinary drought or serious accident to the irrigation system in the United States, thereby making it difficult for the United States to deliver the guaranteed quantity of 1,500,000 acre-feet...a year, the water allotted to Mexico under subparagraph (a) of this Article will be reduced in the same proportion as consumptive uses in the United States are reduced."[117]

The term "extraordinary drought" is not defined in the 1944 Treaty nor is it defined in any parallel agreement.[118] Nevertheless, the term appears in Article V of the Treaty, which provides for Mexican deliveries on the Rio Grande to users in the United States.[119] During a prolonged drought in the 1990s, Mexico claimed it suffered an extraordinary drought along the Rio Grande and failed to deliver sufficient water to irrigation districts in the United States.[120] Its invocation of extraordinary drought was controversial, and similar

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116. Getches, *supra* n. 6, at 826.

117. *Treaty with Mexico*, *supra* n. 19, at art. X.

118. *Id.* at 826–827.

119. There are, however, some differences between the use of extraordinary drought in Article X and Article V. Article X says that deliveries to Mexico will be decreased in proportion to consumptive use decreases in the United States. Article V permits Mexico to deliver less water for five years, but requires it to make up delivery deficiencies in the next five-year cycle. Treaty with Mexico, *supra* n. 19, at Art. V, Art. X.

120. Stephen Viña, *The United States-Mexico Dispute over the Waters of the Lower Rio Grande River*, Congressional Research Service 3–4 (Mar. 21, 2005) (available at http://assets.opencrs.com/rpts/RS22085_20050321.pdf).

disagreements are likely to occur should the U.S. declare extraordinary drought on the Colorado River.[121]

The 2007 EIS discusses the magnitude and timing of basin-wide curtailments during periods of scarcity, including an assessment of the Mexican priority.[122] Generally, if Lake Mead elevations drop enough to trigger shortages in Lower Basin deliveries, then the Secretary of the Interior shall consult the Department of State, the USIBWC,[123] and the Basin States to determine whether and how the United States should reduce deliveries to Mexico consistent with the 1944 Treaty.[124] While the EIS includes some assumptions about possible levels and timings of curtailments, Mexico did not approve the scenarios presented, and the curtailments await completion of ongoing international negotiations.[125]

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121. In the 1990s, the Rio Grande Basin in Mexico experienced a severe drought that caused Mexico to miss required deliveries. Mexico claimed extraordinary drought, and, under Article V, obtained the ability to make up deliveries in the next five-year period. Texans reliant on the water claimed the basin's growth in Mexico and Mexican storage of Rio Grande water was to blame instead of the drought. Mass. Inst. of Tech., *Mission 2012: Clean Water, Rio Grande Debt Due to Extraordinary Drought*, http:// web.mit.edu/12.000/www/m2012/finalwebsite/problem/international.shtml; U.S. Water News, *Satellite Data Show Mexico can no Longer Claim Drought, Researcher Says*, http://www.uswaternews.com/archives/arcglobal/2satdat10.html (2002).

122. Current thinking on curtailment is that the Upper Basin would be curtailed first. Not until only present perfected right remained in the Upper Basin, would cutbacks begin in the Lower Basin. The Secretary would first curtail CAP, then Nevada and Arizona's non-CAP water, and finally California. Getches, *supra* n. 6, at 830.

123. The USIBWC is the United States section of the International Boundary and Water Commission ("IBWC"), the bi-national organization responsible for administration of the 1944 Treaty.

124. Robert Adler, *Revisiting the Colorado River Compact: Time for a Change?*, 28 J. Land Resources & Envtl. L. 19 (2008).

125. In furtherance of this agreement, on June 17, 2010, the U.S. and Mexican representatives to the IBWC signed the *Conceptual Framework for U.S.-Mexico Discussions on Colorado River Cooperative Actions*, also known as *Minute 317*. Intl. Boundary & Water Commn., *Framework for U.S.-Mexico Discussions on Colorado River Cooperative Actions* (June 17, 2010).

ISSUE 4: Administration of Compact Calls

Under the prior-appropriation system, a senior appropriator will place a "call" on a river when flows in the river are insufficient to satisfy all rights on a river.[126] The "call" forces junior appropriators to stop diverting until the senior's water right is satisfied.[127] There are two possible types of interstate calls on the Colorado River, neither or which has ever happened: a Lower Basin call against the Upper Basin, and an intra-Upper Basin call amongst two or more Upper Basin states.[128] A Lower Basin call would only occur when, due to nearly empty reservoirs and severe low flows in the Colorado River, the Upper Basin fails to meet either its Article III(d) flow requirements or its Article III(c) deliveries to Mexico.[129] In an Upper Basin call, one Upper Basin state would make a call on another Upper Basin state, perhaps as part of efforts to comply with a Lower Basin call.[130]

Administration of a basinwide call may entail at least three contentious and phased efforts.[131] First, a call between the Upper and Lower Basin would require an assessment of the magnitude and timing of downstream deliveries required to bring the Upper Basin back in compliance with the Compact[132]. Second, a system of reservoir releases and user curtailments would need to be allocated

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126. Bureau of Land Management, *Water Appropriation Systems: Prior Appropriation* (2010) (available at http://www.blm.gov /nstc/WaterLaws/ appsystems.html).

127. *Id.* A call is a "request by an appropriator for water which the person is entitled to under his decree; such a call will force those users with junior decrees to cease or diminish their diversions and pass the requested amount of water to the downstream senior making the call." R. Waskom and M. Neibauer, *Glossary of Water Terminology*, Colorado State Extension (2008) (available at http://www.ext.colostate.edu/pubs/crops/04717.html).

128. MacDonnell, *supra* n. 66, at 831.

129. David Getches, *Performance of Legal and Institutional Systems in Drought,* in *Severe, Sustained Drought in the Southwestern United States: Phase 1* (Getches, ed.) 100–101 (1991).

130. *Id.* at 101.

131. *Id.* at 102–106.

132. *Id.* at 100.

among the Upper Basin states, presumably using the rules featured in the Upper Colorado River Basin Compact.[133] And third, state water officials would need to devise and enforce curtailments within each state.[134]

Every aspect of every stage figures to be filled with bitterness, data deficiencies, and legal challenges.[135] Determining whether or not the Upper Basin is out of compliance with the Compact is perhaps the most salient of the issues, as it could require resolution of several of the legal omissions and ambiguities already discussed.[136] If there is any doubt among Upper Basin interests as to the validity of whether or not a Compact violation exists, Upper Basin water officials would likely be hesitant to implement a call—especially considering the fact that an interbasin call could be requested in a period when Lower Basin uses are already significantly higher than those in the Upper Basin.[137] Should Upper Basin interests concede that an interbasin call is warranted, interpreting the language in the Upper Colorado River Basin Compact ("UCRBC") then becomes a central issue.[138] The UCRBC requires that any of the Upper Basin states that used, in the ten years prior to curtailment, more water than they were entitled under the Compacts must supply the overdraft to Lee Ferry before any other state faces curtailment.[139] If there is no overdraft, then the UCRBC is

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133. Upper Colorado River Basin Compact, *supra* n. 20, at art. IV.

134. MacDonnell, *supra* n. 66, at 831.

135. Hundley, *Water and the West: The Colorado River Compact and the Politics of Water in the American West*, *supra* n. 6, at 352.

136. Getches, *supra* n. 130, at 101.

137. It's worth noting that the Secretary of the Interior is, essentially, the river master for the Lower Basin, but likely does not have the same breadth of legal authority over the Upper Basin. Gregory Hobbs, *Upper Colorado River Basin Compact: Sharing the Shortage*, 32 Wyo. Lawyer 1 (2009). This conclusion is based on the *Arizona v. California* litigation. Likewise, the unanimity rule that surrounds existing mechanisms of interstate negotiation is likely to be poorly suited to such an obvious zero-sum conflict. For more information on the resolution of interstate river conflicts, *see* Edella Schlager & Tanya Heikkila, *Resolving Water Conflicts: A Comparative Analysis of Interstate River Compacts*, 37 Policy Studies J. 367 (2009).

138. Larry MacDonnell, *Law of the Colorado River: Coping with Severe, Sustained Drought,* in *Coping with Severe, Sustained Drought in the Southwestern United States* (Robert Young, ed.) 4–9 (1994).

139. Upper Colorado River Basin Compact, *supra* n. 20, at art. IV(b).

less clear about curtailment.[140] There are two different theories as to how curtailment rules apply: curtailments are proportional to consumptive uses in the prior year[141] or curtailments are proportional to apportionment percentages within the UCRBC.[142] Under the consumptive use interpretation, each Upper Basin state must deliver to Lee Ferry an amount of water that is proportional to their consumptive use in the preceding water year divided by the total consumptive use in that same year in the entire Upper Basin.[143] Under the apportionment interpretation, each state must curtail its use based on its allocation in the UCRBC, not its consumption in the prior water year.[144] The Commission has yet to formally endorse either interpretation, but unanimously adopted a resolution in December of 2010 to "work with the Upper Division states' representatives to develop options for implementing articles III through VI of the Upper Colorado River Basin Compact and provide a recommendation for consideration by the Commission as soon as

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140. *Id.* at art. IV(c). The UCRBC specifically references curtailment procedures on the Little Snake River (Art. XI), Henry's Fork of the Green River (Art. XII), the Yampa River (Art. XIII), and the San Juan River (Art. XIV). It is unclear how these curtailment procedures fit in with curtailment procedures in the Upper Division as a whole. *Id.*

141. Pat Tyrrell, the current Wyoming State Engineer, stated that "the curtailment by each State is to be proportionate to the [consumptive use] of Upper Colorado River System water made by each State during the water year immediately preceding the year in which the curtailment becomes necessary." Pat Tyrrell, Wyo. St. Engr. Off., *Colorado River Compact Administration Program: Consumptive Use Determination Plan*, 3 (Jan. 2008) (available at http://seo.state.wy.us/PDF/CU_Plan_Final.pdf). This testimony is similar to that of Tipton during the Compact hearings (in 1949), in which he concludes that, during curtailment, the states will take a cut in "proportion to the amount they are using, not in proportion to their apportionment." The Upper Colorado River Basin Compact Hearing, 81st Cong. 38 (1949).

142. Hobbs, *supra* n. 138, at 1.

143. Steve Wolff, *Colorado River Compact Administration Project*, Wyoming State Engineers Office (2006) (available at http://seo.state.wy.us/Forum/2006/Wolff%2012-06.ppt).

144. Gregory Hobbs, a current Colorado Supreme Court Justice, supports this interpretation. Hobbs, *supra* n. 138, at 2.

practicable but, in no event, later than December 31, 2013."[145] Regardless of the approach used, the magnitude of curtailments for each Upper Basin state must be sufficient to result in the required delivery to Lee Ferry.[146] Once this step is completed, "it will be up to the individual states as to the particular uses that will be curtailed to take care of the obligation."[147] In recent years, each Upper Basin state worked to promulgate curtailment rules.[148]

ISSUE 5: Compact Rescission or Reformation

Perhaps the most disconcerting of the potential legal conflicts are those that could result in rescission or reformation of the Compact. As noted earlier, the Colorado River Compact apportioned

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145. Upper Colorado River Commission, *Resolution of the Upper Colorado River Commission: Regarding the Development of Policies and Procedures for Implementing Curtailments of Water Use Pursuant to Article IV of the Upper Colorado River Basin Compact* 1 (2011).

146. Upper Colorado River Compact, *supra* n. 20, at art. IV.

147. *The Upper Colorado River Basin Compact: Hearing on H.R. 2325, H.R. 2336, H.R. 2327, H.R. 2328, H.R. 2329, H.R. 2330, H.R. 2331, H.R. 2332, H.R. 2333, H.R. 2334 before the H. Subcomm. on Irrigation ad Reclamation*, 81st Cong. 38 (1949) (statement of Royce J. Tipton, Consulting Engineer, Colo. Water Conserv. Bd.).

148. In 2007, Colorado began crafting rules for curtailment in the Colorado River Basin as part of the Colorado River Curtailment Studies. Ltr. from Randy Seaholm, Ken Knox & Carol Angel to the Colorado Water Conservation Board 1 (Nov. 4, 2007) (available at http://cwcb.state. co.us/NR/rdonlyres/ AB7913F9-566A-43AA-846C-5C2444589A01/0/16h.pdf). New Mexico is currently preparing an Active Water Resources Management Initiative ("AWRM") to allow the State Engineer to create curtailment rules. New Mexico State Engineer's Office, *Active Water Resource Management: Statewide Readiness* 8 (Mar. 31, 2010) (available at http://www.ose.state.nm.us/PDF/ Maps/AWRM-PerformanceMeasureMap.pdf). Utah is also in the midst of quantifying its present perfected rights and examining Colorado River issues, yet it is unclear whether Utah is undertaking a comprehensive study on curtailment or whether Utah is in the process of promulgating curtailment procedures. Minutes and Information from DNR Executive Water Task Force Meetings, Utah Division of Water Rights (available at http://www.waterrights.utah.gov/ meetinfo/taskforce.asp) (accessed June 15, 2010). The Wyoming State Engineer's Office has created a new program called the Colorado River Compact Administration Program. Information gathered in this program will be used in the case of curtailment necessary to fulfill obligations in the Colorado River Compact. Tyrrell, *supra* n. 147.

water to the Upper and Lower Divisions based on data from 1899 to 1920—an unusually wet period. The data prompted negotiators to believe the river featured an average virgin flow of (at least) 16.4 MAF per year.[149] However, both measured flows and tree-ring data now suggest the actual average flow of the Colorado River is considerably less—probably no more than 15 MAF—and is likely to drop further due to climate change.[150] As a result, the Colorado River is significantly over-allocated. Exacerbating the problem are apportionment commitments under the Treaty with Mexico, and the Supreme Court's decision to exclude Lower Basin tributaries from the basic apportionment.[151] As noted elsewhere, inaccurate flow assumptions not only have serious consequences, but also allocate most of those consequences to the Upper Basin.[152]

While interstate compacts are both statutory and contractual, courts normally apply contract law to compact issues.[153] Accordingly, there are two contract remedies available to the Upper Basin states regarding the Compact: rescission (i.e., voiding) based on mutual mistake or reformation (i.e., altering) based on mistake as to the legal effect of language used in the Compact .[154] Rescission is possible only if the Upper Basin did not knowingly accept the risk of factual mistake; if the Upper Basin did, then honoring the Compact would still be required under contract law.[155] This determination may hinge on the interpretation of Article III(d). If there is, in fact, a delivery requirement, then the Compact seems to allocate the risk to the Upper Division. However, if it is an obligation not to deplete or is an expression of the equal shares theory, then perhaps it is less

149. Hundley, *Water and the West: The Colorado River Compact and the Politics of Water in the American West*, *supra* n. 6, at 192–93.

150. USBR, *supra* n. 34.

151. Carlson, *supra* n. 32, at 14–15.

152. *See e.g.* Josh Clemons, *Interstate Water Disputes: A Road Map for States*, 12 S.E. Envtl. L.J. 115 (2004).

153. *Kan. v. Colo.*, 533 U.S. 1, 5–9 (2001); *Tex. v. N.M.*, 482 U.S. 124, 130 (1987) (acknowledging that a compact is statutory but applying contract doctrine). *See* David Getches, *Competing Demands for the Colorado River*, 56 U. Colo. L. Rev. 413, 417 (1985); Grant, *supra* n. 66.

154. Carlson & Boles, *supra* n. 53, at 33–52

155. *Restatement (Second) of Contracts* § 156 (1981).

likely that this article expressly allocates the risk of mistake to the Upper Division, and rescission may thus be possible.[156]

The second possibility that the Upper Basin bears the risk of the mistake is that Upper Basin was aware that it had only limited facts at the time the Compact was made, but treated those facts as sufficient.[157] Throughout the negotiations, the Bureau of Reclamation, the United States Geological Survey, and Compact Commission sub-committees presented data to the Commissioners.[158] The negotiations and subsequent congressional testimony illustrate that nearly all representatives believed that they had sufficient information to apportion the river.[159] Furthermore, the representatives believed that the Colorado River had more than sufficient flows to satisfy the apportionments.[160] While the Upper Basin Commissioners treated their knowledge as sufficient, the fact that they were unaware that the knowledge was biased raises an important question. Did they knowingly accept the risk of mistake in apportioning the Colorado River's flow in the Compact? Given the facts, rescission of the Compact seems plausible based on mutual

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156. *See* Carlson, *supra* n. 32 at 20; Carlson & Boles, *supra* n. 66, at 38.

157. *Restatement (Second) of Contracts* § 156.

158. 1 Record, *supra* n. 64, Sess. No. 6.

159. Delph Carpenter (Colorado) said that, "the twenty-year record that we had will not be improved by more records at this point. And the hydrographs and experts advise me that a twenty-year record on a river is adequate in its completeness and includes enough years to warrant an assumption that the average there deduced would be the average flow of the river in the future." 1 Record, *supra* n. 64, Sess. No. 12 at 6. Carpenter also remarked that engineers presenting to the group had indicated that a fifty-year record would be best to determine an extreme minimum, but that general calculations could be accomplished through a twenty-year record. 1 Record, *supra* n. 64, Sess. No. 12, at 29.

160. Richard Sloan, the legal advisor to Arizona's Colorado River Commission, believed that one of the major assumptions of the Compact was that "sufficient water [exists] in the river if conserved to meet all the demands for agricultural and business use, both in the upper and lower basins," and that this was illustrated by a "study of the river and of various estimates made by reclamation service and by state engineers." H.R. Doc. No. 717, 80th Cong., 2d Sess. A66 (1948). Specifically, Commissioner Emerson from Wyoming declared that "over 18,500,000 acre-feet of water is contributed annually to the river by the Upper Basin, and all of this amount could be diverted and the return flow would still be sufficient to supply the specified delivery at Lee's Ferry." H.R. Doc. No. 717, 80th Cong., 2d Sess. A127 (1948).

mistake; however, it is unlikely that the remedy would provide any real benefit to the Upper Basin.[161] Since the Lower Division uses more water and has senior water rights over the Upper Basin, voiding the Compact and equitably apportioning the Colorado River is unlikely to improve the Upper Division's current allocations.[162]

Reformation of the Compact to resolve legal ambiguities may be another option for the Upper Basin. However, the Upper Basin must prove that reformation should follow the Compact's approach of dividing water equally.[163] Reformation due to mistake requires that the mistake arise from a writing or where the parties misunderstand the legal effect of the language.[164] As discussed earlier, it is plausible that the parties misunderstood the legal effect of some of the terms used—"equitable division" for example.[165] More problematic is the prohibition against reformation. When third parties rely on the contract to acquire property interests, courts disallow reformation.[166] Since 1922, numerous water users in the Upper and Lower Basins have relied on the provisions in the Compact.[167] This includes individual irrigators, municipalities, water supply companies, power companies, and recreational users, among others.[168] Reformation to ensure equal shares would likely affect Lower Basin users more severely than Upper Basin users, and could unfairly affect the rights of third parties acting in reliance on the Compact's provisions.[169]

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161. Carlson & Boles, *supra* n. 66, at 45.

162. *Id.* at 21–45.

163. Getches, *supra* n. 116, at 417.

164. *Restatement (Second) of Contracts* § 155 (1981) (Reformation due to mistake as to written expression may occur "where a writing that evidences or embodies an agreement in whole or in part fails to express the agreement because of a mistake of both parties as to the contents or effects of the writing.").

165. Compact, *supra* n. 8, at art. III(a). *See* Section III(B)–Issue 2.

166. *Restatement (Second) of Contracts* § 155 (The court can reform the contract to "express the agreement, except to the extent that rights of third parties such as good faith purchases for value will be unfairly affected.").

167. United States Bureau of Reclamation, *Introduction*, in *Colorado River Interim Surplus Criteria FEIS* 13 (2000).

168. *Id.*

169. *See* Carlson & Boles, *supra* n. 66, at 45–46.

Reformation of the Compact is theoretically possible using either congressional or judicial pathways. When Congress consents to an interstate compact, it presumably retains the right to revise or interpret the agreement.[170] However, it is unlikely to revise a compact in the absence of demonstrable injustice.[171] As the Upper Basin states are well aware, the Lower Basin wields the political leverage associated with high populations, large economies, and vast congressional representation.[172] Alternatively, the Supreme Court could address, under original jurisdiction, whether the Compact should be enforced when it produces such an unintended and inequitable result.[173] Since the Court accepted the Compact's allocations in *Arizona v. California*,[174] it would likely hesitate to modify the Compact. Yet, the fact remains that the Colorado River Compact was a contract based on a factual error (about average flow volumes), an expectation (at least among some parties) of equal sharing, and an ignorance of climate change.[175] The combined effect of these deficiencies, especially on the Upper Basin, may be too extreme to ignore.[176] Additionally, a precedent for this type of action already exists: in *Texas v. New Mexico*, the Supreme Court used contract law to change the flawed allocation formula in the Pecos River Compact.[177]

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170. David Getches, Competing Demands for the Colorado River, 56 U. Colo. L. Rev. 413, 426 (1985).

171. *Id.*

172. For example, the Lower Basin has 75 Congressional representatives (California – 60, Arizona – 10, Nevada – 5). The Upper Basin has 22 congressional representatives (Colorado – 9, New Mexico – 5, Utah – 5, Wyoming – 3). U.S. House of Representatives, *Directory of Representatives* (available at http://www.house.gov/representatives/); U.S. Senate, *Senators of the 112th Congress* (available at http://www.senate.gov/general/contact_information/senators_cfm.cfm).

173. U.S. Const. art. III, 2, cl. 2.

174. *Ariz. v. Cal.*, 373 U.S. at 565. It's worth noting, however, that *Arizona v. California* primarily focused on an intra-basin dispute, and not the inter-basin apportionment.

175. Kenney, *supra* n. 35, at 17–19.

176. *See e.g.* Getches, *supra* n. 72; Grant, *supra* n. 66; and Adler, *supra* n. 5.

177. In *Texas v. New Mexico*, the Court held that "unless the compact to which Congress has consented is somehow unconstitutional, no court may order relief inconsistent with its express terms." *Tex. v. N.M.*, 462 U.S. 554, 564 (1983).

IV. CHARTING A DIFFERENT COURSE: COLORADO RIVER LEADERS' VIEWS ON OPTIONS AND OPPORTUNITIES

A. *Assessment Overview*

Researchers with the University of Montana's Center for Natural Resources and Environmental Policy spoke with Colorado River Basin leaders in late 2010 and early 2011 to identify areas of shared concern and possible steps to respond to future challenges facing the basin.[178] The leaders included current and former employees of local governments, states, interstate agencies, and tribes, as well as the U.S. and Mexican governments, water supply organizations, conservation groups, universities, and related research institutes.

Several common themes emerged in the conversations. First, leaders expressed shared concerns that the Colorado River Basin's water supply and demand are in a precarious balance, and that conditions are likely to get less certain rather than more secure in the near term.[179] Second, although many people anticipate increased conflict as a result of current conditions, leaders expressed shared preferences for resolving conflicts through discussion and negotiation, and an equally strong aversion to Compact-related litigation.[180] Third, although the conversations revealed nothing resembling consensus about the ideal response to these challenges, people from a variety of backgrounds acknowledged the need to address and in some way involve more diverse interests in basin management.

The Pecos Compact was found to be based on a flawed allocation formula that lead to a variety of water delivery problems, leading the Court to enact a new allocation formula, although not relieving New Mexico from the obligation of remedying the past failures under the initial agreement. *See Tex. v. N.M.*, 482 U.S. at 133.

178. CNREP, *supra* n. 3.

179. *Id.* at 3, 17.

180. *Id.* at 3, 21.

B. *Assessment Questions and Responses*

The assessment summarized the leaders' responses to two broad questions that began each conversation:

(1) If the Colorado River continues to be managed pursuant to current laws, including the Interim Guidelines,[181] what conditions do you foresee in 15 years in terms of water shortages, water security, and interstate conflicts?

Hydrologic Conditions: "The sky is not falling . . . yet."

Although all do not agree that climate change is the cause, leaders expressed general agreement that water supplies will be more stressed and conditions less certain in the future.[182] They shared a consistent message that all parties need to be prepared for continued increases in demand and tighter supplies.[183] All those involved in water supply planning said that they are currently taking the projected shortage into account.[184]

As underscored by the supply/demand deficit described above, the Colorado River is near or beyond capacity in meeting the demands of current uses. Several people remarked that growth has proceeded without regard for limitations.[185] The recession reduced growth in the region and thus dampened demand for urban supplies, at least temporarily.[186] In response to tightening supplies, water users in some areas have turned to groundwater pumping.[187] Several people expressed concern that this finite source of water might prove an unreliable substitute for Colorado River water, and suggested that regulatory attention would be necessary to address this trend.[188] Others noted that groundwater storage can be a useful mechanism to

181. U.S. Bureau of Reclamation, *supra* n. 25.
182. CNREP, *supra* n. 3, at 3, 17.
183. *Id.* at 17–19.
184. *Id.* at 19.
185. *Id.*
186. *Id.* at 18.
187. CNREP, *supra* n. 3, at 19.
188. *Id.*

buffer shortages, and described current practices to "bank" unused portions of states' allotments for use in case of curtailment.[189]

A shortage as defined in the Interim Guidelines is likely to be declared much sooner than was anticipated in 2007.[190] Many people characterized the Interim Guidelines as well-intentioned but insufficient to address conditions likely to develop in the coming decade or two.[191] Several people predicted the conditions in the next 15 years in terms of scenarios—from relatively wet to extremely dry. In each case, the "dry" scenario included conditions that would exceed the anticipated shortfall in the Interim Guidelines, possibly for multiple years in a row, causing substantial political and legal ramifications.[192] Given the possibility that Lake Mead's elevation may drop below the initial threshold level for a shortage declaration as early as 2012, it was not surprising to hear that basin states are already discussing how such a shortage might play out.

Political Conditions: Unstable footing ahead

The consequences of a shortage would vary a great deal among the seven basin states. As described above, the Compact's formula for water allocation exposes the parties to different levels of risk, as shortages do not fall equally.[193] Leaders described the situation as "basinwide misallocation," "gross inequities," and "a battle between the haves and the have-nots."[194] Some remarked that this sort of disparity is likely to provoke litigation unless the parties can negotiate a different way to deal with shortages.[195] One source of instability is that individual water users in the basin rely on water rights that depend on states receiving their full share of Colorado

189. *See e.g. Storage and Interstate Release Agreement*, 43 C.F.R. pt. 414 (WL current through June 30, 2011) (available at http://www.usbr.gov/lc/region /g4000/contracts/ SNWA_MWDSIRAfinal.pdf).

190. CNREP, *supra* n. 3, at 19.

191. *Id.*

192. *Id.*

193. See discussion *supra* at Section III and CNREP *supra* n. 3 at 20.

194. CNREP, *supra* n. 3, at 20.

195. *Id.*

River water.[196] If a shortage forces delivery curtailments, the impact will cascade through the water user chain, but impacts will not be spread evenly due to different users' priorities.[197]

A variety of unresolved legal issues make discussion of solutions difficult; some will have to be resolved to move forward productively.[198] Colorado River leaders interviewed for the assessment concluded that these issues would require resolution before long-term solutions are possible.[199] Among the most frequently mentioned legal issues were the following:

- How to treat tributary waters in the Lower Basin;
- Whether and how deliveries to Mexico may be limited in times of shortage, and how the delivery obligation to Mexico is shared between the Upper and Lower Basins;
- What happens if Lake Mead drops below elevation 1,025 feet,[200] the lowest contemplated level in the Interim Criteria (one person remarked that the Interim Criteria are "political, not hydrological"); and
- Resolution of the Navajo Nation's reserved rights claim on the mainstem river and its tributaries.

Leaders predicted a real possibility of litigation in the next 15 years, although most parties share a strong commitment to resolve conflicts outside of the courtroom.[201] Some of the leaders predicted a Compact call within the next 15 years.[202] No one viewed the prospect of a new lawsuit in the Supreme Court as an attractive option for resolving outstanding legal issues, but many remarked that such litigation is a real possibility.[203] Everyone who mentioned this

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196. *Id.*
197. *Id.*
198. *Id.*
199. CNREP, *supra* n. 3, at 20.
200. The elevation was 1,096 feet as of March 31, 2011, having risen from a low of 1,081 feet in November, 2010. Bureau of Reclamation, *Lake Mead at Hoover Dam: Elevation (ft.)* (2011) (available at http://www.usbr.gov/lc/region/g4000/hourly/mead-elv.html).
201. CNREP, *supra* n. 3, at 21.
202. *Id.*
203. *Id.*

possibility linked it with the likelihood of an intensified conflict over how the Upper and Lower Basins share the delivery obligation to Mexico.[204] There was a general agreement that litigation is always an option, often discussed, and universally viewed as the least productive way forward. Several people described an informal but shared agreement to consult with one another before taking steps toward litigation.[205] Many people cited the Interim Guidelines as a positive and encouraging example of the states' willingness to set aside their differences and resolve issues without litigation.[206]

Many feel strongly that the Law of the River provides important protection for states' interests and does not require major changes.[207] Proposals for change are contentious in the Colorado River Basin.[208] Many but not all the leaders shared the opinion that the existing legal regime provides a sufficient balance of certainty and flexibility to adapt to new challenges.[209] This was the dominant but not universal opinion among the people interviewed.[210] Some expressed concerns that the system's vulnerabilities are greater than is generally acknowledged.[211]

Recent initiatives offer encouragement for the promise of collaborative solutions, assuming the parties have an incentive to negotiate. Over the past 20 years, various interests in the Colorado River Basin have collaborated to respond to environmental and other challenges.[212] In many cases, the federal government provided the leverage for the collaboration through mandates in congressional legislation, regulatory programs, financial incentives, and resolution of litigation.[213] Leaders expressed cautious optimism that such

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204. *Id.*
205. *Id.* at 22.
206. CNREP, *supra* n.3, at 22.
207. *Id.*
208. *Id.*
209. *Id.* at 22.
210. *Id.*
211. CNREP, *supra* n. 3, at 22.
212. *Id.*
213. *Id.*

initiatives demonstrate the ability of basin interests to work productively across jurisdictional lines.[214]

Some see an unmet need for leadership in the basin, defined generally as political leaders willing to step beyond the interest of their own constituencies and promote a basin-wide vision.[215] Several people noted that the Secretary of the Interior played a critical role in sparking the discussions that led to the Interim Guidelines by threatening to address shortages through federal regulations.[216] Some suggested that similar intervention might be necessary soon to update and revise the Interim Guidelines.[217]

(2) What might be necessary to achieve a more satisfactory outcome in this time period and beyond? We're interested in your thoughts about how to improve decision-making processes, certainty, meaningful participation by stakeholders, and political/financial support for innovative management solutions.

The Law of the River: The key is flexibility

The majority of leaders agreed with the fundamental value of the Law of the River as it currently exists.[218] In particular, leaders expressed near-universal opposition to the idea of renegotiating the 1922 Compact, which is seen as the foundational document of the

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214. One example mentioned by several people is the Upper Colorado River Endangered Fish Recovery Program, which was established in 1988 through a cooperative agreement between the Governors of Colorado, Utah, and Wyoming; the Secretary of the Interior; and the Administrator of Western Area Power Administration. Other efforts received mixed reviews, including the Glen Canyon Adaptive Management Working Group, which includes states, Indian nations, environmental groups, and resource managers from federal agencies. Because many of the issues regarding implementation of this group's work remain contentious, not everyone holds this up as a model for future collaborative efforts, but some mentioned it as an example of a movement toward more inclusive and "rational" approaches to addressing Basin challenges. Upper Colorado River Endangered Fish Recovery Program, *About the Upper Colorado River Endangered Fish Recovery Program* (2011) (available at http://colorado riverrecovery.org/general-information/about.html).

215. CNREP, *supra* n. 3, at 23.

216. *Id.*

217. *Id.*

218. *Id.* at 25.

Law of the River.[219] On the other hand, leaders expressed widespread support for the idea of negotiating changes that would update and improve implementation of the Law of the River.[220] Several people observed that the idea of major institutional change is worrisome, as states fear losing their current legal allocations.[221] One person predicted no major changes to the Law of the River in the next 15 years because: (1) it provides certainty and definition of existing rights; and (2) the costs of renegotiating are prohibitively high in terms of time, effort, and money.[222]

A number of people cited the Interim Guidelines as an example of how the Law of the River provides sufficient flexibility to meet critical water supply demands in the face of changing conditions.[223] Some suggested using the flexibility to improve the rules governing river management.[224] But, importantly, some predicted the need for larger changes, possibly rethinking the terms of the Compact.[225] "In the short term," said one, "we have the capacity to work cooperatively . . . but in the long run we have not shown the willingness to address *very* difficult issues for the seven states . . . No one will come out of this unscathed."[226] Another, noting the incorrect flow assumptions in the Compact, remarked that the impacts of climate change might push the limits of the agreement beyond viability.[227]

Many people noted the importance of a broader and more sustained conversation among Colorado River Basin interests to address challenges ahead. One person noted that, "it is a fair criticism that states have left others out of the decisions until the end."[228] Another described the system as "shuttle diplomacy,"

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219. *Id.*
220. CNREP, *supra* n. 3, at 25.
221. *Id.*
222. *Id.*
223. *Id.*
224. *Id.* at 26.
225. CNREP, *supra* n. 3, at 26.
226. *Id.*
227. *Id.*
228. *Id.*

because environmentalists and others are left out of direct negotiations but manage to provide input by informal means of consultation and input—a sort of guerrilla consultation process.[229] Several initiatives (such as the multi-party endangered species recovery efforts) have successfully engaged a broader group of stakeholders and sovereign entities, including conservation groups, Indian nations, and Mexico. But most important planning and decision processes are limited to the seven basin states in cooperation with the federal government.[230]

Some believe that broader participation is possible within existing institutions, pointing to the U.S. Bureau of Reclamation's outreach efforts related to the Interim Guidelines as a positive example of how this might be done.[231] A number of people suggested creation of a new basin-wide forum or entity to help coordinate planning, management, and/or dispute resolution.[232] The various models that might be considered include:

- A new organization with decision-making powers, such as a river basin authority;
- A body that plays more of a coordinating and advisory role, such as a river basin council or a basin-wide compact commission;
- A nested collection of local bodies that feed information into a larger basin-wide coordinating council; and
- An ongoing forum for sustained dialogue and problem solving.

Some felt that such a change would provide the opportunity to involve broader interests in Colorado River Basin management.[233] One person suggested that a basin-wide forum could "broaden the circle of cooperation" among basin interests (including Mexico and Indian nations), and help integrate various resource management

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229. CNREP, *supra* n. 3 at 26.
230. *Id.*
231. *Id.*
232. *Id.* at 27.
233. *Id.*

efforts.[234] Other suggested benefits of a new entity include: prioritizing sub-basin projects and individual actions; addressing operations of the river as a whole, relative to Upper Basin releases and Lower Basin demands; unifying and coordinating management decisions; and providing an "ongoing forum for genuine communication, understanding, and agreement."[235] Others expressed equally strong opinions that such a broad conversation would not accomplish much and would not be consistent with the states' primary role as implementers of the Law of the River.[236] Several people predicted gridlock if a new basin entity extended decision-making authority beyond the current players.[237]

Some believe that the Secretary of the Interior could play a more active role in coordinating and directing basin-wide discussions.[238] Opinions are decidedly mixed on this question. Many think it appropriate that the federal government supports state leadership in the basin, but does not control it. Among the identified roles for the Secretary of the Interior:

- Pressure parties to negotiate through threatened exercise of allocation/operation authority.
- Pressure the Upper Basin to prepare for the possibility of a Compact call.
- Implement federal environmental mandates and support multi-party restoration initiatives.
- Ensure meaningful representation of public interests and other parties not otherwise represented in existing decision processes.
- Access financial resources and technical support (including modeling).

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234. CNREP, *supra* n. 3, at 27.
235. *Id.*
236. *Id.*
237. *Id.* at 27.
238. *Id.* at 28.

- Promote the national significance of the Colorado River Basin (along the lines of the Everglades[239] and Great Lakes[240]) to garner political support and resources for action.

As described above, leaders expressed general agreement that the shortage conditions specified in the Interim Guidelines are likely to occur far sooner than the states anticipated when negotiating the provisions in 2007. Many expect to revisit the agreement sooner than its expiration in 2026.[241] According to some, such conversations are already beginning.[242] A few interviewees suggested specific changes that might be considered, such as revising elevations that trigger a shortage declaration and addressing concerns about power generation capacity in light of reservoir levels.[243] Some would like to see the criteria more explicitly linked to climate change impacts, with additional decision-making processes and management actions triggered when projected impacts occur.[244] Others called for a simpler method for calculating such triggers.[245]

As described above, some believe shortages may become severe enough to warrant Compact enforcement, sparking litigation and conflict. Several people suggested that the Upper Basin states should craft a new agreement among themselves to guide their response to a Compact call.[246] Several others mentioned that preliminary discussions among Upper Basin states toward this end are already underway.[247]

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239. U.S. Army Corps of Engr., *Central and Southern Florida Comprehensive Review Study: Final Integrated Feasibility Report and Programmatic Environmental Impact Statement* (1999).

240. The Great Lakes Charter: Principles for the Management of Great Lakes Water Resources, *reprinted in* Great Lakes Governors Task Force, Council of Great Lakes Governors, *Final Report and Recommendations: Great Lakes Governors Task Force on Water Diversions and Great Lakes Institutions*, app. III at 40–45 (1985).

241. CNREP, *supra* n. 3, at 28.

242. *Id.*

243. *Id.*

244. *Id.*

245. *Id.*

246. CNREP, *supra* n. 3, at 28.

247. *Id.*

River Management: More information and better practices

Many people mentioned the work currently underway on the Colorado River Basin Water Supply and Demand Study.[248] Some see it as a promising opportunity to develop scenarios for a range of hydrologic and growth conditions, but several expressed skepticism about the likely product.[249] One person suggested that the Basin Study's approach could be complemented by use of the Delphi Method[250] to solicit water managers' views about the likelihood and timing of a potential Compact call.[251] This approach would reveal just how serious a threat a Compact call may be and provide an informed prediction of timing. It might provide a useful complement to the modeling work underway, and would give a sense of the variation in opinions among the Upper and Lower Basin leaders.

A number of people believe that the only way to meet growing demands is to enhance the basin's natural water supplies. The options mentioned included weather modification, desalination of ocean water, brackish water treatment, urban runoff capture and reuse, and imported supplies from outside the basin, such as a pipeline to the Mississippi River.[252] Several people expected that augmentation would be a primary focus of the options identified in

248. U.S. Bureau of Reclamation, *supra* n. 5.

249. CNREP, *supra* n. 3, at 29.

250. The Delphi Method is a structured communication technique, a systematic and interactive forecasting method that depends on a panel of experts who respond to questions in a series of surveys, with each new round informed by a summary of answers (and the respondents' reasoning) to the previous round. Thus, experts revise their answers based on what they've heard from one another and—it is believed—the range of answers is refined and narrowed to reflect the best-informed "correct" outcome. Norman C. Dalkey, *The Delphi Method: An Experimental Application of Group Opinion*, *in* Norman Dalkey, et al. (Eds.) *Studies in the Quality of Life* (1972).

251. CNREP, *supra* n. 3, at 29.

252. *Id.* at 30.

the Basin Study.[253] The Colorado River Augmentation Study described and evaluated a menu of twelve augmentation strategies.[254]

Several leaders emphasized more aggressive conservation/efficiency measures such as irrigation improvements, lining canals, dry-year leasing from irrigators, eliminating invasive species, and water reuse.[255]

A number of leaders predicted an increase in voluntary transfers from agricultural to urban water users throughout the basin, with a few noting that the quantities of water available from irrigated agriculture are more than sufficient to meet projected urban needs.[256] Such transfers raise issues of impacts on other irrigators and the environment, which several people noted as requiring attention and mitigation.[257]

Some argued in favor of cross-boundary water exchanges, including interstate water banks.[258] Several suggested economic arrangements in which water users and states pay others to forgo water use and allow water to flow to more economically valuable uses.[259] Those favoring this sort of exchange expressed confidence that the Law of the River would permit it. Others are concerned that an exchange would threaten state allotments, and cautioned that any such proposals would fail in the face of political or possibly legal opposition.[260]

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253. *Id.*

254. Southern Nevada Water Authority, *Colorado River Augmentation Study* (2011) (available at http://www.snwa.com /html/wr_colrvr_augmentation. html).

255. One person mentioned the Prairie Water Program in Aurora, Colorado, as an example. This project captures the city's return flows, pumps and treats the water, and reintroduces the supply into city reservoirs, boosting the city's supplies by as much as 20%. Aurora Water, *Prairie Waters Project* (2011) (available at http://www.prairiewaters.org).

256. *See e.g.* Douglas J. Kenney, *The Colorado River: What Prospect for 'a River No More'? in* River Basin Trajectories: Societies, Environments, and Development (François Molle & Phillipus Wester 2009).

257. CNREP, *supra* n. 3, at 30.

258. *Id.*

259. For example, one person suggested that California could agree to share shortage calls in exchange for access to marketable water that is not currently available to it, such as water currently supplied to irrigated agriculture in Arizona.

260. CNREP, *supra* n. 3, at 30–31.

Several people mentioned arrangements already in place for cooperative water storage. For example, the Southern Nevada Water Authority stores water for the Metropolitan Water Agency of Southern California.[261] Lower Basin water entities have negotiated more of these arrangements than their Upper Basin counterparts. However, Wyoming manages water in North Platte River reservoirs using a flexible system of ownership accounts, so this is not an unfamiliar concept in the Upper Basin.[262] Those who receive water from the Colorado Big Thompson Project in Colorado receive shares that vary in quantity annually depending on supplies.[263]

Many people mentioned the ongoing importance of addressing environmental issues on the Colorado River. Concerns include restoration of the Colorado River Delta ecosystem, which is designated for protection under the Ramsar Convention;[264] addressing impacts of desalting on a large scale; protecting the intact tributaries of the White, Yampa, and Green rivers in the Upper Basin; and protecting and recovering endangered species throughout the basin.[265]

Several people noted that habitat restoration is an experimental process, and much remains to be learned about how to measure success.[266] Others noted that environmental flows need to be part of every modeling process, but generally are not.[267] Another argued for a basin-wide evaluation of the investments in ecological

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261. *See* Wash. Dept. of Ecology, *Analysis of Water Banks in the Western States* (2004) (available at http://www.ecy.wa.gov /biblio/0411011).

262. CNREP, *supra* n. 3, at 31.

263. N. Colo. Water Conserv. Dist., *Colorado-Big Thompson Project* (2011) (available at http://www.ncwcd.org/project _features/cbt_main.asp).

264. The Convention on Wetlands of International Importance, called the Ramsar Convention, is an intergovernmental treaty that provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources. The treaty was adopted in the Iranian city of Ramsar in 1971; the United States and Mexico are both parties to the convention. Convention on Wetlands of International Importance especially as Waterfowl Habitat, Feb. 2, 1971, T.I.A.S. No. 1084, 996 U.N.T.S. 245 (1971).

265. CNREP, *supra* n. 3, at 31.

266. *Id.*

267. *Id.*

mitigation and restoration relative to the results they achieved. [Name] suggested that money could be spent more strategically on portions of the river and tributaries where full restoration is an actual possibility.[268] And one person suggested that such an evaluation should not be limited to environmental flows, but should extend to all uses of Colorado River water.[269]

Some mentioned that habitat and flow restoration initiatives provide broad public benefits, but this is at a cost to water and power interests.[270] Some suggested that the public beneficiaries of environmental protection measures should compensate those who bear the burden of altered flows or other measures.[271] Others felt that restoration is among the highest priorities for future management.[272] One person cautioned that the primary goal of Colorado River management is to meet economic and social needs: "Environmental considerations take a back seat out of necessity."[273] Another noted that the river's hydrological changes are permanent, and we ought to recognize that restoring some species is unlikely and perhaps undesirable.[274] Similarly, one person expressed doubt that people will be willing to give up significant amounts of water and energy to save species such as the humpback chub when pressures get intense.[275]

Some suggested that the looming pressures on Colorado River management will require monetary contributions from water users, states, conservationists, and others.[276] One person suggested a small fee on water users' bills to go into a basin-wide fund to pay for conservation improvements and other measures to stretch resources as far as possible.[277] Several mentioned the importance of continued and expanded support for projects funded by the Title XVI Water

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268. *Id.*
269. *Id.*
270. CNREP, *supra* n. 3, at 31.
271. *Id.*
272. *Id.*
273. *Id.*
274. *Id.* at 31–32.
275. *Id.* at 32.
276. *Id.*
277. *Id.*

Reclamation and Reuse Program,[278] described as an incentive for water providers to adapt infrastructure to climate change and encourage water conservation. One person urged expansion of the program to include the practice of treating and injecting water into aquifers to be used for municipal supplies.

C. *Some Options*

The leaders interviewed for this assessment did not speak with a unified voice, but their observations suggest numerous starting points for productive, forward-looking dialogue. The conversations suggest several opportunities for action.

First, it would be productive to explore how to improve public engagement in the Colorado River Basin, both within and alongside official decision processes.[279] Experience with regional collaboration in many parts of the country[280] suggests that the conditions may be ripe in the Colorado River Basin to explore options for complementary processes to involve a wider range of interests to address these issues and inform future management decisions. Several leaders expressed strong interest in some type a basin-wide forum.[281] The Secretary of the Interior could play an important role in encouraging and supporting such a broader dialogue, but success would be more likely if this were not solely a federal initiative.

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278. Authorized by the Reclamation, Wastewater and Groundwater Study and Facilities Act of 1992 (P.L. 102-575), this program provides funds for the reclamation and reuse of wastewater and naturally impaired ground and surface waters through projects constructed and owned by non-federal sponsors in partnership with states and local water managers. Projects aim at: improving water use efficiency; supplementing water supplies; increasing drought resistance in existing water supplies; and reduced reliance on inter-basin water transfers. U.S. Bureau of Reclamation, *Title XVI Fact Sheet* (2009).

279. *See e.g.* Getches, *supra* n. 72 (on the federal role in creating a new authority) and Jean R. Sternlight, *Symposium – Collaboration and the Colorado River*, 8 Nev. L.J. 803 (Spring 2007).

280. *See* Matthew J. McKinney & Shawn Johnson, *Working Across Boundaries: People, Nature, and Regions* (Lincoln Inst. of Land Policy 2009).

281. CNREP, *supra* n. 3, at 33.

Second, given the broad agreement that conditions are likely to be less certain in the future (with many believing this to mean less water availability), it makes sense to step up efforts to find agreement about a range of long-term river flow scenarios. Ideally, hydrological models need to encompass a wide enough range of possible conditions to inform a discussion of the choices that future uncertainty implies. The leaders' assessment underscored a shared belief that a sense of crisis can provide an opportunity to drive parties to the table to discuss options that otherwise might not be politically acceptable. The current Basin Study process is one platform for discussion, but it should be reconciled with others under development.

Third, beyond the questions of supply, which are the focus of various hydrological models, the demand side of the equation deserves equal attention. Although many of the leaders expressed a desire to maintain the protected status of all existing uses, others suggested that it is time for thoughtful evaluation of all uses—human and environmental—as part of envisioning a sustainable future for the Colorado River Basin. This concern about water uses suggests the value of an honest and integrated analysis of the possibilities for and impacts of augmentation, conservation and efficiency, market-based transfers, and environmental mitigation and restoration.[282] The current deficit between annual supply and demand in the Basin suggests that future shortage risks be minimized by offsetting any new consumptive uses with reductions in existing demands. Voluntary reallocation of water from lower- to higher-valued uses is likely to play an increasingly important role in meeting anticipated human and environmental demands in the Basin.

Fourth, although some of the water management challenges facing the Colorado River Basin are physical, many are political.[283] The division of the basin into two halves at Lee Ferry, and the allocation of entitlements based on that division, offers both a firm anchor for enforcing responsibilities and an arbitrary separation of a single river basin. At least some of today's conflicts could be alleviated by: (1) a basin-wide approach to water management,

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282. Lawrence MacDonnell, *The Disappearing Colorado River* (pending publication 2011).

283. CNREP, *supra* n. 3, at 34.

optimizing use of the basin's extensive storage facilities to meet an overall water budget rather than focusing on water deliveries at Lee Ferry; and (2) considering additional agreements similar to the Interim Guidelines to address shortages.

Finally, it is common for people to speak of the Colorado River Compact and the Law of the River interchangeably, although the Compact is just one element (albeit the foundational document) of the broader Law of the River. To be clear, a minority of leaders suggested actions that would require revisiting the Compact; the majority would prefer to leave this document alone. A far greater number of people observed that the Law of the River is dynamic—as evidenced by the 2007 Interim Guidelines—and predicted that it will continue to change to reflect new realities and values in the Basin. The conflation of these references often derails public conversations about options and opportunities, resulting in misunderstanding that a policy proposal is taking aim at the Compact when in fact it would affect further evolution of the Law of the River. Additional clarity may encourage more constructive dialogue and an honest exchange of ideas to address identified challenges.

IV. CONCLUSION

This review of key hydrologic and water-use trends, legal and political positions, and the insights of key Colorado River leaders collectively paints a picture of a basin on the cusp of significant change. Even the most ardent supporter of the *status quo* will acknowledge that demands cannot, over the long term, outstrip supplies; the Law of the River may allow this, but the laws of physics will not. What is not so apparent is how the water budget will be brought into balance, and the degree to which the required changes will result from deliberate and well-reasoned reforms or from a less managed, piecemeal (and presumably more disruptive) process. But the inevitability of change is difficult to deny.

Basin states widely disparage the notion of the federal government imposing on them, but if solutions are to emerge from interstate negotiations, it is unclear if existing forums and processes of decision-making are sufficient to meet this formidable governance

challenge. Several of the needed areas of conversation remain politically sensitive (if not completely taboo), including strategies for limiting existing and projected demands, for expanding the role of markets (perhaps both intra- and inter-state), for adapting arrangements to meet the uncertainties associated with climate change, and for resolving the remaining omissions and ambiguities in the Law of the River. Additionally, while it may conceptually be desirable to include more voices and ideas in these discussions, it will take great skill and leadership to make sure the discussions lead toward sustainable and equitable solutions, rather than to greater delays and tighter gridlock.

There are many reasons for optimism despite the magnitude of the challenges. On several previous occasions, the basin states, Mexico, and the U.S. government have successfully negotiated agreements on many facets of Colorado River management. Additionally, the physical infrastructure for controlling Colorado River flows, while contributing to many environmental problems, also offers several opportunities for operational flexibility. And perhaps most importantly, there is a rapidly growing cadre of decision-makers, researchers, and other stakeholders who have demonstrated serious commitment to crafting long-term solutions. It is time to build upon this momentum and the assembled data, and to make the most of the short window of opportunity that remains.