

# [***BOOK NOTE: BOOK NOTES***](https://advance.lexis.com/api/document?collection=analytical-materials&id=urn:contentItem:5XBK-6JB1-F7VM-S436-00000-00&context=1516831)

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**Reporter**

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**[\*779]**

**Peter Annin, The Great Lakes Water Wars,**Island Press (2d ed. 2018); ISBN 978-1-610919-92-0.

In 2006, Peter Annin [[1]](#footnote-2)1published the first edition of The Great Lakes Water Wars, which received critical acclaim and the Great Lakes Book Award for nonfiction. The book provides a history of different water controversies in the Great Lakes region and insight into the creation of the Great Lakes Compact. The second edition, published in 2018, provides an update on critical water issues and recent legal battles in the Great Lakes water basin. Annin divides the book into three parts. The first part provides a general overview of water issues, the second part focuses on legal battles over water in specific locations within the Great Lakes basin, and the third part covers the history and formation of the Great Lakes Compact.

Part I, "Hope and Hopelessness," contains four chapters. Chapter one, "To Have and Have Not," focuses on global disparities of access to freshwater that have led to water conflicts. As populations rise across the world, many conflicts center on water scarcity. While noting that the developing world is more at risk for water conflict than the developed world, Annin cites many examples of water conflict in the United States over the last century. In particular, he notes that the western half of the United States is at risk for future water conflict because of unsustainable water practices and its drier landscape. He describes Great Lakes region officials' fear of future water diversions out of the Great Lakes water basin because of western drought, which sets the theme for the rest of the book.

Chapter two, "The Aral Experiment," shifts from the Great Lakes to the Aral Sea, located in the central Asian countries of Kazakhstan and Uzbekistan, to illustrate how poor water management can lead to disaster. The Aral Sea, which once hosted a thriving fishing economy, has lost 90 percent of its surface area and 96 percent of its volume since 1960. Annin describes how an ambitious Soviet plan to divert water to surrounding areas for agriculture drained the Aral Sea. Annin illuminates the sheer size of this water retreat by noting that old boats sit idle atop a dry waterbed, as well as discussing the shift in climate and ecosystem in this area. Annin addresses efforts to save the Aral Sea, but notes that the water diversion plan from the 1960s has likely created permanent impacts on the region. He ends the chapter by comparing the Aral Sea disaster to the Great Lakes to show that even water-abundant areas are susceptible to ecological disaster with poor water management.

**[\*780]**Chapter three, "Climate Change and Water Levels - Going to Extremes?," addresses how climate change leads to uncertain water levels in the Great Lakes. Annin notes that some experts believe water evaporation in the Great Lakes will increase due to higher temperatures and a loss of ice cover during the winter months. He then leads the reader through historic high and low levels in the Great Lakes over the last forty years, and the different proposed responses to these fluctuations. While no major responses have come to fruition, Annin explains that regional officials are shifting towards an adaptive approach to respond to the variability of rising and sinking water levels.

Chapter four, "Aversion to Diversion," describes past proposals for large Great Lakes water diversions across Canada and the United States. Beginning with the North American Water and Power Alliance proposal, Annin describes how proponents of the plan sought to move water to where humans needed it most, rather than letting the unused water flow into the oceans. Another proposal in the 1980s, the GRAND Canal, sought to divert water out of the Great Lakes to the American West. While neither proposal gained much traction, Annin explains that these proposals garnered attention in the Great Lakes region and caused concern about future proposals to divert water out of the Great Lakes water basin. Officials in the region considered outright bans on water diversion. However, in 1982, the U.S. Supreme Court, in *Sporhase v. Nebraska*, invalidated a Nebraska law that prohibited groundwater exports to another state, holding that groundwater was an article of commerce and therefore Nebraska's law violated the commerce clause. Annin ends the chapter by recounting the first efforts by the Great Lakes states to circumvent the Supreme Court's ruling. First, the governors and premiers of the Great Lakes basin signed the Great Lakes Charter, an agreement between governors and premiers of the basin states designed to control both out-of-basin diversions and in-basin consumption. Second, Great Lakes states' officials successfully lobbied the United State's Congress to amend the Water Resources Development Act to require any out-of-basin diversion from the Great Lakes to have the unanimous approval of all eight Great Lakes governors.

Part II, "Battle Lines and Skirmishes," begins with Chapter 5, "Reversing a ***River***." The chapter begins by describing Chicago's poor sanitary conditions in the late 1800s. In response, Chicago officials decided to reverse the Chicago ***River*** to prevent sewage from reaching Chicago's water treatment plants located on Lake Michigan. The reversal sent wastewater into the Mississippi ***River*** water basin instead of returning it to Lake Michigan. Annin explains that the Chicago ***River***'s reversal led to the first water conflicts in the Great Lakes basin. The conflicts continued throughout the twentieth century as Chicago increased the amount of water diverted to its suburban areas.

Chapter 6, "Carp in the CAWS," shifts away from the central theme of water diversions to invasive species, specifically the Asian Carp. Annin describes how Asian Carp significantly alter water ecosystems, and how the Great Lakes are threatened by the possibility of the carp entering the Great Lakes from the Mississippi water basin via the Chicago ***River***. He details attempts to stop the carp from entering the Great Lakes, while also providing evidence that carp have thwarted each attempt, continuing to move closer and closer to the Great Lakes. Annin explains that the best solution may be to re-reverse the Chicago ***River*** to flow back into Lake Michigan, at a significant construction **[\*781]**cost. Annin observes that re-reversal is still far away from implementation, and invasive species will continue to be a Great Lakes issue going forward.

Chapter 7, "Long Lac and Ogoki," returns to the subject of water diversions. However, Annin notes that the Long Lac and Ogoki diversions actually divert water into the Great Lakes rather than out of them. Annin explains that Canada constructed the Waboose Dam in remote Ontario during World War II to increase water flow to the Great Lakes in an effort to maintain water levels and promote water flow for downstream hydroelectric dams. Although the diversion was enormous, the project did not receive the same attention as the Chicago diversion because of its remote location in the forests of Ontario. Annin concludes the chapter by citing the negative consequences of the diversion and noting that a water diversion of this scale is unlikely to occur again.

Chapter 8, "Pleasing Pleasant Prairie," returns to the United States and sets up the rest of the book by describing the first water diversion conflict after the signing of the Great Lakes Charter in 1985 and the passage of the amended Water Resources Development Act in 1986. These regulations, first introduced in Chapter 4, mandate unanimous governor approval of all Great Lakes states for any water diversion out of the basin. Annin tells the unfortunate story of a town's poor water quality, caused by elevated levels of radium, and the resulting need for a new source of drinking water. Pleasant Prairie, Wisconsin, sits just a few miles from Lake Michigan, and the lake seemed like a cost-effective alternative. However, Pleasant Prairie straddles the Great Lakes water basin boundary; therefore pulling water out of the Great Lakes water basin to supply the town required the approval of all eight Great Lakes governors. Although the water diversion to Pleasant Prairie would have a negligible effect on water levels, Annin recounts Pleasant Prairie's difficulty in gaining approval.

Chapter 9, "Sacrificing Lowell," parallels Pleasant Prairie's situation, but with a different outcome. Annin describes how Lowell, Indiana, was the first and only town that has ever been denied a water diversion from the Great Lakes. Lowell, like Pleasant Prairie, had contaminated water and its requested diversion would have had a negligible effect on water levels. However, Lowell resides entirely outside of the Great Lakes water basin. Annin explains that Michigan vetoed the water diversion because of the precedential effect of a town outside of the basin gaining access to the Great Lakes. While Lowell never gained access to Great Lakes water, Annin concludes the chapter by providing the perspective that if Lowell had received access, it could lead to difficult questions of where to cut off future proposals for diversions outside of the basin.

Chapter 10, "Tapping Mud Creek," turns to in-basin water consumption. Around the same time as the Lowell dispute, Michigan, a staunch advocate against water diversions, proposed to increase its in-basin consumption of water near Lake Huron to assist farming through irrigation. Throughout the chapter, Annin explains the flaws in the Great Lakes Charter as applied to in-basin consumptive uses. Because the charter was nonbinding, Michigan was able to move forward with the irrigation plan for Mud Creek, even though Indiana and other basin states did not support the plan. Annin ends the chapter underscoring the inconsistencies between the rules for out-of-basin water diversions and in-basin consumption.

Chapter 11, "Akron Gets the Nod," examines the city of Akron's long history of water conflicts. Annin explains that Akron's water supply could not keep **[\*782]**up with the significant growth of the city in the early twentieth century. To gain access to more water, Annin describes the unusual steps Akron took to acquire water rights to the Cuyahoga ***River***. Akron obtained water rights by purchasing riparian rights that gave Akron ownership over portions of the Cuyahoga ***River***. By the 1990s, Akron was proposing to sell water from the Cuyahoga ***River*** to surrounding communities, including some located outside of the Great Lakes water basin. Annin describes the lengths that Akron went through in an attempt to convince others that selling water outside the basin would not be a diversion because any water diverted outside of the basin would be returned. Ultimately, the dispute went to the Ohio Supreme Court, which ruled that Akron had the ability to sell water to surrounding communities. Annin concludes by noting the importance of return flows to the Great Lakes water basin for diversion approval.

Part III, "New Rules of Engagement," begins with chapter twelve, "The Nova Group and Annex 2001." Annin begins the chapter with a Canadian entrepreneur's proposal to send water from Lake Superior to Asia. While this never happened, media reports of the proposal spurred the Great Lakes states and Canadian provinces to action. Great Lakes politicians created a legal team to examine current laws and explore options for developing a new binding agreement. The team produced a fifty-page document, known as the "Lochhead Report," that highlighted weaknesses in the current law and offered suggestions for how the governors could create a new water management structure. The chapter concludes with reactions to the "Lochhead Report" and how the report set the stage for a future Great Lakes Compact.

Chapter 13, "Marching toward a Compact," builds on chapter 12 and starts with the negotiation process for the binding agreement. Annin thoroughly examines the perspectives of each state and province and describes how negative reaction to the first 2004 draft almost caused the negotiations to completely fall apart. However, in 2005, the states and provinces came together again to refine the draft in response to the 2004 reaction. The new compact agreement was signed on December 15, 2005, but this still did not make it binding. Each state legislature, Canadian province, and the U.S. Congress needed to adopt the compact in order to make the document binding, and to avoid violating the commerce clause and international trade agreements. Finally, on October 3, 2008, all necessary levels of government adopted the compact and the agreement officially became law.

Chapter 14, "Waukesha Worries," begins in Waukesha, Wisconsin, during the late nineteenth century. In 1892, Waukesha, a town with internationally acclaimed spring water, fervently blocked a Chicago entrepreneur's plan to send Waukesha water to Chicago. By the 1990s, Waukesha faced a new problem - a lack of sustainable drinking water. Annin guides the reader through an analysis of Waukesha's attempt to divert water out of Lake Michigan even though the city is not located within the Great Lakes water basin. The chapter offers insight into legal arguments, policy decisions, and political battles between the city and opponents to the diversion. The chapter ends in the middle of negotiations between the city and the Wisconsin Department of Natural Resources, setting up the finale of this controversy, discussed in chapter sixteen.

In Chapter 15, "New Berlin: The Compact's Forgotten Test Case," Annin **[\*783]**switches from Waukesha to its nearby neighbor, New Berlin, Wisconsin. Annin explains that New Berlin faced similar contamination problems in its deep groundwater and faced a court order to clean up its water. However, there is a major geographical difference between Waukesha and New Berlin. Part of New Berlin's boundary was in the Great Lakes water basin, while no part of Waukesha was in the basin. Because of its geographical location, Annin explains, New Berlin falls under the compact's straddling community exception for diverting water out of the Great Lakes. Annin examines the political battle over New Berlin's water diversion. The issue was not the size of the diversion, but the precedent it would set as a first test case.

Chapter 16, "Waukesha Takes its Shot," returns to Waukesha's water problems, beginning with Waukesha's situation in 2010, the year the city applied for a water diversion. Annin discusses Waukesha's local politics and the city's tenuous situation throughout its Great Lakes water application process. While the city of Waukesha resides outside of the Great Lakes water basin, the county it is in partially straddles the basin border. The compact created a "straddling county" exception for water diversions with the condition that all eight governors approve of the diversion. Annin describes how Waukesha made its case to the other states for its water diversion, a diversion the other basin states ultimately approved.

Annin wraps up the book in Chapter 17, "Who Will Win the War?," by exploring potential future problems in the Great Lakes water basin. Annin provides different perspectives on these potential future water conflicts through numerous quotes from water experts. He examines how the compact drafters likely did not consider industrial water use as a potential issue, and how corporations may have found a loophole in the straddling community exception under the compact's language. Annin concludes by discussing the uncertainties surrounding this issue, and how the compact will hold up to future issues in the Great Lakes water basin.

In conclusion, *The Great Lakes Water Wars*, describes in detail how water conflicts occur not only in water deprived areas, but also in water abundant areas, such as the Great Lakes region. Annin recounts important historical water conflicts that spurred the creation of the current compact, and he provides the legal, political, and ecological perspectives that arose during the negotiation process. Annin leads the reader through the complex legal problems and political ramifications associated with the creation of the compact and guides the reader chronologically through each water conflict, educating the reader on effective water management solutions.

*Josh Horman*

**[\*784]**

**David Owen,*****Where the Water Goes: Life and Death Along the Colorado River***, Riverhead Books, New York, NY (2018); 274 pp; ISBN 978-1-594633-77-5.

In *Where the Water Goes: Life and Death Along the* ***Colorado******River***, David Owen [[2]](#footnote-3)2gives the reader an overview of the ***Colorado*** ***River*** from its headwaters in ***Colorado*** to its delta in the Gulf of California. Owen set out to trace the course of the ***Colorado*** ***River*** and examine "where the water came from, and where it went," as a way to study and think about water issues of all kinds. Owen weaves information about water use, climate change, agriculture, power production, and government intervention with current and historical characters and their interactions with the ***Colorado*** ***River*** and its tributaries to find out where the water goes along its path from ***Colorado*** to Mexico.

Chapter one, "The Headwaters," describes the headwaters of the ***Colorado*** ***River*** from the vantage point of an airplane. Owen discusses two transbasin diversions, which collect water that would normally flow into the ***Colorado*** ***River*** system, but instead transport it across the Continental Divide to provide water to the eastern plains of ***Colorado***. On top of drinking water, the ***Colorado*** ***River*** provides water to irrigate almost six million acres of farmland, powers hydroelectric plants, and supports a $ 26 billion dollar recreational economy. Unfortunately, the ***Colorado*** ***River*** is over-allocated, meaning more water is claimed than exists in the ***river***, causing problems with water availability and environmental degradation.

Chapter two, "The Law of the ***River***," gives an overview of western water law and the interstate compact that eventually divided the waters of the ***Colorado*** between the seven basin states. While most of the precipitation that feeds the ***Colorado*** ***River*** originates in ***Colorado***, most of the users are located at the other end of the ***river***. The basin states entered into negotiations for a compact to divide up the waters in the ***Colorado*** ***River*** in a manner agreeable to all the states. Unfortunately, Owen notes, the compact assumed the ***river*** contained an average of seventeen million acre-feet of water per year, when, in fact, that was not the case. In a 1944 treaty with Mexico, the allocations specified by the Compact were increased by 1.5 million acre-feet to accommodate water users in Mexico.

Chapter three, "Tributaries," discusses the ***Colorado*** ***River*** Basin. Owen notes that the basin includes not only the ***Colorado*** ***River*** itself, but also tributaries of all sizes. Owen visited the Blue ***River*** and describes how it was dammed near Silverthorne in the 1960s to create Lake Dillon, a reservoir for Denver Water. In addition, Lake Dillon provides year-round recreational opportunities. After staying the night near Lake Dillon, Owen drove to Carbondale, where he stopped to see the Crystal ***River*** - a ***Colorado*** ***River*** tributary, once removed. Owen explains that since the 1980s, conservationists have been trying to get the headwaters valley of the Crystal ***River*** designated as "Wild and Scenic," and they have successfully opposed suggestions for several dams in the process. While the dams would provide irrigation water to farmers in other **[\*785]**parts of the state and provide flood-control for the valley, damming ***rivers*** disables a ***river***'s natural ability to maintain its ecosystems.

Chapter four, "Go West," is an examination of various energy sources and their affect on the ***Colorado*** ***River***. Owen describes how electricity is created when water turns electricity-generating turbines. He notes that while hydroelectricity remains America's largest renewable-energy source that does not involve burning things, "it carries other environmental costs because it always involves interfering with a ***river***'s natural flow." Mining is another issue in ***Colorado***, which has more than 20,000 abandoned subsurface metal mines. Many of the mines pose a threat to the ***Colorado*** ***River*** because of things like acid mine drainage. Owen points out that there is a discrepancy between our current drive for more clean-energy technology, and the fact that almost all of that technology relies on mined metals, such as lithium, to make it possible. He then examines hydraulic fracturing or "fracking" in ***Colorado***, including conventional fracking, and attempts to replace conventional fracking with the detonation of nuclear bombs underground.

In chapter five, "Grand Valley," Owen introduces ***Colorado***'s Grand Valley, a major population center and broad valley attractive to farmers. Despite having only eight inches of rainfall each year, the valley has good soil and a long growing season. The farmers irrigate their fields with water from the ***Colorado*** ***River*** via the Grand Valley Diversion Dam, which serves about forty acres of agricultural land in the valley. Owen visited the Mesa Park Vineyards near Palisade, ***Colorado***, and relates what he learned from the owners about water use in the valley, including efforts to improve efficiency and handling wastewater. Owen explains, however, that efforts to improve water efficiency often lead to an increase in the consumed fraction of water. The environmental consequences of efficiency improvements depend on what happens to the water saved by implementing the more efficient practices.

Chapter six, "Salt, Dry Lots, and Houseboats," opens with a discussion about ***Colorado*** ***River*** salinity levels. The ***Colorado*** ***River*** is saltier than most ***rivers***, and by the 1960s, the salinity level of the ***river*** as it crossed into Mexico reached a level that killed Mexican crops. The solution was to build a salt removal facility on the Dolores ***River***, a ***Colorado*** tributary and major salt contributor. While the facility solved the salinity problem, at least for now, it has also caused roughly 6,000 earthquakes in the area. Owen also describes living conditions in areas of northeast Arizona where most residents do not get any water from the ***Colorado*** ***River*** but live on what are known as "dry lots," meaning they have to order water from a commercial supplier or buy it from a pipestand some distance away and haul it themselves. Owen next discusses the Glen Canyon Dam, a part of the ***Colorado*** ***River*** Storage Project. The town of Page, Arizona, is the closest town to Glen Canyon Dam, and its economy is dependent on the ***Colorado*** ***River***. Its biggest business is houseboats and powerboats that are used by those coming to Lake Powell for recreational purposes.

Chapter seven, "Lees Ferry," discusses the historical necessity of Lees Ferry as a ***river*** crossing, the gauging station located just upstream, and recreational in-channel diversions. Lees Ferry is the last chance for travelers to cross the ***Colorado*** before reaching Nevada, and it also marks the boundary between the ***river***'s upper basin and lower basin as defined by the ***Colorado*** ***River*** Compact. Owen describes the gauging station, a flow measuring station upstream of Lees **[\*786]**Ferry, which has operated continuously since 1921. He also notes that Lees Ferry is the last departure point for rafting the ***Colorado*** above the Grand Canyon. The topic of rafting leads to observations on the inception of recreational in-channel diversions, a relatively new beneficial use of water, and the quantity and timing for such diversions.

Chapter eight, "Boulder Canyon Project," tackles the subject of the Hoover Dam and Lake Mead. Owen noted that Lake Mead's volume has fallen over 60 percent since the last time it was full in 1998. He describes the history and construction of the Hoover Dam, authorized by the 1928 Boulder Canyon Project Act, including the dangerous and noisy working conditions, the lack of labor laws and decent living and working conditions, and the racist hiring practices. The dam helped transform Las Vegas from a remote desert outpost into a major city. Owen notes that the project also fueled Los Angeles, as it uses 60 percent of the electricity produced by the dam. Owen concludes with a discussion about the concerns over the shrinking water levels of Lake Mead and Lake Powell and what that means for power generation.

In chapter nine, "Las Vegas," Owen explains that while Las Vegas is blamed by many for shrinking Lake Mead, that is far from the truth. Nevada's share of ***Colorado*** ***River*** water under the ***Colorado*** ***River*** Compact is only 300,000 acre feet - that is only 2 percent of the paper water total. Additionally, Nevada, even today, takes less ***river*** water than it is entitled to take. There is strict conservation in Nevada with 93 percent of the water used indoors being treated and reused or returned to the lake. Owen argues, however, that recycling water and other conservation measures may not do everything we intend. For example, irrigating with recycled water causes salinity issues, and successful conservation often causes price increases or is driven by an expanding population.

Chapter ten, "***Colorado*** ***River*** Aqueduct," explores Lake Havasu and Parker Dam, from which water is diverted west to California and east to central Arizona; the remainder of the water continues downstream. The dam was really created to provide water to metropolitan Los Angeles. Owen describes meeting with Donald Nash, the manager of the desert portion of the aqueduct who lives and works at the Lake Havasu pumping station. Nash explained that each of the nine pumps could fill an Olympic-size swimming pool in twenty seconds. They push ***Colorado*** ***River*** water from Lake Havasu into nine pipes. The water then travels via gravity and five additional pumping stations for 239 miles until it gets to Lake Matthews, located forty-five miles southeast of downtown Los Angeles. The dam only produces half the electricity to move the water to Los Angeles, so the water district has to purchase additional electricity to make up the difference.

Chapter eleven, "Central Arizona Project," continues the story of the Parker Dam, this time discussing the Central Arizona Project ("CAP"). CAP, completed in 1993, is 340 miles of canals, tunnels, and pumping plants that reach as far as Tucson, Arizona. CAP is the largest and most expensive aqueduct system ever built in the United States. While the federal government financed the project, it was subject to repayment by Arizona. Unfortunately, upon completion, there was no one to buy the water because Arizona farmers could not afford such expensive water. Arizona, however, was concerned that if it did not use the water it would be usurped by California. Arizona cities agreed to buy the CAP water and then sell it to farmers at significantly reduced prices to keep **[\*787]**the water from California.

Chapter twelve, "The Rule of Capture," explores the connection between groundwater and surface water and what that means for ***Colorado*** ***River*** water users. The rule of capture is a legal doctrine that grants landowners the rights to use as much water as they want from wells on their own land, even if doing so dries up neighboring wells. However, Owen notes, there is almost always a hydrologic connection between water on the surface and water underground. Therefore, when you take water from the ground, it will inevitably cause problems on the surface. He concludes by discussing how different states handle groundwater in the ***Colorado*** ***River*** Basin.

In chapter thirteen, "Boondocking," Owen explores the ***Colorado*** ***River*** downstream of Parker Dam. He recounts visiting a place called Quartzsite, where recreational vehicle owners gather for wintertime camping. Quartzsite has over two million visitors annually, and without enough plumbed and wired campsites, most of the campers "boondock" - they park in the desert, mostly on Bureau of Land Management land, and run on generators and solar power, getting their water from filling stations. Located further downstream are the Cibola and Imperial National Wildlife Refuges. The refuges have no dams, diversions, or farms. About seven or eight miles downstream from the Imperial Wildlife Refuge visitors center is the Imperial Dam, which is the largest diversion on the entire ***Colorado*** ***River*** system. It feeds water to Arizona and also to the Imperial and Coachella Valleys in California.

In chapter fourteen, "Imperial Valley," Owen considers the Imperial Valley and its use of ***Colorado*** ***River*** water. Today the Imperial Valley is the largest single user of ***Colorado*** ***River*** water. It is also one of the most productive agricultural areas in the United States. Owen discusses the effects of drought on the Imperial Valley farmers. Under the Quantified Settlement Agreement of 2003 ("QSA"), municipalities pay farmers in the valley to cut back and send the excess water to Southern California municipalities. While fallowing is not necessarily unpopular with farmers because it allows the soil to rest, it causes other problems such as unemployment and the failure of businesses that cater to farming. Imperial Valley farmers have also started lining ditches and installing drip irrigation in efforts to conserve water and send that conserved water to the cities. However, this is causing the Salton Sea to shrink and will compound an existing ecological disaster once the QSA is in full effect.

Chapter fifteen, "The Salton Sea," describes how conservation in the Imperial Valley is affecting the Salton Sea. The Salton Sea is a 400 square mile lake created when the ***Colorado*** ***River*** changed its course in 1905. The problem is that the lake is endoheric, meaning it has no outlet other than evaporation and seepage into the ground. Farmers in the Imperial and Coachella Valleys have kept it filled over the years by using it as a dump for their irrigation runoff. However, the quality of water has steadily worsened because evaporation causes the concentration of dissolved minerals and agricultural chemicals to rise. Today, the Salton Sea plays an important role in sustaining a large number of bird species, but is threatened by the evaporation and increasing concentration of salt and irrigation chemicals. There are also threats to human health. As the lake evaporates, it leaves chemical residue in the lake bed, which wind can carry as far as 130 miles northwest to the suburbs of Los Angeles.

Chapter sixteen, "Reclamation," delves into the Bureau of Reclamation's **[\*788]**("Reclamation") efforts to "conserve" water on the ***Colorado*** ***River*** near the U.S.-Mexico border. Mexico's right to use ***Colorado*** ***River*** water became official in a 1944 treaty with Mexico, and Mexico was to receive the rights to 1.5 million acre-feet of water per year. Until the Glen Canyon Dam was completed in the 1960s, large volumes of water in excess of Mexico's allotment routinely flowed over the border, and the extra water was sufficient to sustain the ***river***'s historical delta. However, once Lake Powell began to fill, all that extra water was trapped behind the dam. "Conservation" efforts have continued over the years, as Reclamation built off-stream retention reservoirs to catch unused water before it crossed the border to Mexico, and the irrigation districts lined the All-American and Coachella Canals with concrete. Owen argues that efficiency does not create water, it just moves it from here to there. While these projects may have "saved" water for the United States, it "took" water from Mexican farmers and a wetland environment that had come to rely on its availability.

Chapter seventeen, "The Delta," discusses the environmental issues affecting the ***Colorado*** ***River*** Delta because of the lack of water crossing the border. Owen went to the Morelos Dam, just south of the U.S.-Mexico border. The dam diverts virtually all of its water to the Alamo Canal, which feeds farms and towns in the Mexicali Valley. Owen described the view downstream as a "swampy rectangle covering four or five acres." He describes the one-time release of over 100,000 acre-feet of water past the Morelos Dam in 2012, and the positive effects it had on the delta. Owen also visited a 40,000-acre-foot wetland that was accidentally created when the Welton-Mohawk Irrigation and Drainage District in Arizona started sending 100,000 acre-feet of salty American groundwater to Mexico annually via a bypass canal rather than dumping it into the ***Colorado*** ***River***. Owen notes that it is the largest section of delta that functions anything like the way the delta used to function, and it shows how little water is needed for a fully functioning and environmentally healthy delta.

Chapter eighteen, "What Is to Be Done," discusses factors to consider when pondering remedies for the current ***Colorado*** ***River*** crisis. Among them are over-allocation, the role of the federal government, diversion from other ***river*** systems, desalination, cloud-seeding, agriculture, the water footprint beyond economics, threats outside of the basin, differing environmental views, and managing growth. Some of these factors are not currently either feasible or economically sound, such as diverting water from other systems, desalination, and cloud-seeding. Owen argues that we should view everything in a larger context, as environmental problems are "deeply interrelated" and we cannot address them in isolation.

*Where the Water Goes: Life and Death Along the* ***Colorado******River*** examines the many issues plaguing the ***Colorado*** ***River*** and its dependents. It discusses water law, environmental issues, over-allocation issues, and the different ways we have tried to solve these problems over the years. Owen argues that environmental and water issues are interconnected, and the only way to find a solution is to consider all the different aspects together as a functioning whole. Otherwise, a solution for water will negatively affect the environment, and a solution for the environment will negatively affect water rights. It is only when viewing all the issues as one interconnected system that we will be able to find a solution that everyone can live with.

*Kathleen Arsenault*

**[\*789]**

**Eric P. Perramond,*****Unsettled Waters: Rights, Law, and Identity in the Ameri-can West***, University of California Press (2019); 239 pp.; ISBN: 978-0-520-29936-8.

In Eric P. Perramond's [[3]](#footnote-4)3latest work *Unsettled Waters: Rights, Law, and Identity in the American West*, the author brings together over a decade of research that explores the past, present, and future challenges of water adjudication in the state of New Mexico. These state-driven adjudication lawsuits find, map, and inventory existing water rights and are adversarial, expensive, and lengthy. The process most often brings to bear disagreements over use, local and expert knowledge contests, competing legal notions of water, and conflicting views on the purpose of water more generally.

The introduction, "The Cultures of Water Sovereignty in New Mexico," begins by examining what adjudication means to local water users. Many users are concerned that they are losing control over decision-making and the ability to keep water attached to the land. Customary and formal legal traditions can coexist in the same space, and Perramond argues that other western states seeking solutions to water scarcity can draw lessons from New Mexico.

Part I, "Unsettled Waters: How Water Adjudication Works, What It Does, and What Happens When It Fails," covers three chapters that focus on the process of adjudication and case studies. Chapter One, "How Local Waters Become State Water," describes the origins and purposes of adjudication. The complex political, legal, and cultural understanding of water in New Mexico is the result of two major episodes of settler colonialism and three political shifts, beginning with the Spanish and shifting to Mexico before finally coming under the control of the United States beginning in 1848. Perramond explains how New Mexico created the 1907 water code to affirm, map, and create an inventory of water rights across the state. For many New Mexicans, adjudication signals the final dismantling of the communal economy of water. Adjudication disrupts the sovereignty of the institution of the acequias, which are gravity-fed irrigation ditches that function with the aid of a water boss (mayordomo), three commissioners, and other individual members who use the ditch. Adjudication creates a patchwork of private water rights owners who become less tied to the community that built the ditches and enables these owners to dispose of their individual water rights as they see fit.

Perramond goes on to explain how, under New Mexico law, beneficial use of water is the basis for water rights, the limit for awarding water rights, and rooted in prior appropriation law. It presumes that beneficial use has economic benefits, and under prior appropriation the earlier user has the better, or more senior, water right. There are three ways to trigger an adjudication lawsuit: the state's attorney general and state engineer can file a case, the Office of the State Engineer can record the claim or claims of a water rights holder within the area of adjudication, or the government can construct a large infrastructure project affecting water rights within the area of adjudication. An alternative to the oftentimes decades-long process of complete adjudication is settlement, a process **[\*790]**that Perramond notes is both less court driven and less adversarial. Adding to the overall legal complexity of adjudication is the interaction between federal and state laws; individual identity determines entitlement to specific types of water rights under either federal or state law.

Chapter Two, "Aamodt, Dammit! Big Trouble in a Small Basin," analyzes the Aamodt adjudication in the Pojoaque ***River*** Valley. Originally filed in 1966, this case involved four pueblos, federal agencies, and local acequias, and it highlights the complexity of adjudication. The Aamodt adjudication's complications derived mainly from the question of how to define and quantify Indian water rights, and from issues of legal pluralism - differences in how water users discussed, used, or understood water. The adjudication generated so much legal paperwork that scholars refer to it in two separate episodes: Aamodt 1 (1966-1984) and Aamodt 2 (1985-2000). The first legal phase established federal water protections for the four pueblos and selected the presiding court. In the second phase, the court defined Pueblo priority rights based on historical irrigation acreage between 1846 and 1924, tying their resource claims to their date of transfer to the United States as Mexican citizens. Perramond notes that because the United States government redefined the Pueblo as "Indians" in 1924, they did not qualify for full Winters (Indian) water rights treatment, rights that are more generous than historically calculated figures.

For non-Pueblos, the concern was twofold: the sheer scale of Pueblo Indian water assertions and the need to acquire funding for legal representation. The 1987 court ruling that granted the Pueblo's less land than they had originally claimed somewhat lessened the first concern. However, regarding the second, there remained a feeling amongst all involved in the adjudication process that the only ones profiting from it were the attorneys. After all, more money was spent adjudicating, and subsequently settling, the valley's water rights than all the land in the basin was worth. Perramond observes how a shift toward cooperation among non-Indian water users led to a change in legal strategy, away from the strict individual prior appropriation plan, in favor of a valley-wide priority date. The effects of the Aamodt adjudication percolated to villages upstream and downstream for decades, as the question of whether to push for individual water rights by specific dates heightened tensions between and within communities. In attempting to prove historic priority dates, friction arose in the communities where water was historically a shared, communal enterprise. Aamodt involved 5,284 defendants, lasted nearly fifty years, and pitted neighbor against neighbor by separating residents into Indian and non-Indian. The final settlement, which included a new $ 261 million regional water system, restrictions, and a harsher cap on use for wells established after 1983, did not heal the cultural wounds adjudication generated.

Chapter Three, "Abeyta: Taos Struggles, Then Negotiates," explores the Taos Valley adjudication lawsuit known as the Abeyta suit, filed in 1969. It is notable as the first lawsuit to avoid a "normal" full state adjudication and settle out of court, and it later influenced the Aamodt suit negotiations to its south. According to Perramond, in this case, adjudication failed because the negotiating parties did not want the adversarial relationships inherent in adjudication. Today, Indian water rights settlements are the preferred route at the federal level. Yet, as Perramond discusses, settlement is not without its shortcomings, as it does not provide useful precedents for future cases or adjudications. In **[\*791]**the end, the parties in the suit got their individual water rights while avoiding prior appropriation. Additionally, the settlement caused surface and groundwater to become mingled both physically and legally.

Chapter Four, "Local Settlements Connect What State Adjudication Severed," details the problematic social, political, and hydrological consequences when adjudications leave the courts to become settlements. Perramond discusses the value in the Aamodt and Abeyta settlements, in that they both stipulated that the Pueblos would not put senior water rights "calls on the ***river***"; Abeyta went further and implemented an actual water-sharing agreement. Law and engineering, Perramond argues, coproduce each other during adjudication, and settlements are driving new diversion and pipeline water infrastructure in this century. Federal and state agencies attempt to provide water from any source, however, local irrigators seek legal protections to keep the water local. Not everyone wants their water connected to the new water systems. The primary resentment of those who do not want the connection stems from the feeling that the state is forcing them into a new system without their input. Ditch organization are not powerless, however, and have carved their own space in the New Mexico water code, such as the ability to deny a transfer or sale away from the ditch. But, as Perramond observes, modern water law denies collective water rights, and thus the argument that acequias deserve water rights as entities has fallen on deaf ears in the courts.

Part II, "The Production of Water Expertise: The Adjudication-Industrial Complex and Its Consequences," covers three chapters examining what adjudications and settlements produce. Chapter Five, "Changing Measures: How Expert Metrics Change Water," discusses how adjudication has produced new metrics of water and new forms of expertise. Adjudication necessitated new measures to make water use across the state commensurate and to individuate water rights. As Perramond notes, these new metrics often conflicted with previous understandings and methods of measuring water. Many New Mexicans viewed these new metrics, along with a live market test program for water markets, as suspicious attempts at making water a marketable commodity.

Chapter Six, "Working for the Adjudication-Industrial Complex," concerns how adjudication has produced new forms of expertise. Each adjudication or settlement involves thousands of defendants and hundreds of lawyers. Additionally, the scale and complexity of adjudications, along with the knowledge required for them, have produced legions of "water experts" from lawyers to cartographers, engineers to historians. Perramond points to the importance of law in drafting new measures and statutes, as well as its involvement in governing private groundwater wells, active water resource management, and endangered species recovery plans.

In Chapter Seven, "New Water Agents and Actors in Civil Society," Perramond looks at civil organizations that help citizens navigate the financial and logistical demands of adjudication. Organizations have developed to benefit groups of water users by aggregating decision-making and funding paths and by giving water users the ability to collaborate. Groups like New Mexico Legal Aid have been vital for those who cannot afford legal counsel. For many water users in the state, nonprofits are the only option they have to effectively protect their interests in places where the state has begun to map and monitor water use.

**[\*792]**Part III, "Adjudicating the Unknown Future of New Mexico's Water," covers three chapters and addresses the need to cope with new water demands in the face of a changing climate. Chapter Eight, "City Water, Native Water, and the Unknown Future," discusses adjudication in heavily populated regions along the Rio Grande, the effects that growing cities have on the adjudication system and water rights in general, and how adjudication will (or will not) work to divide water between cities and rural areas. The state designed adjudication to account for rural agrarian water and it is imperfectly suited to dealing with urban water needs. Perramond explains how many cities in New Mexico have appropriated the necessary water for urban growth through questionable tactics, and those water rights have not yet been adjudicated. Santa Fe is an example of what Perramond describes as "water dispossession through urbanization." He notes that beginning in the nineteenth century, the city began quietly moving water away from the countryside by trapping it behind dams on the Santa Fe ***River*** for urban use, and by the time that veterans returned from World War II, the city had appropriated much of the local water. The city had effectively usurped the Santa Fe ***River***'s flow through reservoirs. The "pueblo rights doctrine" is another method some cities, such as Las Vegas, New Mexico, used to effectively move water from agrarian uses to urban uses. Under this doctrine, based on a Spanish myth, a pueblo (town) has a higher right to water than any other category of water users. The doctrine remained in effect until being overturned by the New Mexican Supreme Court in 2004.

Perramond also points out the inconsistency involved in adjudication lawsuits throughout the state because of constantly changing parties, representatives, and even judges. For example, the case on the Lower Rio Grande has involved five judges, at least twenty state attorneys, and around eighteen thousand individual claimants. Perramond notes how adjudication settlements have resulted in more hardware infrastructure projects. Large infrastructure projects are not disappearing, but rather shifting from surface storage to interconnections between basins, groundwater, and off-channel storage strategies. These accommodating works are the result of legal compromises, though they are less visible to the public. They may alter the allocation of water for the state and will change the future of New Mexicans upstream who depend on it.

In Chapter Nine, "Beyond Adjudication: Nature's Share of Water," Perramond assesses the complexities of adjudication in the face of a future with less water. One effect of the Anthropocene, or period in which human activity has come to influence the earth's climate, is that New Mexico, along with the entire southwestern United States, will experience water shortages. In times of drought, senior water rights holders demand their priority access rights. As Perramond explains, the state designed water laws on the assumption that long-term precipitation and climate averages hold steady over time. It is unclear if those laws can cope with new water issues generated by rising temperatures and decreasing precipitation, as well as environmental demands to protect ecosystems and endangered species. Perramond contends that developing a water rights mechanism in anticipation of climate change would require two components. First, it would have to account for stream loss due to aridity. Second, it would have to set water aside in particularly vulnerable settings, such as critical environments that will become increasingly susceptible to wildfires as temperatures rise. He notes that one of the most recent pressures to extend water rights **[\*793]**to the environment is from the Endangered Species Act and local non-profits that sue under that act to restore water to particular ***rivers***. Stakeholders can and have redefined "beneficial uses" of water for the new challenges that a shifting water supply presents. Perramond asserts that planning for a worst-case scenario based on predictions of decreasing precipitation is a good starting point for all western states.

In Chapter Ten, "Water Coda, with No End in Sight," Perramond reflects on the experiences of New Mexicans and lessons they may provide to other states. He notes that adjudication was the engine for creating water rights as property out of public waters. However, through settlements, New Mexicans successfully reconceptualized the state's vision of water as property and created a more flexible and less adversarial system. Perramond advocates for the state to enact proportional shortage sharing instead of strict prior appropriation. Proportional shortage sharing is a legal accounting system based on priority, by which water users share actual and available water, in times of plenty or in times of need. In his hundreds of discussions with water users along the streams and ditches of New Mexico, Perramond states that people made clear to him that their local institutions remain important and can inform water governance and property rights.

In conclusion, *Unsettled Waters* serves as a compelling narrative on the process of adjudication and its concomitant complexities. Adjudication is a top-down approach driven by the state and its army of experts. Perramond, however, studies it from the bottom up, by examining the experiences and collecting the testimonials of various New Mexicans, ditch community members, and water experts alike. Through his work, Perramond provides an accounting of the resurfaced tensions adjudication brings, explains the legal differences that come with differing conceptions of water, and explores whether state adjudications can change to meet the water demands in the twenty-first century.

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