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The Complexities of Managing Hydrologically Connected Surface Water and Groundwater Under the Appropriation Doctrine

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The management of hydrologically connected surface water and groundwater under the appropriation doctrine is widely acknowledged to be complicated.[1] The immediate cause of complexity is that surface water and groundwater differ physically. Groundwater moves slower and more diffusely, and its movement is less readily ascertainable. This article attempts to show, however, that the ultimate cause of complexity is deep-rooted ambivalence and conflict regarding water management objectives. The article examines appropriation doctrine water management objectives, describes the physical complications associated with integrated management of hydrologically connected surface and underground supplies, explains how the physical complications generate tensions among the management objectives, and explores how the law has resolved these tensions to date. A concluding section evaluates the appropriation doctrine as a tool for dealing with the complexities of integrated management.

I. BACKGROUND

Surface water and groundwater are often hydrologically connected.[2] A stream or lake may discharge into an adjacent groundwater basin or vice versa, depending on the relative surface water and groundwater

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1. *See, e.g.*, C. CORKER, GROUNDWATER LAW, MANAGEMENT AND ADMINISTRATION 148-53 (1971) (Legal Study No. 6 prepared for Nat'l Water Comm'n); Trelease, *Conjunctive Use of Groundwater and Surface Water*, 27B ROCKY MT. MIN. L. INST. 1853, 1858-60 (1982); Ellis, *Water Rights: What They Are And How They Are Created*, 13 ROCKY MT. MIN. L. INST. 451, 469-74 (1967).

2. NATIONAL WATER COMM'N, WATER POLICIES FOR THE FUTURE 233 (1973) [hereinafter WATER POLICIES]; Thompson & Fiedler, *Some Problems Relating to Legal Control of use of Ground Waters*, 30 J. AM. WATER WORKS ASS'N 1049, 1060 (1938). *But cf. Discussion: Jon Kyl* in WATER SCARCITY 75 (E. Engelbert & A. Scheuring eds. 1984) (most aquifers in Arizona are not hydrologically connected to surface flows).

levels.[3] If the connection is significant, the surface and underground waters constitute one supply since the diversion and use of either might well impair the availability of the other. For that reason, water professionals have long advocated that hydrologically connected waters be managed as a single, integrated system.[4]

A logical first step toward integrated management is to unify the law governing surface water and hydrologically connected groundwater. The prior appropriation doctrine governs such waters in thirteen western states.[5] Six of these states have a single water code for hydrologically connected surface water and groundwater.[6] Although the other seven states have separate codes,[7] five of them have statutes that expressly integrate rights in connected surface and underground waters.[8] In the remaining two states, the courts have upheld integrated administration of rights by

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3. H. RAGHUNATH, HYDROLOGY 105 (1985).

4. *See, e.g.*, WATER POLICIES, *supra* note 2, at 230-46 (1973); Ellis, *supra* note 1, at 472; Piper, *Requirements of a Model Water Law*, 51 AM. WATER WORKS ASS'N J. 1211, 1212 (1959); Wiel, *Need of Unified Law for Surface and Underground Water*, 2 S. CAL. L. REV. 358 (1929). Another reason for integrated management, even where surface and underground supplies are not connected, is that it may enable greater water use at less cost than if the supplies are managed separately. *See* R. FREEZE & J. CHERRY, GROUNDWATER 367 (1979); D. TODD, GROUNDWATER HYDROLOGY 364-66, 371 (2d ed. 1980).

5. *See* ALASKA STAT. § 46.15.030 (1962 & 1982); COLO. REV. STAT. §§ 37-92-102 (Supp. 1985); IDAHO CODE §§ 42-101, -103, -226, -229, -230 (1977 & Supp. 1986); KAN. STAT. §§ 82a-703, -707 (1984); MONT. CODE ANN. §§ 85-2-101, -102(14) (1985); NEV. REV. STAT. §§ 533.025, .030, 534.020 (1983); N.M. STAT. ANN. §§ 73-1-1, -1-3, -3-1 (1985); N.D. CENT. CODE § 61-01-01 (1985); OR. REV. STAT. §§ 537.120, .515, .525, .535 (1985); S.D. CODIFIED LAWS ANN. §§ 46-1-1 to -3 (1983)); UTAH CODE ANN. §§ 73-1-1, -1-3, -3-1 (1980); WASH. REV. CODE ANN. §§ 90.03.010, 44.020, 44.035, 44.040 (1962 & Supp. 1985); WYO. STAT. §§ 41-3-101, -901, -905, -930, -936 (1977 & Cum. supp. 1986). In Arizona, California, Nebraska, Oklahoma, and Texas, the appropriation doctrine governs surface and underground streams (in some cases, together with the riparian doctrine); but a different doctrine governs the vast majority of groundwater, which does not flow in well-defined underground channels but percolates more diffusely. *See* 3 W. HUTCHINS, WATER RIGHTS LAWS IN THE NINETEEN WESTERN STATES 162-214, 332-64, 423-40, 503-35 (1977). In these states, the legal distinction between percolating water and subterranean streams is often fuzzy. *See, e.g.*, NATIONAL WATER COMM'N, A SUMMARY-DIGEST OF STATE WATER LAWS 7 (1973) [hereinafter SUMMARY-DIGEST]; Johnson, *Texas Groundwater Law: A Survey and Some Proposals*, 22 NAT. RESOURCES J. 1017, 1019 (1982).

6. ALASKA STAT. §§ 46.15.010 to -.270 (1962, 1982, & Cum. supp. 1986); COLO. REV. STAT. §§ 37-92-101 to -602 (1973 & Supp. 1985); KAN. STAT. §§ 82a-701 to -731 (1984); MONT. CODE ANN. §§ 85-2-101 to -520 (1985); N.D. CENT. CODE §§ 61-01-01, 61-04-01 to -25 (1985); UTAH CODE ANN. §§ 73-3-1 to -29 (1980 & Supp. 1986). The situation in Colorado is extraordinarily complicated. Separate legislation governs nontributary groundwater. *See infra* notes 86-93 and accompanying text. Although the Colorado legislation cited above governs both natural streams and tributary groundwater and integrates rights in the two sources, separate legislation for nontributary groundwater establishes a permit program for constructing wells outside of designated groundwater basins, including wells that will withdraw groundwater tributary to a natural stream. COLO. REV. STAT. § 37-937 *(1974 & Supp. 1985)*.

7. *In these states, groundwater is governed by the following provisions:* IDAHO CODE §§ 42-226 to -240 (1977 & Supp. 1986); NEV. REV. STAT. §§ 534.010 to -.190 (1983); N.M. STAT. ANN. §§ 72-12-1 to -28 (1985 & Supp. 1986); OR. REV. STAT. §§ 537.505 to -.795 (1985); S.D. CODIFIED LAWS ANN. §§ 46-6-1 to -31 (1983 & Supp. 1986); WASH. REV. CODE ANN. §§ 90.44.010 to -.250 (1962 & Supp. 1986); WYO. STAT. §§ 41-3-901 to -938 (1977 & Supp. 1986).

8. IDAHO CODE § 42-237a(g) (Supp. 1986); OR. REV. STAT. §§ 537.525(9), -.620(3) (1985); S.D. CODIFIED LAWS ANN. § 46-6-3 (1983); WASH. REV. CODE ANN. § 90.44.030 (1962); WYO. STAT. § 41-3-916 (1977 & Cum. supp. 1986).

the state engineer.[9] All thirteen states, then, have a legal foundation for integrated management of hydrologically connected surface water and groundwater.

Despite this legal foundation, experience with integrated management under the appropriation doctrine is limited. With perhaps only two exceptions,[10] the appropriation doctrine states have not yet had to deal with widespread, acute pressure on hydrologically connected surface and underground supplies.[11] However, as more complete development of water resources occurs in these states, integrated management will surely become more crucial.

The central feature of the appropriation doctrine is the principle that priority in time gives priority in right.[12] A water right has a priority date based on when it was initiated,[13] and priority affects both the acquisition of new rights and the exercise of existing rights. Permits for new rights are denied if the available supply is already fully appropriated.[14] The exercise of existing rights is curtailed in inverse order of priority if drought or seasonal fluctuation makes the supply insufficient for all, that is, junior appropriators are shut off completely to supply fully those with more

9. City of Albuquerque v. Reynolds, 71 N.M. 428, 379 P.2d 73 (1963); Griffin v. Westergard, 96 Nev. 627, 615 P.2d 235 (1980). For at least twenty years, administrative practice in Nevada has protected senior stream appropriations from interference by junior wells. Hutchins, *Ground Water Legislation*, 30 ROCKY MT. L. REV. 416, 428 n.52 (1958). *See also* El Paso & R.I. Ry. v. District Court, 36 N.M. 94, 8 P.2d 1064 (1931) (combined adjudication of rights to interconnected surface water and ground water).

10. *See* WATER POLICIES, *supra* note 2, at 233 (reporting acute water supply problems in Colorado and New Mexico).

11. The three western states with the greatest groundwater use are California, Texas, and Nebraska. Heath, *Introduction to State Summaries of Ground-Water Resources* in U.S. GEOLOGICAL SURV., NATIONAL WATER SUMMARY 1984, WATER SUPPLY PAPER 2275 118-21 (1985). None of these is an appropriation doctrine state for hydrologically connected surface water and groundwater. *See supra* note 5.

12. *E.g.*, Lindsey v. McClure, 136 F.2d 65, 69 (10th Cir. 1943) (priority is the "cardinal rule"); Strickler v. City of Colorado Springs, 16 Colo. 61, 26 P. 313, 315 (1891) (priority is the "fundamental principle"); Caviness v. La Grande Irrigation Co., 60 Or. 410, 424, 119 P. 731, 736 (1911) (priority is the "fundamental principle").

13. The priority of a right initiated through a permit is the date of the permit application if water is thereafter put to beneficial use under the permit. 1 W. HUTCHINS, *supra* note 5, at 388-89 (1971). The priority of a right initiated without a permit, if allowed by state law, generally relates back to the date of the first significant step to make the appropriation if water is thereafter put to beneficial use with due diligence. *Id.* at 383-86. For exceptions to the general relation back rule in nonpermit cases, see *id.* at 347-48, 386-88.

14. Water permit statutes are discussed *infra* notes 100-02 and accompanying text. All appropriation doctrine states except Colorado now have a mandatory permit system for initiating water rights. Although Colorado does not require a permit to appropriate the waters of a natural stream, the water court will not issue a "conditional decree" for a proposed water right if the source of supply is fully appropriated. Southeastern Colorado Water Conservancy Dist. v. City of Florence, 688 P.2d 715 (Colo. 1984). Colorado has a permit system for the construction of wells, including wells that will withdraw groundwater tributary to a natural stream, and no permit can issue if the proposed well will materially injure the vested water rights of others. COLO. REV. STAT. § 37-90-137 (1974 & Supp. 1985). A water court can confirm a water right from a well despite the state engineer's denial of a well permit application, or failure to act on an application within a prescribed time, if the court determines that unappropriated water is available and the well will not materially injure the vested water rights of others. *Id.* §§ 37-90-137(2), -92-302(2), -305(6).

senior priorities.[15] Although integration of priorities is not the only tool available to coordinate the management of hydrologically connected surface and underground waters,[16] the crucial role of the priority principle in the appropriation doctrine means that integration of priorities will almost inevitably be at the heart of efforts to coordinate management.[17] Therefore, this article focuses on the integration of priorities.

II. APPROPRIATION DOCTRINE WATER MANAGEMENT OBJECTIVES

Not surprisingly, the priority principle is the key to understanding water management objectives under the appropriation doctrine. Discovering the objectives of a legal rule can be tricky, however, because the rule's practical effects do not necessarily reveal its objectives: effect can easily be mistaken for intention.[18] Therefore, an effort is made here to present authoritative sources that speak more or less explicitly about objectives. The approach is historical, looking at the original objectives of the priority principle and tracing their evolution.

A. Greater Productive Use of Water

The appropriation doctrine began in the mid-nineteenth century as a system in western states for assigning rights to water in surface streams.[19] The priority principle fostered development of the vast expanses of arid western land by affording security of water use needed to encourage investment in water projects.[20] As one western court explained in an early decision:

> The climate is dry. The soil is arid, and largely unproductive in the absence of irrigation, but, when water is applied by that means, it becomes capable of successful cultivation.... Irrigation... cannot be accomplished with any degree of success or permanency without the right to divert and appropriate water of natural streams for that purpose and a security afforded to that right.[21]

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15. *E.g.*, Beecher v. Cassia Creek Irrigation Co., 66 Idaho 1, 9, 154 P.2d 507, 510 (1944): "Each junior appropriator is entitled to divert water only at such times as all prior appropriators are being supplied under their appropriations under conditions as they existed at the time the appropriation was made."

16. *See, e.g.*, WATER POLICIES, *supra* note 2, at 230-43 (suggesting various water management tools, including pump taxes and aquifer recharge programs).

17. *Cf. Discussion: Raymond L. Anderson* in WATER SCARCITY 430 (E. Englebert & A. Scheuring eds. 1984) (Rather than dramatic change in water allocation institutions, "[a] more probable course will be for the existing institutions governing water use and ownership to gradually loosen and evolve to provide for new uses. That is the traditional way institutions react.").

18. A. WILDAVSKY, SPEAKING TRUTH TO POWER: THE ART AND CRAFT OF POLICY ANALYSIS 91 (1979).

19. C. MEYERS, A HISTORICAL AND FUNCTIONAL ANALYSIS OF THE APPROPRIATION SYSTEM 1-6 (1971) (Legal Study No. 1 prepared for the Nat'l Water Comm'n).

20. *See id.* at 6.

21. Moyer v. Preston, 6 Wyo. 308, 318-19, 44 P. 845, 847 (1896). *See also*, A-B Cattle Co. v. United States, 196 Colo. 539, 589 P.2d 57, 64 (1978) (Erickson, J., dissenting) ("[T]he appropriation doctrine was considered most conducive to the economic development of semi-arid western states such as Colorado. The doctrine encouraged the expenditure of labor and resources with the promise that a decreed appropriation would receive legal protection.");

The courts readily extended the priority principle from streams to their surface tributaries, such as springs and creeks.[22] One reason was that separate treatment for tributaries would result in "ruinous and useless expenditures of money in a race between rival claimants in the extension of ditches towards the source of water supply . . . ."[23] Thus, security of water use aided development not only by encouraging new investment but by avoiding premature obsolescence of existing investment of scarce labor and capital in water projects.

Economic development continues to be an important objective under the appropriation doctrine.[24] Modern water management statutes refer to "economic . . . well-being,"[25] "maxim[um] . . . beneficial use of . . . waters,"[26] "full economic development of underground water resources,"[27] "maximum economical development,"[28] "development . . . for maximum benefit,"[29] "maximum economic development,"[30] and "obtaining of economic efficiency."[31] However, two changes should be noted in the policy of promoting economic development.

First, the function of security of use to help develop unappropriated water is largely obsolete because most water is now appropriated. Security of use, however, can still be important in helping to maximize the use of appropriated water. For example, a study of irrigated agriculture found that estimates of the dependable water supply during the next crop season affect the amount of acreage irrigators decide to plant that season.[32] By increasing the security of an irrigator's water supply, the priority principle helps to avoid underplanting. Similarly, security of use probably helps to avoid underutilization of water that is appropriated for other uses if those uses require periodic investment decisions.

Second, the pioneer economic development objective has evolved to reflect growing societal interest in protecting the natural environment. Modern water statutes and judicial decisions make it clear that pursuit of water-related economic development must be balanced against en-

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F. Arthur Stone & Sons v. Gibson, 230 Kan. 224, 630 P.2d 1164, 1169 (1981) (The priority principle "is said to reward development by giving the early appropriator the fruits of his industry.").

22. *See* 2 W. HUTCHINS, *supra* note 5, at 201-05 (1974).

23. Strickler v. City of Colo. Springs, 16 Colo. 61, 67, 26 P. 313, 315 (1891).

24. In fact, a modern water law scholar attributes the endurance of the appropriation system to its capacity to promote economic development by giving security of use. C. MEYERS, *supra* note 19, at 6.

25. ALASKA STAT. § 46.03.010(a) (1962 & 1982).

26. COLO. REV. STAT. § 37-92-102(1)(a) (Supp. 1985).

27. IDAHO CODE § 42-226 (Supp. 1986). IDAHO CONST. art. XV, § 7 calls for "optimum development of water resources in the public interest."

28. KAN. STAT. § 82a-711 (1984).

29. MONT. CODE ANN. § 85-2-101(3) (1985). *See also* WASH. REV. CODE ANN. § 90.54.020(2) (Supp. 1986).

30. OR. REV. STAT. § 536.310(2) (1985). *See also id.* § 536.220(1) ("increased economic and general welfare of the people").

31. WYO. STAT. § 41-2-109(a) (1985).

32. *See* Bredehoeft & Young, *Conjunctive Use of Groundwater and Surface Water for Irrigated Agriculture: Risk Aversion*, 19 WATER RESOURCES RES. 1111 (1983).

vironmental concerns.[33] To borrow a phrase from the National Water Commission, one might say that the early objective of economic development has evolved into the broader objective of "greater productivity, in both monetary and nonmonetary terms, from existing water supplies."[34] As the objective has broadened, however, it has become ambivalent. Dispute now often arises about which of several possible ways to deal with water supplies will lead to greater productivity in the broad sense.[35]

Even within the narrower economic development aspect of greater productivity, doubts have been raised about how well the priority principle maximizes economic development. As a governmental study once observed, "it frequently happens that a prior appropriator uses water which might be more beneficially used by a junior appropriator, because no account is taken of the fertility of the soil of the various appropriators."[36] In addition, the priority principle has been charged with inducing premature development and excessive water use (by basing rights on priority in time of use), and with ignoring the economic concepts of marginal productivity and pooling of risk (by giving full water to senior appropriators and none to juniors during shortage).[37] Although these criticisms have not significantly undermined support for the priority principle in appropriation doctrine states, the criticisms might influence solutions to presently unresolved complexities in integrating priorities to hydrologically connected surface water and groundwater.

B. Allocative Fairness

In the frontier West, the priority principle was thought to allocate water fairly. Elwood Mead, a major figure in early western water law,[38] described this function:

> Justice seemed to demand that when there was not water for all, those who first used water from a stream should have the bet-

33. *E.g.*, ALASKA STAT. § 46.15.080 (1962 & 1982); MONT. CODE ANN. § 85-2-101(3) (1985); OR. REV. STAT. § 537.170(5)(a) (1983); Alamosa-La Jara Water Users Protection Ass'n v. Gould, 674 P.2d 914 (Colo. 1983); Shokal v. Dunn, 109 Idaho 330, 707 P.2d 441 (1985).

34. WATER POLICIES, *supra* note 2, at 227. A background study prepared for the Commission reported: "The people of the United States give far greater weight to environmental and aesthetic values than they did when the nation was young and less settled." C. HOWE, C. RUSSELL, R. YOUNG & W. VAUGHN, FUTURE WATER DEMANDS 5 (1973).

35. Furthermore, Southeastern Colo. Water Conservancy Dist. v. Shelton Farms, Inc., 187 Colo. 181, 191, 529 P.2d 1321, 1327 (1975) (emphasis in original), suggests that the goal of greater productive use requires looking at how water use affects land: "The waters of Colorado belong to the people, but so does the land. There must be a balancing effect, and the elements of water and land must be used in harmony to the maximum *feasible* use of both." *Accord*, R.J.A., Inc. v. Water Users Ass'n, 690 P.2d 823 (Colo. 1984).

36. NATIONAL RESOURCE PLANNING BD., REPORT OF SUBCOMM. ON STATE WATER LAW, STATE WATER LAW IN THE DEVELOPMENT OF THE WEST 81 (1943).

37. Gaffney, *Economic Aspects of Water Resource Policy*, 28 AM. J. ECON. & SOC. 131, 139-40 (1969). *But cf.* J. HIRSHLEIFER, J. DE HAVEN, & J. MILLIMAN, WATER SUPPLY: ECONOMICS, TECHNOLOGY AND POLICY 243 (1960) ("Another alleged disadvantage of the law of appropriation is that it may encourage waste. This charge makes sense only to the extent that water rights are non-transferable. Only then would a person with a fixed quota not have incentive to consider the value of water to alternative users.").

38. Mead was the Territorial Engineer and first State Engineer of Wyoming, and later was Commissioner of the U.S. Bureau of Reclamation.

> ter right to continue that use, and the doctrine of priority was the result. This doctrine grew out of the belief of the first settlers that their claims were superior to those of later comers, and they insisted that the owner of the last ditch built should be the first to suffer when the stream failed to supply the needs of all. The first builders of ditches could not anticipate how many were to follow. Unless protected by some such principle, the greater their success, the sooner they would be injured by the attempts of others to benefit from their experience.[39]

Mead did not explain why justice seemed to demand that the claims of the first settlers should be superior. Perhaps the underlying philosophical principle was that rights should be based on first occupancy,[40] but there may also have been elements of the Lockean labor theory of property acquisition,[41] or a utilitarian notion that risk takers who pioneer development deserve to be rewarded.[42]

Allocative fairness is still an objective under the appropriation doctrine, but fairness and the role of the priority principle in achieving it have become more complicated. Samuel C. Wiel[43] long ago criticized the priority principle as a pioneer doctrine best suited to sparsely settled regions. He contended that where supplies are largely developed, the priority rule "is inadequate because based upon too selfish a principle, opening the way to monopoly."[44] For settled regions, Wiel favored remaking the appropriation doctrine to include the riparian doctrine principles of equality among users and pro rata sharing of water, arguing they were more just.[45]

Wiel's criticism of the priority principle relates to allocative fairness. But it downplays the being-there-first aspect of fairness and emphasizes what might be called the antimonopoly aspect of fairness. It focuses on the harshness of barring any new use of water by latecomers, and of shut-

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39. E. MEAD, IRRIGATION INSTITUTIONS 65 (1903).

40. *But cf.* 2 W. BLACKSTONE, COMMENTARIES **2-5, *14-15* (suggesting that as to water, the right based on first occupancy lasts only during possession). For a modern defense of the principle of first occupancy, see Epstein, *Possession as the Root of Title,* 13 GA. L. REV. 1221 (1979).

41. *See* Basey v. Gallagher, 87 U.S. 670, 682 (1874) ("[H]e who first connected his labor with [water on federal public lands] thus situated and open to general exploration, did in natural justice acquire a better right to its use and enjoyment than others who had not given such labor . . . .").

42. *See* Pima Farms Co. v. Proctor, 30 Ariz. 96, 245 P. 369, 373 (1926) ("[T]o permit a junior appropriator, who, perhaps, obtains his knowledge of such body of [underground] water by the pioneering explorations and sacrifices of the first appropriator, to lower the water level and thereby destroy or greatly impair the latter's means of diversion, including his pumps and water containers, does not comport with justice and equity . . . ."). *See generally* L. BECKER, PROPERTY RIGHTS: PHILOSOPHIC FOUNDATIONS chs. 3-5 (1977) (discussing first occupancy, the labor theory of property acquisition, and arguments from utility).

43. Wiel's treatise, WATER RIGHTS IN THE WESTERN STATES (3d ed. 1911), was long the dominant text on western water law. *See* Corker, *Inadequacy of the Present Law to Protect, Conserve And Develop Groundwater Use,* 25 ROCKY MT. MIN. L. INST. 23-1, 23-18 (1979).

44. S. WIEL, *supra* note 43, § 112a, 128.

45. *Id.* The chief difference between the riparian doctrine and the appropriation doctrine as reformed in accordance with Wiel's views is that under the latter water use would not be limited to riparian land. *Id.* § 314, at 339.

ting down junior appropriators completely during shortages to satisfy fully the demands of senior appropriators.[46]

Wiel's idea of borrowing riparian principles to cure the monopolistic tendencies of the appropriation doctrine has gained little acceptance.[47] However, courts and legislatures have widely embraced another solution. They have decided that priority does not insulate a senior appropriator from having to bear reasonable costs and risks to enable greater productive use of water supplies or to promote the antimonopoly aspect of allocative fairness.

Almost universally, for example, priority in time protects a senior appropriator's means of diverting water only if the means is reasonable.[48] Consequently, a senior appropriator might have to improve his original means of diverting water, at his own expense, to accommodate a junior appropriator's depletion of the supply. Similarly, many appropriation doctrine states allow the exchange of water, whereby a junior appropriator may divert water to which a senior right would normally attach if the junior provides the senior with substitute water of like quality and quantity from another source.[49] Consequently, the senior appropriator might have to bear a risk that the water exchange plan will fail because geohydrologic data supporting the plan are flawed, the exchange facilities are badly constructed, or the junior appropriator negligently maintains the facilities.[50]

Although it is widely accepted that reasonable limits may be put on the rights of senior appropriators, the being-there-first aspect of allocative fairness is hardly dead. As a modern philosopher has observed: "The notion that being there first somehow justifies ownership rights is a venerable and persistent one."[51] This notion often makes it difficult to

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46. *Cf.* Ellis, *supra* note 1, at 464, 472 (describing a practice in New Mexico of voluntary pro rata sharing during times of shortage as "less harsh" than strict enforcement of priorities, but later recognizing that it is "hardly fair" to ignore priorities if senior rights will be seriously impaired).

47. The practice in New Mexico of voluntary pro rata sharing during shortage, *supra* note 46, arose in the absence of water right adjudications determining priority definitively. *Id.* at 463-64. Pro rata sharing during scarcity is common among users served by a canal company or an irrigation district. *See* F. TRELEASE & G. GOULD, WATER LAW 503, 518 (4th ed. 1986). But in this situation, the water delivery organization can control the total number of users and thus prevent individual pro rata shares from becoming too small to be productive.

48. Grant, *Reasonable Groundwater Pumping Levels Under the Appropriation Doctrine: The Law and Underlying Economic Goals*, 21 NAT. RESOURCES J. 1, 8-9 (1981). In Idaho, domestic wells drilled before 1978 are exempt from the reasonable means of diversion requirement. Parker v. Wallentine, 103 Idaho 506, 650 P.2d 648 (1982).

49. 1 W. HUTCHINS, *supra* note 5, at 606-14. Idaho's retreat from the water exchange is described *infra* note 50.

50. At one time, Idaho allowed water exchanges despite a risk that the exchange plan might fail. Wilder Irrigation Dist. v. Jorgensen, 64 Idaho 538, 136 P.2d 461 (1943) (risk of failure emphasized in Justice Givens' dissent). Subsequently, the exchange statute was amended to bar any exchange without the written consent of all senior users affected. 1969 Idaho Sess. Laws 901 (codified at IDAHO CODE § 42-105 (1977)).

51. L. BECKER, *supra* note 42, at 24 (1977). Trelease, *New Water Legislation: Drafting for Development, Efficient Allocation and Environmental Protection*, XII LAND & WATER L. REV. 385, 414 (1977), argues that when a seasonal shortage of streamflow can be solved

decide in specific situations how much cost or risk can fairly be imposed on senior appropriators to achieve greater productive water use or avoid monopolistic allocation of water.

C. *Stability of Water Rights*

In the frontier West, stability of water rights was linked to economic development (by affording security necessary to encourage investment), and it may also have been an aspect of allocative fairness (by preserving an initially fair allocation). Since stability may simply have been a by-product of these objectives, it is hard to say whether stability was an objective in its own right. However, stability of property rights seems to be a basic societal value long reflected in different legal doctrines. For example, Justice Oliver Wendell Holmes argued that the true reason behind the doctrine of title to property by prescription is that "man, like a tree in the cleft of a rock, gradually shapes his roots to his surroundings, and when the roots have grown to a certain size, cannot be displaced without cutting at his life."[52] It would not be surprising if the fledgling appropriation doctrine included similar concern about stability.[53]

In any event, modern water cases can be found that suggest stability is a management objective in its own right. In *Colorado v. New Mexico*,[54] a dispute between two appropriation doctrine states over a small interstate stream, the United States Supreme Court spoke of "society's competing interests in increasing the stability of property rights and in putting resources to their most efficient uses."[55] Although interstate water allocation disputes are governed by the doctrine of equitable apportionment rather than straight priorities, it is interesting that the Court decided in favor of stabilizing senior appropriations in New Mexico against depletion of the supply by proposed upstream uses in Colorado. In *Fellhauer v. People*,[56] the Colorado Supreme Court emphasized the need to promote maximum water use, but also acknowledged the constitutional necessity

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by building a dam to store high flows early in the year for release later during the dry season, it is fair to impose the cost only upon junior appropriators rather than all appropriators:

> From the standpoint of equity and justice, it should be remembered that development takes place over time. The first users take cheap, easily available, always available water. There is no shortage. When more and more uses are made, shortages are created as demands increase to meet or exceed low flow supply. Additional risks are created and additional costs must be met. It seems not unfair for the government to place those risks and those costs on those who create them.

52. Letter from O.W. Holmes to William James (Apr. 1, 1907), *reprinted in* M. LERNER, THE MIND AND FAITH OF JUSTICE HOLMES 417-18 (1953); *cf.* Willis v. Ana Maria Sugar Co., 23 F.2d 457, 458 (1st Cir. 1927) ("Statutes of limitation (prescription) are provisions necessary for peace and security in property rights.").

53. *See also* Grant, *Reasonable Groundwater Pumping Levels Under the Appropriation Doctrine: Underlying Social Goals*, 23 NAT. RESOURCES J. 53, 69-72 (1983) (discussing security of investment as a value in its own right).

54. 467 U.S. 310 (1984).

55. *Id.* at 316.

56. 167 Colo. 320, 447 P.2d 986 (1969).

of protecting vested rights.[57] The constitutional protection of vested rights can be viewed as representing in part a societal policy of stability in property rights.[58]

The stability objective was given an unusual twist in the later Colorado case of *Alamosa-La Jara Water Users Protection Association v. Gould.*[59] The major streams of Colorado's San Luis Valley are the Rio Grande and Conejos Rivers. The Conejos joins the Rio Grande shortly before the latter flows into New Mexico. Because of the lack of decreed rights within Colorado below the confluence, rights on the Rio Grande had long been administered independently of rights on the Conejos. Then more vigorous enforcement of an interstate water compact meant Colorado would have to reduce water use in the valley to increase the Rio Grande's flow into New Mexico. To accomplish this, the Colorado State Engineer issued proposed rules defining the respective contributions of the Conejos and the Rio Grande above the confluence toward meeting New Mexico's water entitlement. The rules continued the independent administration of priorities on the two rivers, with the result that senior water users on the Conejos would be shut down while more junior users on the Rio Grande could continue to divert.

The Colorado court upheld this approach, ruling that the interstate compact was not intended to change the longstanding practice of independent administration. One of several factors in the court's decision was the stability of historical water uses. The court observed that the appropriation doctrine allocates water "according to chronology because such allocation has the effect of protecting historic patterns of use."[60] However, priority in time did not help appropriators on the Conejos as against more junior appropriators on the Rio Grande:

> To hold . . . that the compact obligation has the effect of resorting settled water rights on both streams into a single system of priorities based solely on dates of appropriation would reshuffle the economies of the valley according to a chronology of events unrelated to settled expectations derived from historical patterns of use and reflected in the independent priority systems.[61]

The court was unwilling to upset settled expectations. The problem in *Alamosa-LaJara* was unusual, having arisen from more vigorous enforcement of an interstate compact. Usually the stability objective cuts against,

57. "As administration of water approaches its second century the curtain is opening upon the new drama of *maximum utilization* and how constitutionally that doctrine can be integrated into the law of *vested rights.*" *Id.* at 336, 447 P.2d at 994 (emphasis in original).

58. Whether government regulation of vested property interests goes so far that it takes the property or violates substantive due process depends on factors "such as the economic impact of the regulation, its interference with reasonable investment backed expectations, and the character of the governmental action." Kaiser Aetna v. United States, 444 U.S. 164, 175 (1979). *See also* Williamson County Regional Planning Comm'n v. Hamilton Bank, 105 S. Ct. 3108 (1985) (discussion of distinction between a taking of property and a violation of substantive due process).

59. 674 P.2d 914 (Colo. 1983).

60. *Id.* at 923.

61. *Id.*

not in favor of, junior appropriators. Nevertheless, if rights in hydrologically connected surface water and groundwater are integrated after a history of separate administration, *Alamosa-La Jara Water Users* suggests that stability of water rights might be an ambivalent objective that does not unequivocally favor senior rights.[62]

D. Compatibility of the Objectives

Historically, the priority principle served three objectives: greater economic development, fair allocation, and stability of water rights. Under frontier conditions, these objectives were largely harmonious. Stability complemented greater economic development. The priority principle might prevent a latecomer from settling in a valley where the supply was fully claimed, but this did not violate allocative fairness for perhaps two reasons. First, being-there-first was considered a justifiable basis for allocating property rights. Second, the latecomer could move on to another valley—a new frontier—and find water.

As new frontiers disappeared and available water supplies became ever more fully appropriated, water management objectives and their interrelationship changed. Instead of harmony, the objectives of economic development and stability of water rights increasingly clashed. Furthermore, greater economic development itself broadened into the more ambivalent goal of greater productive use of water in both monetary and nonmonetary terms. In addition, allocative fairness developed an antimonopoly aspect which conflicts with both the being-there-first aspect of fairness and the stability of water rights. Finally, stability might be an ambivalent objective if a water system is overappropriated but the junior uses have continued for years before the problem is addressed. The difficulty of dealing with ambivalent and conflicting water management objectives is a recurring theme in the next section.

III. COMPLICATIONS IN INTEGRATING PRIORITIES

Typically, the integration of priorities means limiting groundwater use for the benefit of surface water appropriators because surface water generally was developed before groundwater.[63] The physical complications of integrating priorities often have parallels in the administration of solely surface water priorities. The complications are just more frequent and dramatic when groundwater is involved. Since experience in applying the priority principle to groundwater is limited, the discussion below often draws upon analogies from the longer and more developed history of administering priorities to surface water.

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62. *Cf.* J. SAX & R. ABRAMS, LEGAL CONTROL OF WATER RESOURCES 837 n.3 (1986) ("There is no *a priori* reason to follow strict priority in a dispute between a groundwater appropriator and a surface water appropriator when the two sets of priorities have been independently maintained by the state.").

63. *See* Thompson & Fiedler, *supra* note 2, at 1057.

A. Delayed Impact of Junior Diversions

When water is diverted from a surface stream, the flow is directly reduced, and the reduction is soon felt by downstream users unless the distances involved are great. When water is withdrawn from an aquifer, however, the impact elsewhere in the basin or on a hydrologically connected stream is typically much slower. If a well withdraws groundwater that is tributary to a surface stream, the stream will be depleted gradually, and the full impact might not be felt for weeks, months, years, or even decades. Conversely, if the well is closed after a period of operation, the stream depletion does not terminate immediately but may continue, gradually diminishing, for weeks, months, years, or decades.[64] Delayed impact complicates the administration of priorities in several respects.

1. Timing of Closure of Junior Appropriators. The priority principle is supplemented by rules that (1) a junior appropriator may divert excess water in the source of supply beyond that appropriated by holders of senior rights, and (2) a junior appropriator may also divert water to which senior rights would otherwise attach when the senior appropriators do not need the water.[65] These rules originated long ago to regulate the rights of successive appropriators from surface streams, and in that setting they usually enabled greater productive use of water without prejudice to senior rights. If a junior appropriator took excess water or took water when a senior did not need it, and later the streamflow decreased or the senior needed water, the junior could be shut down. Typically, the supply to the senior would increase promptly.

With extension of the appropriation doctrine to groundwater, these rules must now operate in situations where delayed impact is common. If a significant time will elapse between closure of a junior well and a resulting increase in the senior appropriator's supply, certain variables may intervene to increase the water available to the senior or to reduce the senior's need for water. In other words, an anticipated need for water by the senior appropriator might not materialize.

This problem is best illustrated, ironically, by a case involving competing surface water appropriators. In *State ex rel. Cary v. Cochran*,[66] senior appropriators had the right to divert 162 cubic feet per second from the Platte River in Nebraska through the Kearney canal. The junior appropriators were situated many miles upstream on that river and its tributaries. The water moved at the rate of about twenty-five miles per day, and the distance from the state line to the Kearney canal downstream was so great that the resulting time lag was about ten days. Because of heavy stream channel losses, 700 cubic feet per second had to be left in the river at North Platte to provide 162 cubic feet per second downstream at the Kearney canal. The senior appropriators wanted Nebraska water

64. *See* City of Albuquerque v. Reynolds, 71 N.M. 428, 379 P.2d 73, 81 (1963).

65. *See* 1 S. WIEL, *supra* note 43, § 302, at 314-15; J. GOULD, LAW OF WATERS § 231, at 410-11 (1883).

66. 138 Neb. 163, 292 N.W. 239 (1940).

officials to close the upstream junior diversions in anticipation of a downstream shortage, rather than wait until the senior users were experiencing a shortage.

The *Cochran* court identified several variables that might intervene during the time lag to increase the downstream flow or to reduce the seniors' need for water, e.g., low temperatures, rains and floods in the lower river basin, and dilatory but ultimate compliance by other junior appropriators previously ordered to cease diverting. The court also noted that figures on the flow of the river were only estimates based on spot measurements. Given all these uncertainties, the court concluded that "the use of water by a junior appropriator does not become adverse to or injure a senior appropriator *until* it results in a deprivation of his allotted amount, or some part thereof."[67] In other words, the downstream senior appropriators had to bear the risk regarding changed weather conditions and other variables that might intervene during a period of up to ten days. The court added that "[t]o pursue any other rule would greatly add to the loss by waste of the public waters of this state."[68] The goal of greater productive use of the water supply (minimizing loss by waste) prevailed over protecting vested rights.[69]

In contrast to the *Cochran* rule, statutes in Colorado and Idaho expressly authorize the closure of a junior appropriator in anticipation of injury to a senior appropriator. The Colorado statute directs water division engineers to order the discontinuance of any diversion that "is causing or will cause material injury" to senior appropriators.[70] The Idaho statute allows administrative closure of a well if the withdrawal of water would adversely affect "the present or future use of any prior surface or ground water right."[71]

These statutes, however, do not necessarily avoid the policy question with which the *Cochran* court had to grapple, that is, conflict in the time lag situation between the goals of greater productive use of the water supply and stability of vested rights. Surely, the statutes implicitly include some limit on anticipating events that are too improbable. For example, suppose the water supply is sufficient in normal water years for all surface water and groundwater appropriators. In a drought year, however, runoff to the stream from rain and snowmelt is insufficient for the senior surface rights. If the closure of some junior wells will add materially to streamflow, but not for five years, is it likely a water administrator or court would decide the wells should be closed during a normal water year

67. *Id.*, 292 N.W. at 246 (emphasis added). Colorado reportedly followed the same rule prior to a legislative change. Harrison & Sandstrom, *The Groundwater-Surface Water Conflict and Recent Colorado Water Legislation*, 43 U. COLO. L. REV. 1, 18 (1971).

68. *Id.*

69. The court did not address whether the result would have been different if stream channel losses had not been so heavy. *But cf. infra* text accompanying note 118 (suggesting that the stream channel losses were not going to waste).

70. COLO. REV. STAT. § 37-92-502(2) (Supp. 1985).

71. IDAHO CODE § 42-237a(g) (Supp. 1986).

in anticipation of a drought year that might occur five years hence? What if a drought bad enough to create a shortage occurs on average once every decade, or every quarter century?

The Colorado statute on anticipatory closure was part of legislation integrating the management of surface streams and tributary groundwater. The initial regulations issued to implement the legislation authorized the curtailment of junior wells to benefit senior streamflow appropriators "in time of shortage or projected shortage."[72] In *Kuiper v. Well Owners Conservation Ass'n*,[73] the anticipatory closure regulation was challenged on the ground that by the time curtailment would produce water for the senior appropriators, they might no longer need it because of an intervening storm. The court, however, upheld the regulation. The holding is perhaps implicitly limited by the court's remark that even if a storm should eliminate the need for water by the senior appropriator who had called for it, the water would not go to waste because the record showed it could be picked up by other wells or used by junior surface appropriators who would otherwise be unable to obtain water.

Sometimes a water exchange might be physically available to solve the anticipatory closure problem. Suppose that a storage reservoir can be built upstream from senior appropriators who will not have enough water under drought conditions, and that water can be obtained from some other source for storage in the reservoir. Then, rather than grappling with anticipatory shut down of the junior wells, it would be possible to let the juniors pump and see if a drought actually occurs. If it does, water could be timely released from the storage reservoir to supplement the supply to the senior stream appropriators. Such an exchange plan might enable greater productive use of water with little risk to senior rights.

A variation of the water exchange, albeit to solve a different physical problem, was approved in *Cache LaPoudre Water Users Ass'n v. Glacier View Meadows*.[74] A subdivider proposed to develop wells that would tap groundwater tributary to an overappropriated stream, and thus deplete the streamflow by the amount of consumptive use from the wells. To counteract the depletion, the subdivider purchased reservoir water upstream for release to meet the needs of downstream appropriators who would otherwise be deprived of water. Thus, instead of a classic water exchange, in which new water is added to the system from another source, the subdivider purchased existing reservoir rights for release to augment the flow downstream.[75] Downstream appropriators objected to the plan, arguing

72. DIVISION OF WATER RESOURCES, RULES AND REGULATIONS Rule 5 (July 14, 1969), *reprinted in* Kuiper v. Well Owners Conservation Ass'n, 176 Colo. 119, 490 P.2d 268, 285 (1971) (Appendix A).

73. *Id.*, 490 P.2d at 280-81.

74. 191 Colo. 53, 550 P.2d 288 (1976).

75. The subdivider's proposal was made under legislation authorizing the use of water augmentation plans, which are defined as programs "to increase the supply of water available for beneficial use . . . by water exchange projects, by providing substitute supplies of water, by the development of new sources of water, or by any other means." COLO. REV. STAT. § 37-92-103(9) (Supp. 1985).

it might fail due to faulty geohydrologic data. However, the Colorado court approved the plan. It reasoned that while the plan's geohydrologic analysis was to a degree uncertain, "the uncertainty is no greater than that inherent in the administration of water rights generally and is not of great significance."[76]

If a water exchange is physically available to solve the anticipatory closure problem, the policy question arises of who should pay for it. There are two main alternatives. The senior appropriators might be denied anticipatory closure of the junior wells, in which event the seniors would have to build upstream storage (or, as in *Cache LaPoudre Water Users,* purchase existing storage rights) to protect themselves. Alternatively, the senior appropriators might be granted anticipatory closure, in which event the juniors would have to build the upstream storage and seek approval of a water exchange if they want water. The alternative selected will not necessarily affect the productive use of water, but will affect allocative fairness and the stability of water rights.

2. Selection of Junior Appropriators for Closure. Suppose several junior wells are far from senior stream appropriations, and wells of intermediate priority are closer to the stream. The intermediate wells deplete the streamflow sooner, but eventually the junior wells will affect both the intermediate and the senior priorities. In time of water shortage on the stream, which wells should be shut down?

The problem of selecting junior appropriators for closure has a long history on surface streams. In an early case where administrative enforcement of priorities between water districts had broken down, a senior appropriator on a stream sued to enforce its priority against several ditch companies with junior priorities on a tributary river.[77] The defendants argued that other unjoined diverters from the river system were junior to them, and closure of these more junior diverters would supply the needs of the plaintiff. The court rejected the defense, saying in effect that the defendants themselves would have to sue the allegedly junior third parties, thus creating a domino approach to closing down the most junior appropriators. This holding promotes the stability of senior rights by making it less expensive to enforce priorities. A senior appropriator does not risk dismissal for failure to join every water user who is, or might be, junior to the chosen defendant.[78]

76. 191 Colo. 53, 550 P.2d at 296 (quoting from the trial judge's findings). *See also* Kelly Ranch v. Southeastern Colo. Water Conservancy Dist., 191 Colo. 65, 550 P.2d 297 (1976) (companion case confirming that a Colorado augmentation plan need not introduce new water into the system but may be based on the retirement of existing water rights).

77. Lower Latham Ditch Co. v. Louden Irrigating Canal Co., 27 Colo. 267, 60 P. 629 (1900).

78. In Bender v. District Court, 133 Colo. 12, 291 P.2d 684 (1955), the court purported to adopt the same rule for suits between groundwater appropriators. However, it is not clear the court truly comprehended the *Lower Latham Ditch* rule. The defendants in *Bender* were junior appropriators who objected to nonjoinder of seventy other appropriators from the aquifer involved. All seventy were junior to the plaintiff, but only one was junior to the defendants. Even though the *Bender* court said it was following the *Lower Latham Ditch* rule, its opinion also hinted that nonjoinder of the one appropriator junior to the defendants was only "perhaps" improper.

In 1903, Elwood Mead described the enforcement of priorities on surface streams by water commissioners and other state administrative officials:

> In theory the last appropriator should be the first to be cut off, but in practice it often happens that this appropriator is fifty or one hundred miles away, while another appropriator, inferior to the one seeking relief, is near at hand. To wait for water to come from turning off the last appropriator might cause the loss of crops, and in practice it is often the junior appropriator who can be first reached whose water-supply is curtailed.[79]

Apparently, this early administrative practice was seldom challenged in court.

In modern times, the Colorado court is in the vanguard of reviewing the administrative enforcement of priorities in hydrologically connected surface water and groundwater. In 1966, a Colorado water division engineer ordered the closure of 39 of more than 1600 wells in the Arkansas Valley to satisfy senior surface priorities. In *Fellhauer v. People,*[80] the Colorado court held the administrative action invalid, principally because the engineer's selection of wells was arbitrary and thus violated equal protection. The court said that the regulation of wells "must be under and in compliance with reasonable rules, regulations, standards and a plan established by the state engineer prior to the issue of the regulative orders."[81] The state legislature responded with a statute that says: "The state engineer may adopt rules and regulations to assist in, but not as a prerequisite to, the performance of [water administration] duties."[82] However, the constitutionality of the statute has never been squarely determined.[83] Since *Fellhauer,* the state engineer has adhered to a practice of issuing rules and regulations as the foundation for water right administration.

The state engineer's initial post-*Fellhauer* regulations grouped wells into zones based on the time between withdrawal of water and effect on streamflow. Wells in Zone A were estimated to affect streamflow within 10 days; wells in Zone B within 10 to 30 days; and wells in Zone C within 30 to 75 days. Wells could be closed only upon written demand of a senior surface appropriator, and no wells could be closed more than three days per week. As the end of the irrigation season approached, wells could resume full pumping by zone if they would not affect the river until after the end of the irrigation season. The rules were to be effective from August 8, 1969, to October 15, 1969; but in a suit challenging their application to the South Platte drainage, the trial court declared the rules void and enjoined their implementation. In 1971, the Colorado Supreme Court

79. E. MEAD, *supra* note 39, at 166.
80. 167 Colo. 320, 447 P.2d 986 (1968).
81. *Id.*, 447 P.2d at 993.
82. COLO. REV. STAT. § 37-92-501(1) (1973).
83. Hannay, *Recent Developments in Colorado Groundwater Law,* 58 DEN. L.J. 801, 810 (1981).

upheld the then expired regulations.[84] However, the state engineer's more recent regulations have abandoned the zone approach.[85]

3. Overlong Delay. The Colorado court has grappled also with whether to apply the priority principle against a junior appropriator if the delay between the junior diversion and adverse impact on a senior right is lengthy. By statute, Colorado treats groundwater that is tributary to a stream as part of the stream in enforcing priorities,[86] while nontributary groundwater is not subject to stream priorities.[87] The court has concluded that groundwater should be considered tributary, and thus subject to stream priorities, even though its withdrawal by a well will not affect a stream for 40 years.[88] However, the court has decided groundwater should be considered nontributary if the time lag exceeds 100 years because then the water's tributary character is de minimis.[89] The court has expressly left open how to treat groundwater withdrawals that will first affect a stream in 40 to 100 years.[90]

In setting the 100 year limit, the court had to interpret statutory language stating that groundwater in an alluvial aquifer[91] is considered tributary to a stream if it "can influence the rate or direction of movement of the water in [the] natural stream."[92] Although the statute mentions no time limit, the court reasoned as follows:

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84. Kuiper v. Well Owners Conservation Ass'n, 176 Colo. 119, 490 P.2d 268 (1971). Though the regulations had expired, the court said the problem was not moot and guidance was needed for the future.

85. For example, regulations proposed for the San Luis Valley would phase out all wells over a five-year period regardless of distance from a stream, unless individual well owners prove no material injury to senior rights or provide an augmentation plan to replace water they consume. Alamosa-La Jara Water Users Protection Ass'n v. Gould, 674 P.2d 914, 942-46 (Colo. 1983) (Appendix C). *See also* Shupe, *Administration of Ground Water Rights: A Darkening Cloud Over Irrigated Agriculture,* 20 GONZ. L. REV. 729, 740-44 (1985); Hannay, *supra* note 83, at 810-14; Hillhouse, *Integrating Ground and Surface Water Use in an Appropriation State,* 20 ROCKY MT. MIN. L. INST. 691, 713-19 (1975).

86. *See* Water Right Administration Act of 1969, COLO. REV. STAT. §§ 37-92-101 to -602 (1973 & Supp. 1985).

87. The nontributary groundwater rules vary depending on whether the groundwater is within or outside of a designated groundwater basin. *See* COLO. REV. STAT. §§ 37-92-101 to 141 37 (1973 & Supp. 1985) (Ground Water Management Act); *id.* § 37-92-203(1) (Supp. 1985) (water court jurisdiction to adjudicate rights to nontributary groundwater outside of designated basins).

88. Hall v. Kuiper, 181 Colo. 130, 510 P.2d 329, 330-31 (1973) (groundwater held tributary when proposed wells were about 13 miles from a river, and the groundwater was moving toward the river at the rate of 0.3 mile per year). In District 10 Water Users Ass'n v. Barnett, 198 Colo. 291, 599 P.2d 894 (1979), an expert witness testified that if the groundwater was left undisturbed, it would take 171 years to flow from the well to the stream, but the cone of depression of the water table, which would be formed by pumping, might affect the stream within 40 years. The court clarified *Hall* by saying that the proper measure of time lag is the time within which a well will affect a stream, not the time it would take the groundwater to flow undisturbed to the stream. *Id.,* 599 P.2d at 896.

89. Kuiper v. Lundvall, 187 Colo. 40, 529 P.2d 1328 (1974).

90. District 10 Water Users Ass'n v. Barnett, 198 Colo. 291, 599 P.2d 894 (1979).

91. An alluvial aquifer consists of unconsolidated sand, gravel, and other sedimentary materials. About ninety percent of all aquifers developed for water production are alluvial. Other types of aquifers include limestone, volcanic rock, sandstone, igneous and metamorphic rock, and clay. D. TODD, *supra* note 4, at 37-42.

92. COLO. REV. STAT. § 37-90*3(11) (1973).*

> We cannot believe that the General Assembly was talking about water that could not influence the rate or direction of movement of a stream for over a century. By the time the rivers are affected by the pumping from this basin, we have little doubt but what scientific progress will have solved many of the problems caused by the failure of this water then to reach the stream.[93]

Thus, senior appropriators from the stream (or, more accurately, their successors) must bear the risk regarding scientific progress. The court apparently deemed the risk reasonable given its optimism about scientific progress.

Present value analysis might illuminate the court's scientific progress rationale. For simplicity, assume an economy without inflation so that a long term interest rate of only three percent would be appropriate.[94] Using a three percent discount rate, each $100 of damage that stream appropriators will suffer in 100 years from pumping groundwater today has a present value of little more than five dollars,[95] an amount perhaps far outweighed by the benefits of presently consuming the groundwater. However, a problem with using present value reasoning to justify today's consumption of depletable natural resources is that it raises charges of disregarding the rights of future generations.[96] The Colorado court's optimism about scientific progress conveniently enabled it to skirt the issue of intergenerational fairness.

Colorado has a more elaborate statutory foundation than other appropriation doctrine states for distinguishing between tributary and nontributary groundwater. Yet, in any state the issue can arise of whether the impact of a junior groundwater diversion will be delayed so long that it should be ignored in integrating priorities. Whether the Colorado court's optimism about scientific progress will appeal to other courts (or legislatures) remains to be seen.

B. Attenuated Impact of Junior Diversions

When a junior well withdraws groundwater connected with a surface stream, the resulting depletion of the stream might be less than the consumptive use from the well. One cause of attenuated impact is an incomplete tributary connection between the groundwater and the streamflow. An aquifer might discharge water not only into a stream but through springs or into a connecting aquifer. It might also lose water by evapo-

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93. *Kuiper*, 187 Colo. 40, 529 P.2d at 1331.

94. Interest rates reflect not only the time value of money but inflation, the risk of nonpayment, and income taxes if the interest income is taxable. After factoring out inflation and income taxes, the real rate of interest over the long run in the United States is 2.5% to 3%. A. RANDALL, RESOURCE ECONOMICS: AN ECONOMIC APPROACH TO NATURAL RESOURCE AND ENVIRONMENTAL POLICY 210-12 (1981).

95. At a discount rate equal to 3% interest compounded annually, the present value of $100.00 to be received in 100 years is $5.20.

96. *See* A. RANDALL, *supra* note 94, at 220, 241-42 (1981); T. PAGE, CONSERVATION AND ECONOMIC EFFICIENCY 9-12, 149-70 (1977).

transpiration if the water table is near enough to the surface.[97] Consequently, part of the groundwater withdrawn by a well and consumed on the surface might never have reached the stream even if left in the aquifer.[98]

Another cause of attenuated impact is delayed impact. Suppose a junior well is operated only for the three peak months of the irrigation season, and the total consumptive use of water is 300 acre feet. Suppose further that the well's impact on the stream is delayed and spread evenly throughout the year, so that only 75 acre feet are depleted during those three months. If the stream is fully appropriated only during the three peak months of the irrigation season, the depletion that counts is only 75 acre feet rather than 300 acre feet. Attenuated impact from junior groundwater withdrawals raises two legal issues.

1. Inconsequential Impact. The first issue is whether the priority principle should be applied against a junior appropriator who is depriving a senior appropriator of only a small quantity of water. This issue has often been litigated between competing appropriators on surface streams. The well-established rule is that a senior appropriator can close an existing junior diversion only if it materially interferes with the senior's right.[99]

The material interference rule might affect not only the relationship of existing appropriators but also water permit applications. Permit statutes typically allow a permit to issue only if the proposed right will not impair existing rights. Some statutes expressly use a standard of material interference.[100] Some others are almost as explicit; they say that a permit cannot issue if any existing right will be "unduly affected."[101] Many permit statutes, however, simply say a proposed use must not impair or adversely affect senior rights, without using any qualifying words like "substantially" or "unduly."[102] Nevertheless, the material interference rule is so firmly a part of the appropriation doctrine tradition that it could easily be read into these latter permit statutes.[103]

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97. *See* Crosby, *A Layman's Guide to Groundwater Hydrology*, in C. CORKER, *supra* note 1, at 60-64; W. WALTON, GROUNDWATER RESOURCE EVALUATION 377-78 (1970).

98. Of course, the priority principle may come into play if a new well taps an aquifer that discharges into a fully appropriated spring or connecting aquifer.

99. *See* W. HUTCHINS, SELECTED PROBLEMS IN THE LAW OF WATER RIGHTS IN THE WEST 335 (1942); C. KINNEY, A TREATISE ON THE LAW OF IRRIGATION AND WATER RIGHTS § 801 (2d ed. 1912). Colorado has codified the material interference rule. COLO. REV. STAT. § 37-92-502(2) (Supp. 1985) prohibits division engineers from ordering the discontinuance of any junior diversion unless the diversion is causing or will cause material injury to senior priorities.

100. *E.g.*, COLO. REV. STAT. § 37-90-137(2) (1973) (A permit to construct a well outside the boundaries of a designated ground water basin, including a well that taps groundwater tributary to a surface stream, cannot issue if the well will "materially injure" the vested rights of others.); OR. REV. STAT. § 537.620 (1985) (A permit to appropriate groundwater cannot issue if the proposed well will cause "undue interference" with prior wells or will "impair or substantially interfere with" prior surface appropriations.).

101. ALASKA STAT. § 46.15.080(a) (1962 & 1982); N.D. CENT. CODE § 61-04-06 (1985).

102. *See, e.g.*, MONT. CODE ANN. §§ 85-2-311(1)(b) (1985); UTAH CODE ANN. § 73-3-8 (Supp. 1986).

103. Semantically, there may be more than one way to read in a requirement that the injury be material. This is illustrated by the interpretation of a New Mexico statute that prohibits an appropriator from changing the location of his well if the change would "im-

Whether interference with a senior right is material depends on the facts.[104] Although no numerical test has emerged, two recent Colorado cases are interesting for their numbers. In *Danielson v. Jones,*[105] a well owner sought to pump an additional 12.5 gallons per minute from an aquifer connected with an already overappropriated stream system. The court ruled that the new pumping would materially interfere with senior rights, noting that with continuous pumping the depletion would total 20 acre feet per year. *Giffen v. City & County of Denver*[106] is noteworthy, not for what the court decided, but for its report of a ruling by the state engineer that a new groundwater withdrawal of 2 acre feet per year would materially injure senior appropriators.

An important factor affecting the materiality of injury to a senior appropriator is the value of the water to the senior.[107] As water becomes more valuable, ever smaller impact on senior rights should constitute material injury. However, a new administrative rule in Idaho for water permit applications suggests another factor which cuts the other way. The rule says a new appropriation will be deemed to injure a senior water right only if the senior appropriator "will be forced to an unreasonable effort or expense to divert his existing water right," or will receive water of unusable quality that "cannot be restored to usable quality without unreasonable effort or expense."[108] The rule is based on the view that time priority does not protect a senior appropriator from having to bear reasonable costs to enable greater productive use of the water supply or achieve fairer (less monopolistic) allocation of the water.[109] The Idaho rule, however, does not go as far as it might have. As proposed, but not adopted, the rule also said that a new appropriation would not be deemed to injure a senior user

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pair" existing rights. In Heine v. Reynolds, 69 N.M. 398, 367 P.2d 708 (1962), the court held that under the statute any impairment bars a change in location; the impairment need not be substantial. In Roswell v. Berry, 80 N.M. 110, 452 P.2d 179, 185 (1969), however, the court upheld a decision by the state engineer to allow relocation of a well that would lower the water level in a protestant's wells by 0.16 feet, resulting in what the state engineer called a "negligible effect" on the water quality in those wells. The court said: "A 'negligible effect' is an effect of such little consequence that it should be disregarded." *Id.* Thus, in *Berry* a de minimis threshold of impairment was read into the statute, even though *Heine* made it necessary semantically in *Berry* to talk about negligible effect rather than insubstantial effect.

104. 5 WATERS AND WATER RIGHTS § 410.2, 129-33 (R. Clark ed. 1972 & Supp. 1978); W. HUTCHINS, *supra* note 99. The Colorado material injury statute, COLO. REV. STAT. § 37-92-502(2) (Supp. 1985), also says: "The materiality of injury depends on all factors which will determine in each case the amount of water such discontinuance will make available to such senior priorities at the time and place of their need."

105. 698 P.2d 240 (Colo. 1985).

106. 690 P.2d 1244, 1246 n.3 (Colo. 1984). The unsuccessful permit applicant later proposed a water augmentation plan under which he hoped to divert 0.20 acre feet of groundwater per year and consumptively use 0.08 acre feet. The court noted, without comment, that his proposal apparently assumed that taking even this amount would constitute material injury unless the water was replaced by the augmentation plan.

107. *See* Model Land & Irrigation Co. v. Hoehne Ditch Co., 70 Colo. 484, 202 P. 712, 713 (1921) (junior diversion of 0.45 cubic feet per second was material because that amount of water had "substantial value").

108. DEPARTMENT OF WATER RESOURCES, STATE OF IDAHO, WATER APPROPRIATION RULES AND REGULATIONS Rule 5,1,1 (Apr. 8, 1986).

109. *Supra* text accompanying notes 48-51.

if the senior could continue to produce at the same level from the lands or facilities relying on the water right by reasonable modification of his method of applying the water or using the facilities.[110]

2. Incommensurate Impact. Even if the impact of a junior diversion on a senior right is not inconsequential, the difference between the amount of water the junior diverts and the amount the senior thereby loses still might be incommensurate. The legal issue that arises is whether incommensurate impact justifies not invoking the priority principle against the junior appropriator. This issue, too, has been litigated by competing appropriators from surface streams. The prevailing rule is that notwithstanding incommensurate impact, a senior priority can be enforced against a junior appropriator if enforcement makes water available to the senior appropriator in usable quantities.[111] Wyoming, however, has a statute that departs from the usable quantities rule. If the state engineer finds that reducing junior withdrawals in groundwater control areas "will not result in proportionate benefits to senior appropriators, he may require and specify a system of rotation of use of underground water."[112] Also, under the previously discussed Colorado administrative regulations grouping wells into zones based on time lag,[113] a well was not deemed to affect streamflow unless it would deplete the stream equal to five percent of the consumptive use of water appropriated by the well. In a sense, the five percent threshold was a rough gauge of incommensurate impact.

A delayed impact case discussed earlier, *State ex rel. Cary v. Cochran*,[114] also presented an issue of incommensurate impact. In that case, 700 cubic feet per second had to be left in the river far upstream to provide 162 cubic feet per second at the Kearney canal for diversion by senior appropriators. The court applied the standard usable quantities rule. It reasoned that to allow state water administration officers "the right to say whether prospective losses would or would not justify the delivery of usable quantities of water would clothe such officers with a discretion incompatible with the vested interests of the [senior appropriators] and destroy the very purpose of the doctrine of appropriation."[115] In another case with heavy in transit loss of water from a stream that flowed from Montana into Wyoming, a federal court reasoned that allowing numerous upstream junior appropriators to take water to the detriment of two senior appropriators downstream would benefit more people, "but equity does not consist in taking the property of a few for the benefit of the many, even though the general average of benefits would be greater."[116]

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110. DEPARTMENT OF WATER RESOURCES, STATE OF IDAHO, CURRENTS Proposed Rule 5,1,1 (Spec. Water Allocation Rules Ed. II Dec. 1985).

111. *See* 1 W. HUTCHINS, *supra* note 5, at 579-81 (1971).

112. WYO. STAT. § 41-3-915(a)(iv) (1977).

113. *Supra* text accompanying note 84.

114. 138 Neb. 163, 292 N.W. 239, 247 (1940). *See also supra* text accompanying notes 66-67.

115. *Id.*, 292 N.W. at 247.

116. Morris v. Bean, 146 F. 423, 436 (D. Mont. 1906), *aff'd*, 159 F. 651 (9th Cir. 1908), *aff'd*. 221 U.S. 485 (1911).

These passages emphasize the stability of water rights and the being-there-first aspect of allocative fairness. The usable quantities rule prefers these objectives over greater productive water use (except insofar as stability promotes investment in water use). However, two possible moderating factors need to be noted. First, in *Cochran* the senior appropriators were not allowed anticipatory closure of the junior appropriators.[117] If anticipatory closure is denied, the delay in invoking priority will soften any antiproductive effect the usable quantities rule would have. Second, much of the water supposedly "lost" in transit on the way to senior appropriators might reappear elsewhere and be available for productive use by others. For example, a commentator has suggested that the large water losses from the stream in *Cochran* "feed the alluvial aquifer underlying a vast sea of corn and alfalfa that stretches along the valley, irrigated by thousands of wells."[118]

C. Groundwater in Storage

The volume of water in most aquifers far exceeds the annual recharge,[119] representing a long accumulation of inflow.[120] Water usually moves slowly through an aquifer and ultimately may be discharged by natural forces.[121] In a sense, such slowly moving water is in storage.[122] Individual molecules of groundwater may move into and out of the aquifer. However, the slowness of movement means a large accumulation always remains unless wells extract groundwater in excess of the net recharge, i.e., in excess of the recharge to the aquifer minus the natural discharge by evapotranspiration and seepage into streams, lakes, springs or adjacent aquifers.

Since the priority principle operates only when the water supply falls short of the demand, it is essential to determine the supply. This is easy with a surface stream. The diversions from a stream during a year cannot exceed the amount of water flowing in the stream that year (except for the release of carryover storage in surface reservoirs). With a groundwater basin containing significant storage, however, there is no simple physical limit on withdrawals during a given year. The available supply can be determined only by deciding whether to deplete the storage.[123]

Uncontrolled depletion of storage would impair the stability of water rights and ignore the being-there-first aspect of allocative fairness, without necessarily helping to maximize the productive use of water. Not surpris-

117. *Supra* text accompanying note 67.

118. Trelease, *The Model Water Code, the Wise Administrator and the Goddam Bureaucrat*, 14 NAT. RESOURCES J. 207, 227 (1974). A similar point is made about stream systems in general in Wiel, *Fifty Years of Water Law*, 50 HARV. L. REV. 252, 262 n.20 (1936).

119. W. WALTON, *supra* note 97, at 608.

120. *See* H. THOMAS, THE CONSERVATION OF GROUND WATER 261 (1951).

121. Crosby, *supra* note 97, at 60-61.

122. WATER POLICIES, *supra* note 2, at 231.

123. *See, e.g.*, H. THOMAS, *supra* note 120, at 261; Hutchins, *supra* note 9, at 439; *see also* Corker, *supra* note 43, at 23-12 to -14 (discussing policy difficulties in managing stored water under the priority principle, regardless of whether the storage is in an aquifer or a surface reservoir).

ingly, no appropriation doctrine state follows that alternative. At the other extreme, prohibiting all depletion of storage would favor stability and the being-there-first aspect of fairness, but often at the expense of greater productive water use and the antimonopoly aspect of allocative fairness. It is doubtful whether any appropriation doctrine state follows that alternative. In contrast, controlled depletion can enable greater productive water use by more people, albeit with some risk or cost to senior appropriators, but perhaps not enough to seriously impair stability or the being-there-first aspect of fairness. Different approaches to controlled depletion are examined below.

1. Temporary Depletion. An Idaho statute prohibits groundwater withdrawals "at a rate beyond the reasonably anticipated average rate of future natural recharge."[124] Similarly, statutes in several other states limit groundwater withdrawals to the estimated average annual recharge,[125] the average annual replenishment of supply,[126] or the safe sustaining yield of the groundwater body.[127] The Idaho statute was construed in *Baker v. Ore-Idaho Foods, Inc.*[128] to prohibit groundwater mining, which the court defined as "perennially withdrawing ground water at rates beyond the recharge rate."[129]

The *Ore-Ida Foods* decision, however, does not necessarily mean that the Idaho statute, or the similar statutes in other states, would forbid temporary depletion of storage. Later proceedings in the *Ore-Ida Foods* controversy illustrate two differing approaches to temporary depletion. The aquifer involved had an average annual recharge of 5500 acre feet. In *Ore-Ida Foods,* the Idaho Supreme Court affirmed a trial court decree that awarded water rights totaling 5500 acre feet to the four senior wells and enjoined pumping by any other wells. The decree also referred the administration of rights to the state water resources department, with authority to modify the decree so long as the pumping would never exceed the average annual recharge.[130] Upon referral from the court, the department took an innovative approach based on the premise that good farming practice requires more irrigation water in a dry year and less in a wet year. The department recalculated all water rights based on average

124. IDAHO CODE § 42-237a(g) (Supp. 1986).

125. S.D. CODIFIED LAWS ANN. § 46-6-3.1 (1983) (greater withdrawals allowed in certain basins by certain users).

126. NEV. REV. STAT. § 534.110(6) (1983).

127. WASH. REV. CODE ANN. 90.44.130, -.230 (1962).

128. 95 Idaho 575, 513 P.2d 627 (1973).

129. *Id.* at 577, 513 P.2d at 629.

130. Since the Idaho Supreme Court sustained the trial court's referral of the case to the state water agency, it did not have to examine the trial court's decree to determine whether the decree would actually prevent mining. On that point, the decree (at least as described in the appellate opinion) is unclear in two respects. First, was 5500 acre feet the *net* natural recharge, i.e., natural recharge minus natural discharge? If the natural recharge was 5500 acre feet and wells depleted the basin by 5500 acre feet annually, then mining would occur to whatever extent natural discharge also occurred. Second, would the entire 5500 acre feet withdrawn by wells be consumed on the surface, or, after use, would some of it percolate back into the basin? If some would percolate back, the pumping withdrawals could exceed 5500 acre feet without causing mining.

annual use for the highest five consecutive years of use historically. It then issued an order allowing the senior appropriators with rights aggregating 5500 acre feet to pump any amount of water necessary in a given year so long as no appropriator pumped over five times his annual water right during any consecutive five year period.

Junior appropriators disputed this order, contending that in a wet year when senior appropriators with rights totaling 5500 acre feet do not need their full amount of water, junior appropriators should be allowed to take the unused portion rather than see it carried over in storage. In short, the department interpreted the statutory prohibition of withdrawals in excess of average natural recharge to mean that wells must not *on average* withdraw more than 5500 acre feet annually, while the junior appropriators argued it means that wells must not *in any year* withdraw more than, or less than, 5500 acre feet.

The case again reached the Idaho Supreme Court but was disposed of on a procedural ground without decision regarding the competing interpretations.[131] The presently significant point about the interpretations is that both would allow temporary depletion of storage. Under the department's interpretation, storage would be depleted during dry years when more than 5500 acre feet could be withdrawn, but would be replenished in other years. Under the junior appropriators' interpretation, 5500 acre feet would be withdrawn every year, but since the recharge figure is only an annual average, storage would be depleted during any year in which actual recharge falls below the average and would be replenished in a year of above average recharge. Temporary depletion is avoidable only if the withdrawals each year do not exceed the actual recharge for that year—an unlikely result since the Idaho statute measures allowable withdrawals against the "average rate of . . . recharge."[132]

2. Short Term But Permanent Depletion. Under certain hydrologic conditions, productive water use might be increased by short term overdraft that permanently depletes some of the groundwater storage. The hydrologic mechanisms have been described as follows:

> When pumping from wells is started, it must be accompanied by a drop in water level (or pressure, in the case of confined aquifers). The drop increases the opportunity for recharge from influent streams. It reduces the area of seep lands and uneconomic losses through consumptive use and evaporation. It provides opportunity for penetration of rain falling on the valley floors, which under normal conditions did not happen because the groundwater levels were too high. It also increases the opportunity for underflow into the reservoir by increasing the gradient.[133]

131. Briggs v. Golden Valley Land & Cattle Co., 97 Idaho 427, 546 P.2d 382 (1976).
132. *Supra* note 124 and accompanying text.
133. Muckel, *Pumping Ground Water so As to Avoid Overdraft*, in U.S. DEP'T OF AGRICULTURE, THE YEARBOOK OF AGRICULTURE 1955, H.R. Doc. No. 32, 84th Cong., 1st Sess. 294, 295 (1955).

In other words, partial depletion of storage over a period of several years might increase the future sustained annual yield of a basin by increasing natural recharge (from sources that are not fully appropriated) or by decreasing natural discharge (to sources that are not fully appropriated).

The resulting gain in water use, however, might well be accompanied by increased cost to senior appropriators to fill their rights caused by lower basin water levels. Then the objectives of greater productive use of water and allocative fairness in its antimonopoly aspect would clash with stability of water rights and the being-there-first aspect of allocative fairness. Furthermore, lower basin water levels might damage environmental values, and thereby bring out the vagueness of the modern productivity objective. The question would be whether greater productivity is better accomplished by withdrawing the groundwater and using it on the surface, or by leaving it in the ground and "using" it to avoid environmental damage.

The Colorado court faced these difficulties in *Alamosa-La Jara Water Users Protection Association.*[134] As noted earlier,[135] that was a suit to review proposed rules of the state engineer to curtail water use in the San Luis Valley to meet an interstate compact obligation regarding the flow of the Rio Grande River from Colorado into New Mexico. The groundwater system in the valley lost considerable water by evapotranspiration from native grasses and phreatophytes, such as cottonwood, greasewood, and rabbitwood. When wells lowered groundwater levels below the phreatophyte root zones, losses by evapotranspiration decreased as much as one million acre feet a year.

Most of the senior water rights in the San Luis Valley are surface rights, and most of the junior rights are groundwater rights. The state engineer's proposed rules integrated tributary groundwater diversions into the priority system for surface streams by prohibiting groundwater diversions unless individual well owners could prove that their wells would not injure senior rights or could remedy such injury through plans to augment the streamflow. The trial court rejected this approach, finding it inconsistent with state policy requiring (1) the integrated administration of surface water and groundwater, (2) the maximum utilization of water, and (3) the use of reasonable means to divert water.[136] The trial court ruled that in some instances senior stream appropriators might properly be required to drill wells to supplement or replace their surface diversions before being entitled to curtail junior groundwater diversions.

On appeal, the Colorado Supreme Court agreed that the state engineer should have considered whether the reasonable-means-of-diversion doctrine would provide a way to maximize water use in the valley. However, the court also noted that

134. 674 P.2d 914 (Colo. 1983). For a case from a nonappropriation state that discusses short term permanent depletion of an aquifer to increase future annual sustained yield, see City of Los Angeles v. City of San Fernando, 14 Cal. 3d 199, 537 P.2d 1250, 123 Cal. Rptr. 1 (1975).

135. *Supra* text accompanying note 59.

136. 674 P.2d at 931.

> [t]he policy of maximum utilization does not require a single-minded endeavor to squeeze every drop of water from the valley's aquifers. [State legislation] makes clear that the objective of "maximum use" administration is "optimum use." Optimum use can only be achieved with proper regard for all significant factors, including environmental and economic concerns. *See* section 37-92-102(3), C.R.S. (recognizing the need to correlate the activities of mankind with reasonable preservation of the natural environment); Harrison & Sandstrom, *supra* at 14-15 (An increase of well diversions at the expense of maintenance of a surface flow would increase the efficiency of irrigation at the expense of other environmental and economic values.).[137]

The court remanded the proposed rules to the state engineer to consider whether senior surface appropriators should have to switch to wells before curtailing junior rights, and also whether junior appropriators should have to pay for the switch. Finally, the court added: "Selection among these and other possibilities, including retention of the scheme of the proposed rules, is a policy decision to be made by the state engineer, after consideration of all relevant factors."[138] Presumably, the relevant factors relate to greater productive use of water (in the modern broad, but vague, sense), allocative fairness (in both of its aspects), and stability of water rights (with its perhaps ambivalent aspects).

Turning to other appropriation doctrine states, short term but permanent depletion of storage might be permissible even under statutes that limit groundwater withdrawals to average recharge or sustained yield.[139] The Idaho statute, for example, limits withdrawals to "the reasonably anticipated average rate of *future* natural recharge."[140] This language seems to imply that the past recharge rate is not determinative. Arguably, the statute refers to a recharge rate anticipated after permanent depletion of some storage if the depletion would increase the future sustained annual yield. This interpretation should not be foreclosed by the *Ore-Ida Foods* statement that the Idaho statute prohibits perennial overdraft.[141] A common meaning of "perennial" is "lasting indefinitely."[142] It should be permissible to deplete storage for a definite time, say, several years, under a plan to increase the future sustained annual yield of the system if geohydrologic studies support such a plan.[143]

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137. *Id.* at 935.

138. *Id.*

139. *Supra* notes 124-27 and accompanying text.

140. IDAHO CODE § 42-237a(g) (Supp. 1986) (emphasis added).

141. *Supra* note 129 and accompanying text.

142. *See* WEBSTER'S THIRD NEW INT'L DICTIONARY 1677 (unabr. ed. 1976) ("perennial" - sense 3a).

143. In *Ore-Ida Foods*, the court rejected an argument that Idaho's reasonable pumping level statute should allow the water in the aquifer to be mined down to a reasonable pumping level. 95 Idaho at 584, 513 P.2d at 636. But in that case, the groundwater level was declining twenty feet per year with no evidence that the overdraft would ever result in a greater sustained annual yield by increasing natural recharge or decreasing natural discharge. Thus, the court did not necessarily have in mind the situation where short term permanent depletion would increase the long term sustained annual yield.

3. Long Term Permanent Depletion. In *City of Albuquerque v. Reynolds*,[144] the New Mexico State Engineer devised a plan to allow controlled long term permanent depletion of storage in a groundwater basin hydrologically connected with the Rio Grande River.[145] The City sought permits to appropriate 6000 acre feet per year from the basin through wells situated six or seven miles from the river. The river was fully appropriated, and the wells would diminish the streamflow. Over a seventy-five year period, about half the water pumped by the wells would come from underground storage and about half from surface flows. New Mexico has no average recharge or safe sustained yield statute, but its groundwater permit statute says a permit may not issue for any proposed appropriation that would impair existing water rights.[146] The state engineer ruled that the proposed wells would impair existing surface rights. He also ruled, however, that the permits could issue without impairment of existing rights if the City would obtain and retire enough existing rights to the consumptive use of surface water to offset the effects of the groundwater appropriations on the Rio Grande. The New Mexico court sustained the ruling in its entirety.

The offsetting retirement of surface rights in *City of Albuquerque* is similar to the subdivider's plan in *Cache LaPoudre Water Users* to release upstream storage to counteract a downstream decrease in flow that subdivision wells would cause.[147] Such modern variations of the traditional water exchange might enable greater productive water use without detriment to the remaining senior stream rights, except for a risk of miscalculation regarding such geohydrologic questions as the rate and pattern of groundwater movement toward the stream, and the amount of consumptive water use by the new wells and the retired surface rights. In *City of Albuquerque*, the state engineer apparently believed the risk was reasonable.

D. Inadequate Geohydrologic Data

The administration of rights under the priority principle requires detailed water supply data.[148] However, adequate data on groundwater

144. 71 N.M. 428, 379 P.2d 73 (1963).

145. Another New Mexico case allowing the long term controlled depletion of groundwater storage is Mathers v. Texaco, Inc., 77 N.M. 239, 421 P.2d 771 (1966). The court upheld the state engineer's issuance of permits to appropriate groundwater that would result in mining two-thirds of the water in a basin over 40 years. Senior appropriators protested the permit applications, relying on a statute that prohibits new appropriations that will impair existing rights. The court, however, concluded that proper application of the no impairment rule must take into account that the basin was nonrechargeable, i.e., the basin received only limited natural recharge from precipitation and this was about equalled by natural discharge. The court reasoned that if the water stored in such a basin were to be put to beneficial use, the supply had to be given a time dimension. *Id.*, 421 P.2d at 775. Although *Mathers* is a good example of controlled long term permanent depletion of storage, it seems peripheral to the present article because the basin most likely was not significantly connected with any surface stream.

146. N.M. STAT. ANN. § 72-12-3E (1985).

147. *Supra* text accompanying notes 74-76.

148. C. CORKER, *supra* note 1, at 21-31.

supply and movement are often lacking.[149] In one respect, this presents a scientific problem of finding affordable ways to improve the data. Until science provides better data, however, courts and water agencies must cope with inadequate data. They do this with rules on the burden of proof.[150]

When data are inadequate, the burden of proof can determine the outcome of a priority principle dispute. For that reason, rules allocating the burden of proof and specifying how much proof is required can significantly favor or disfavor particular water management objectives. For example, putting the burden on junior appropriators to prove their diversions will not interfere with senior rights favors stability of senior rights and disfavors possible greater productive use of the water supply from allowing the juniors to operate.

Generally in the law, however, rules on the burden of proof are not based solely on which objectives to favor. Other factors may also affect who has the burden. The burden may be on the person who seeks administrative or judicial intervention to change an existing situation, the person who has better access to the facts, or the person who asserts improbable facts.[151] In examining how these factors affect the burden of proof under the appropriation doctrine, it is useful to distinguish between the initiation of new water rights and the exercise of existing rights.

1. Initiation of New Rights. Water permit statutes typically prohibit the issuance of a permit if the proposed right will impair any existing right.[152] Most of these statutes fail to address explicitly who has the burden of proof or how much proof is required. The Montana statute is a notable exception. It says a permit applicant must prove unappropriated water is available, and the proof must be by substantial credible evidence, except in specified cases where the proof must be by clear and convincing evidence.[153] Arguably, some permit statutes allocate the burden by implication. For example, several statutes say a permit may issue if the water agency "finds" existing rights will not be adversely affected,[154] and this probably puts the burden of proof on the applicant because an agency

149. *See* W. WALTON, *supra* note 97, at 1, 613.

150. Another tool, used occasionally, is a moratorium on processing applications for permits to appropriate while better data is being gathered. *See* Dinsdale v. Young, 300 Or. 78, 706 P.2d 944 (1985) (moratorium upheld); City of El Paso v. Reynolds, 597 F.Supp. 694 (D.N.M. 1984) (moratorium struck down under Commerce Clause because true purpose was to discriminate against interstate commerce).

151. *See* J. FRIEDENTHAL & M. SINGER, THE LAW OF EVIDENCE 261-62 (1985); Cleary, *Presuming and Pleading: An Essay on Juristic Immaturity*, 12 STAN. L. REV. 5, 5-13 (1959).

152. *Supra* notes 102 and accompanying text.

153. MONT. CODE ANN. § 85-2-311 (1985). *See also* S.D. CODIFIED LAWS ANN. § 46-2A-9 (1983) (permit may issue only if there is "reasonable probability" that unappropriated water will be available for the proposed use).

154. ALASKA STAT. § 46.15.080(a) (1962 & 1982); COLO. REV. STAT. § 37-90-137(2) (1973) (wells outside the boundaries of designated groundwater basins); N.D. CENT. CODE § 61-04-06 (1985). *See also* NEV. REV. STAT. § 534.110(3) (1983) (groundwater permit can issue only upon an affirmative determination that unappropriated water exists).

finding requires supporting evidence.[155] When a statute lacks even implicit guidance on the burden, the void might be filled by reference to general administrative law practice that puts the burden on a permit applicant, since the applicant is seeking administrative action to change an existing situation.[156] The Idaho water agency has sought to clarify the burden of proof issue with a regulation that says a permit applicant has both the initial burden of coming forward with evidence and the burden of persuasion regarding the absence of injury to senior rights.[157]

Even if a water permit applicant technically has the burden of proof, a Utah case shows that in practice the burden may be easily satisfied. In *Little Cottonwood Water Co. v. Sandy City*,[158] the court acknowledged that the joint applicants for a groundwater permit had to show "reasonable ground to believe"[159] unappropriated water was available. The court also noted that the record was "filled with uncertainties"[160] regarding the impact of the proposed appropriation on a fully appropriated stream in the same canyon. Still, the court upheld the state engineer's issuance of a permit. The court explained that it wanted to encourage badly needed water development, and that a permit merely allows an applicant to hunt for unappropriated water without adjudicating that any such water is available. The court implicitly assumed that its hunting license view of water permits would encourage new development without detriment to senior rights because the priority principle would protect seniors if new permittees should fail to find unappropriated water.

According to a National Water Commission study, the hunting license view of water permits is widely accepted.[161] However, the study criticized that view as ill-suited to groundwater. With delayed impact, a new permittee might pump for several years before it is clear no unappropriated water was available, and then several more years will be required to cure the interference with senior rights. This criticism focuses on the stability of water rights, if not the being-there-first aspect of allocative fairness. In contrast, the *Little Cottonwood* court emphasized greater productive use of water. Once again, the crucial issue is how much risk or cost senior appropriators should have to bear to encourage greater productive use of water.

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155. The evidence must come from the applicant, unless perhaps hydrologic data gathered earlier by the agency for other purposes fortuitously establishes that the proposed appropriation could not injure senior rights.

156. 1 F. COOPER, STATE ADMINISTRATIVE LAW 355 (1965). An exception might be made, at least regarding the burden of coming forward with evidence, if another participant in the proceeding has better access to the facts.

157. DEPARTMENT OF WATER RESOURCES, STATE OF IDAHO, *supra* note 108, Rule 4,4 (1986). On certain other issues, the rule puts the burden of coming forward or even the burden of persuasion on a person wishing to protest the application. For example, a permit application must be denied if the proposed appropriation will conflict with the local public interest, IDAHO CODE § 42-203A(5) (Supp. 1986), and the administrative rule says a protestant has the burden of coming forward with evidence on that issue if the protestant can reasonably be expected to have better access to the facts.

158. 123 Utah 242, 258 P.2d 440 (1953).

159. *Id.*, 258 P.2d at 445.

160. *Id.*, 258 P.2d at 444.

161. SUMMARY-DIGEST, *supra* note 5, at 55.

In *State ex rel. Tappan v. Smith*,[162] the Idaho court rejected the hunting license view of water permits. The state engineer issued a critical groundwater area order for the Raft River Basin, which meant no new wells would be allowed. Previously, the U.S. Geological Survey had completed two reports on the basin. The first report estimated that little uncommitted water was available and recommended caution in further development because of scanty data and time lag before overdevelopment might be detected. The second report, based on studies five years later, estimated that substantially more groundwater was available for diversion. Given what the state engineer considered a lack of solid information, he chose to rely on the first report and issue the critical area order.[163] The Idaho court upheld the state engineer's conservative approach to groundwater development.

2. Exercise of Existing Rights. In litigation between appropriators to enforce priorities, the cases are uneven regarding the burden of proof.[164] The details vary from state to state, but the Idaho cases are illustrative. Under one line of cases, a senior appropriator who seeks to enjoin a junior groundwater diversion must prove that the junior is interfering with the senior's water supply.[165] Under another line of cases, the junior appropriator has the burden of proving that his diversion will not interfere with the senior appropriator's right.[166]

Whether the Idaho cases can be reconciled depends on how broadly or narrowly one reads them. Generally, however, the senior appropriator had the burden of proving interference by the junior when the crucial issue was whether any hydrologic connection existed between the sources of supply for the two water rights. In contrast, the junior appropriator had the burden of proof when hydrologic connection between the sources of supply was clear (e.g., the senior was on a stream and the junior was on a visibly connected creek), and the junior was arguing that even if he were shut down, water would not reach the senior in usable quantities (e.g., because of losses in transit). In terms of the previously listed factors affecting allocation of the burden of proof, when a senior appropriator seeks to enjoin a junior diversion, the senior—the person seeking judicial intervention to change an existing situation—must prove the water sources for the two diversions are connected. But once hydrologic connection is shown, it becomes probable that the junior diversion interferes with the

162. 92 Idaho 451, 444 P.2d 412 (1968).

163. Two private hydrologic studies introduced in evidence in the subsequent litigation were more in line the second Geological Survey study. *Id.* at 454, 444 P.2d at 415.

164. Cases from various jurisdictions are collected in 1 W. HUTCHINS, *supra* note 5, at 582-83 (1971) and 2 *id.* at 203 (1974).

165. Jones v. Vanausdeln, 28 Idaho 743, 156 P. 615 (1916); Bower v. Moorman, 27 Idaho 162, 147 P. 496 (1915); Cartier v. Buck, 9 Idaho 571, 75 P. 612 (1904); *see also* Independent Irrigation Co. v. Baldwin, 43 Idaho 371, 252 P. 489 (1926) (state water officials cannot enforce priorities against a junior appropriator without proof that the junior's source is tributary to the supply of senior appropriators).

166. Martiny v. Wells, 91 Idaho 215, 419 P.2d 470 (1966); Cantlin v. Carter, 88 Idaho 179, 397 P.2d 761 (1964); Silkey v. Tiegs, 54 Idaho 126, 28 P.2d 1037 (1934); Jackson v. Cowan, 33 Idaho 525, 196 P. 216 (1921); Neil v. Hyde, 32 Idaho 576, 186 P. 710 (1919).

senior right if the senior's source is fully appropriated by rights prior to the junior diversion. Then the junior appropriator—the person arguing against probabilities—must show his particular water use somehow does not cause interference.

Turning from litigation between appropriators to administrative enforcement of priorities, a hydrology text reports that administrative officials commonly are reluctant to invoke the priority principle against junior groundwater users. The text explains that such officials "may have either of two reasonable doubts: that the available facts would suffice to sustain them against any appeal from an order for reduction, or that the statutory procedure would in fact recapture the status of the earlier appropriations."[167]

In contrast to the common administrative practice, in 1975 the Colorado State Engineer issued proposed regulations designed to curtail groundwater diversions in the San Luis Valley unless individual well owners could prove their wells do not injure senior rights or could provide substitute supplies to seniors.[168] A state statute prohibits the curtailment of a junior diversion unless it materially injures senior rights. The statute refers to "each case" and "each diversion" in specifying how to apply the material injury standard.[169] In *Alamosa-La Jara Water Users Protection Association v. Gould,*[170] well owners argued the proposed regulations were invalid because the regulations did not require materiality of injury to be determined individually for each well. The Colorado court rejected that challenge. The court reasoned that since the record showed streams in the valley were overappropriated and diversions of groundwater significantly affected streamflow, "it may be presumed that each underground diversion materially injures senior appropriators. The state engineer, therefore, will not be required to repeat for every well curtailed the painstaking analysis which led to the aquifer-wide determination of material injury."[171]

In *Alamosa-La Jara Water Users,* the court allocated the burden of proof in accord with probabilities. Under the geohydrologic circumstances in the San Luis Valley, the closure of any junior well probably would benefit some senior stream appropriator. Given that probability, a junior appropriator must prove that because of evapotranspiration losses or other reasons, closure of his particular well would not make usable quantities available in the stream.

IV. CONCLUSION

This article has attempted to demonstrate that (1) water management objectives under the appropriation doctrine, though at first largely harmonious, have become conflicting and vague, and (2) tension among the

167. W. WALTON, *supra* note 97, at 622.
168. *Supra* text accompanying notes 134-38.
169. COLO. REV. STAT. § 37-92-502(2) (Supp. 1985).
170. 674 P.2d 914 (Colo. 1983).
171. *Id.* at 931.

objectives lies at the heart of the physical problems encountered when rights to hydrologically connected surface water and groundwater are integrated under the priority principle. A prominent analyst of public policy in diverse fields has observed: "[T]he assumption that objectives are known, clear, and consistent is at variance with all experience. We know that objectives invariably may be distinguished by three outstanding qualities: they are multiple, conflicting, and vague. They mirror, in other words, the complexity and ambivalence of human social nature."[172] Modern appropriation doctrine water law is no exception.

Those who criticize the priority principle as unsuited for today's water management needs are often just dissatisfied with a particular resolution of the tension among objectives. Usually the criticism boils down to a complaint that insufficient attention is given to greater productive water use (as the critic defines that ambivalent concept). Greater productive use may well deserve to be the strongly dominant objective. However, the complexity and ambivalence of human social behavior suggest that greater productive use will not always prevail, at least not completely, over the stability of water rights and the being-there-first aspect of allocative fairness. In the final analysis, the task of water management is one of making judgments, of striking balances.

The law in general, as distinguished from the law of water rights, often must deal with the complexities and ambivalence of human social behavior. It commonly does this in the following way:

> In an important sense legal rules are never clear, and if a rule had to be clear before it could be imposed, society would be impossible. The mechanism [of legal reasoning] accepts the differences of view and ambiguities of words. It provides for the participation of the community in resolving the ambiguity. On serious controversial questions, it makes it possible to take the first step in the direction of what otherwise would be forbidden ends. The mechanism is indispensable to peace in the community.[173]

The priority principle fits this pattern. It says priority in time gives priority in right, but it does not say priority in right to what, or under what circumstances.

The long history of regulating priorities on surface streams shows that priority in time does not give a senior appropriator the right to avoid all costs and risks in all circumstances. That history also defines to some extent what costs and risks can be imposed on a senior appropriator to promote greater productive use or less monopolistic allocation of water. In differing circumstances, however, courts and water administrators have sometimes favored one management objective and sometimes another. As the priority principle increasingly is extended from surface streams

172. A. WILDAVSKY, *supra* note 18, at 215.

173. E. LEVI, AN INTRODUCTION TO LEGAL REASONING 1 (1948). Levi recognizes the influence of economic and social policy on legal doctrine, but he stresses how the law grows case by case through the process of reasoning by example. *See id.* at 72-73.

to hydrologically connected groundwater—with its slower, more diffuse, and less readily ascertainable movement—ambiguities in that principle regarding permissible costs and risks for senior appropriators will be highlighted. These ambiguities should enable rational examination of the tensions among management objectives and should allow differing emphases on objectives as conditions vary and attitudes change.