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An Economic Review of Inefficiency in Utah Groundwater Law: Cache County Emphasis

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Editors' Summary: The demand for groundwater is projected to grow over the next 20 years, resulting in increasing requests for groundwater extraction permits. However, current groundwater allocation laws in some states are economically inferior for a number of reasons; therefore, these states may have difficulty meeting the growing demand for groundwater. In this Article, Kevin L. Brady reveals the reasons for inefficiency in groundwater allocation and management in Utah. He identifies beneficial use rankings, high transaction costs, permit transfer difficulties, and forfeiture clauses as some of the main causes of inefficiency. He argues that Utah should adopt better groundwater allocation laws in order to prepare for future stresses. He advocates the disbandment of beneficial use hierarchies, increased freedom in permit trading, and the elimination of deed expiration periods to improve Utah's groundwater law efficiency.

I. Groundwater Characteristics

Groundwater is a natural resource of paramount importance. Nevertheless, policymakers often eschew its management by instead concentrating on surface water. While a change of emphasis may be desirable, it is worthwhile to note that there are at least two reasons for the status quo. First, the relative scarcity of surface water became apparent sooner.[1] As a result, lawmakers began focusing on surface water policies before ever considering groundwater regulation, a tendency that continues in the present. Second, technological limitations precluded the study of groundwater physics until the 1900s.[2] Fortunately, surveying techniques have improved. Despite this, "archaic [courtroom] principles" do not reflect society's increased knowledge of "ground water movement."[3] Additionally, as human expansion continues to strain current supplies of surface water, groundwater is increasingly looked to as a substitute.[4] Some urban municipalities are even examining the possibility of transporting groundwater from rural districts to meet their growing demand.[5] The importance of this scarce resource warrants the study of allocation methods.

Groundwater is found in aquifers and is typically extracted through pumping. While most stores of groundwater naturally recharge, some have practically no annual recharge.[6] Hence, some deposits are renewable, and others are nonrenewable. Because the water in aquifers is a common-pool resource,[7] mining regulations are necessary to avoid the "tragedy of the commons."[8] Laws often treat groundwa-

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1. *See* Ronald C. Griffin, Water Resource Economics: The Analysis of Scarcity, Policy, and Projects 131-32 (2006) [hereinafter Griffin].
2. *See id.*
3. *Id.* at 131.
4. *See* Eric C. Schuck & Gareth P. Green, Conservation Pricing and Groundwater Substitution (presented at the Western Agricultural Economics Association Conference, Logan, UT, July 2001), *available at* http://ageconsearch.umn.edu/bitstream/123456789/218/1/sp01sc03.pdf [hereinafter Schuck & Green].
5. *See* James F. Booker et al., Optimal Temporal and Spatial Scheduling of Arid-Region Water Supply Projects With Nonrenewable Groundwater Stocks (presented at the American Agricultural Economics Association Annual Meeting, Salt Lake City, UT, August 1998), *available at* http://ageconsearch.umn.edu/bitstream/123456789/15043/1/spbook01.pdf. These authors analyze the possibility of transporting groundwater to meet the growing demand for water in Las Vegas, Nevada. Although the authors conclude that this is currently unnecessary, they maintain that it may be desirable to act accordingly in the future.
6. *See* Robert A. Young, Determining the Economic Value of Water: Concepts and Methods 13-14 (2005) [hereinafter Young].
7. Groundwater is a common-pool resource because it is nonexclusive—it is difficult to prevent unauthorized users from extracting—and rivalrous—the more water a user extracts, the less water remains for other users. The failure to regulate such goods leads to their overextraction and possible extinction. The American Bison provides a good example of overextraction resulting from the insufficient regulation of a common-pool resource. For a discussion on the distinction between rivalrous, nonrivalrous, excludable, and nonexcludable goods, see The MIT Dictionary of Modern Economics 141, 379 (David W. Pearce ed., 4th ed. 1992) [hereinafter Dictionary of Modern Economics].
8. The term "tragedy of the commons" was coined by Garett Hardin in an influential article concerning society's tendency to overutilize re-

ter and surface water as entirely different goods. However, surface water diversions can affect the availability of groundwater (and vice versa).[9] In places where this occurs, concomitant management is necessary to protect previously appropriated rights.[10] This is called conjunctive use. Policymakers are thus advised to implement efficient groundwater management systems that account for the interconnected nature of water supplies. Such systems help to avoid the imprudent consumption of water resources while preventing the violation of existing rights. Effective policies are especially important in Utah (and the rest of the western United States), where surface water's capricious nature intensifies the necessity for a stable groundwater supply.[11] It is important for Utah to prepare now in order to meet the growing demand for groundwater.[12]

The goal of this Article is to identify economically inefficient regulations in Utah groundwater law and in other allocation systems. Section II provides a review of economic efficiency as it relates to the allocation of groundwater. Section III examines the effectiveness and inefficiency inherent in various property rights systems and provides a summary of the system utilized in Utah. Sections IV and V investigate several aspects of Utah groundwater law, the Cache Valley Management Plan, and other prior appropriative allocations that prevent economically efficient distributions of groundwater.

II. Efficiency Criteria

A. Defining Economic Efficiency

The concept of efficiency is important to economists. According to neoclassical economic theory, an efficient allocation of groundwater is one such that society's total benefits stemming from its consumption are maximized. That is, a distribution of groundwater is efficient if all other groundwater allocations result in at least one person experiencing a lower level of satisfaction. This state of efficiency is called Pareto optimality[13]; movements toward Pareto optimality are Pareto improvements.[14] A sufficient increase in wealth can offset a decrease in welfare stemming from less groundwater access. Therefore, allocation policies that allow the buying and trading of permits precipitate increased social welfare, i.e., Pareto improvements, without raising the total availability of groundwater. This is the aim of efficient property rights systems.

Neoclassical economics relies on the assumption that those who receive the most benefits from water consumption will pay the most to acquire it. Though this supposition ignores income inequalities, it is important to note that the cost of water is relatively low.[15] Furthermore, water is necessary for the preservation of life. As a result, the demand for water is relatively insensitive to income changes. This warrants the preceding assumption. Nonetheless, it may be desirable to limit the proportion of income individuals must spend on water. If this is the case, government subsidies can stabilize real water prices. This may be especially necessary for those in poverty.

As a corollary of the preceding assumption, if multiple users compete for access to groundwater, social welfare is maximized when each user receives the same quantity of net benefits from the final unit consumed—often called the equalization of marginal net benefits (MNBs).[16] To demonstrate this principle, it may be useful to visualize a municipality that auctions off the right to access groundwater to multiple users. The person that possesses the most urgent need for the first unit of water will be willing to pay the most for it. This user is said to receive the most net benefits from its receipt. The individual that derives the second greatest quantity of net benefits will acquire the second unit, and so forth. In this auction, the price of water will continue to drop as users become inundated. When all water is sold, participants will receive roughly the same amount of marginal net benefits from the last units of water. Intuitively, if another user could obtain more benefits from the last unit's consumption than the actual recipient, that person would outbid the original beneficiary. Moreover, if the water is distributed in an economically efficient manner, each buyer will receive the same amount of net benefits from the last units. This efficient distribution can be represented by Equation 1: $MNB_1(w) = MNB_2(w) = \cdots = MNB_N(w)$, where the marginal net benefits derived from water use, $MNB(w)$, are equal for all users, N. This concept can be used to assess the effectiveness of groundwater distribution systems. If a property rights system leads to unequal marginal net benefits, it is inefficient.

B. Conservation and the Discount Rate

Conservation is another important issue in the establishment of efficient groundwater allocations. Policymakers must decide how to best balance the desire to maximize current benefits with the need to preserve groundwater deposits for future generations. Many scientists advocate sustainable consumption—any level of natural resource consumption that can be maintained indefinitely—as the responsible de-

sources that are commonly accessible. *See* Garett Hardin, *The Tragedy of the Commons*, 162 Science 1243, 1243-48 (1968).

9. *See* Griffin, *supra* note 1, at 137.

10. *See id.* at 137-38; *see also* Utah Div. of Water Resources, Interim Cache Valley Groundwater Management Plan 1 (1999), *available at* http://nrwrt1.nr.state.ut.us/wrinfo/mmplan/ugw/cachevly.pdf [hereinafter Water Resources 1999].

11. For a comprehensive look at the variability of surface water flows in Utah, see U.S. Geological Survey, U.S. Dep't of the Interior, Methods for Estimating Magnitude and Frequency of Peak Flows for Natural Streams in Utah (2007), *available at* http://pubs.usgs.gov/sir/2007/5158/pdf/SIR20075158.pdf.

12. *See* Utah Div. of Water Resources, Utah State Water Plan: Section 2, Executive Summary (1990), *available at* http://www.water.utah.gov/planning/swp/Swp_2.htm [hereinafter Water Resources 1990].

13. *See* Dictionary of Modern Economics, *supra* note 7, at 323.

14. *See id.*

15. According to a 2006 survey, the average price for municipal-provided water in the United States is about $0.002 per gallon. *See* NUS Consulting Group, 2006 International Water Survey (2006), http://www.nusconsulting.com/downloads/2006WaterSurvey.pdf. The average American household consumes about 100,000 gallons of water per year; therefore, typical families only spend $200 (roughly) on municipal-provided water each year. *See* Edwin H. Clark II, *Water Prices Rising Worldwide*, Earth Policy Institute: Eco-Economy Updates, Mar. 7, 2007, http://www.earth-policy.org/Updates/2007/Update64.htm.

16. MNBs are calculated by subtracting the cost of a unit of water from an entity's willingness to pay for it. *See* Tom Tietenberg, Environmental and Natural Resource Economics 87-91 (5th ed. 2000) [hereinafter Tietenberg].

cision.[17] Taken to the extreme, sustainability implies that only the rechargeable portion of aquifers is extractable; therefore, nonrenewable aquifers should remain untouched.[18] Despite calls for strict sustainability, many economists and policymakers feel that nonrenewable resources can be consumed as long as the total stock of environmental resources remains constant.[19]

Economists and policymakers currently establish efficient extraction rates according to the social time preference (also known as the discount rate).[20] The social time preference is simply a reflection of the principle that society values present money and resources more highly than future money. That is, $100 is worth more today than the same amount of money one year from now. This is true because the initial $100 could grow in value if it is invested. Interest rates provide the clearest example of the idea that society will only trade current money (and satisfaction) if there are promises of future compensation. Guarantees of recompense provide the necessary incentive to save and conserve.

Time preferences also exist for the consumption of natural resources.[21] Social time preferences and the growth in the value of groundwater determine whether it is efficient to extract or conserve. Groundwater becomes increasingly valuable as less is available. This is reflected in the price of water. If the rate of social time preference exceeds the rate of growth in groundwater's value, it is efficient to extract. However, this case does not imply that all water should be immediately extracted and sold. As more water is recovered and sold, mining costs increase while groundwater prices decrease.[22] Consequently, groundwater extraction becomes irrational if too much is sold in the current time period. The determination of optimal extraction rates requires the utilization of complex dynamic modeling,[23] the substantiation of which lies outside the scope of this Article. Nonetheless, one central aspect of the model should be emphasized: the social time preference heavily influences the socially optimal rate of groundwater extraction.

Extraction in accordance with the social time preference maximizes social welfare. As a result, if individual extractors prefer current consumption to a greater (or lesser) degree than society, they will mine water at a rate that diverges from the socially optimal rate, and society's wellness will not be maximized. Therefore, if policies foster the development of personal time preferences that deviate from the social time preference, they are economically inefficient. Risk and fear of loss are two common reasons that groundwater permit owners extract water more quickly than is socially optimal. In practice, many economists assume that long-term interest rates provide an accurate estimate of the social time preference.[24]

C. Externalities

Since the time of Adam Smith, many economists have theorized that unregulated markets increase social welfare more effectively than regulated markets.[25] If this is true, markets should determine groundwater allocation. However, as mentioned above, water in aquifers is a common-pool resource.[26] This means that government intervention is required to prevent the overextraction of groundwater. Also, because externalities often accompany the mining and use of groundwater, government intercession is required to force external costs back onto extractors. For the purposes of this Article, externalities are defined as unintended costs (or benefits) of water extraction that are imposed on individuals other than the miner.

Two of the most common externalities associated with the withdrawal of groundwater are the private and social time preference discrepancy and the pumping cost externality.[27] Because users assume risks when producing goods dependent upon the uncertain availability of groundwater, private time preferences can be higher than the social time preference. That is, if private extractors are unsure whether their access to groundwater will continue in the future, they are unlikely to be conservative in their rate of extraction. The perpetuation of high extraction rates ensures the premature exhaustion of nonrenewable groundwater reserves. Also, because current groundwater withdrawals precipitate a decrease in its future extractability, there is an incentive to increase pumping in the present.[28] This can

17. *See* Nolberto Munier, Introduction to Sustainability 10-16 (2005).

18. *See* Tietenberg, *supra* note 16, at 96.

19. Consumption such that the total stock of environmental goods remains constant is called strong sustainability; weak sustainability implies that man-made goods can substitute for expended environmental goods. *See id.*

20. *See* Kenneth J. Arrow & Robert C. Lind, *Uncertainty and the Evaluation of Public Investment Decisions*, 60 Am. Econ. Rev. 364, 376-78 (1970). For a review of the debate among economists concerning the use of discounting in assigning value to future generations' natural resource consumption, see Anthony C. Fisher, Resource and Environmental Economics 67-74 (1981) [hereinafter Fisher].

21. For an overview of the discount rate as it applies to water economics, see Griffin, *supra* note 1, at 76-77.

22. *See* Young, *supra* note 6, chs. 23-30. These pages provide a good introduction to the behavior of water extraction costs as more groundwater is mined.

23. For an exhaustive explanation and determination of renewable and nonrenewable resources' optimal extraction rate, see Fisher, *supra* note 20, at 23-36, 79-86.

24. The Office of Management and Budget mandates that analysts must discount the costs and benefits of federal projects using long-term interest rates. *See* Office of Management and Budget, Circular No. A-94 Revised (1992), *available at* http://www.whitehouse.gov/omb/circulars/a094/a094.html.

25. *See* Griffin, *supra* note 1, at 105-07. Smith felt that individuals pursuing their self-interest would promote social welfare in the most effective manner. Smith originally articulated this idea in 1776:

> As every individual, therefore, endeavors as much as he can . . . to direct that industry that its produce may be of the greatest value; every individual necessarily labours to render the annual revenue of the society as great as he can . . . [h]e intends only his own gain . . . and he is in this, as in many other cases, led by an invisible hand to promote an end which was no part of his intention. . . By pursuing his own interest he frequently promotes that of the society more effectually than when he really intends to promote it.

Adam Smith, The Wealth of Nations 572 (Bantam Classic 2003) (1776). Nobel Laureates Kenneth Arrow, Gerard Debreu, and John Hicks contributed to the mathematical formalization of this theorem. *See, e.g.*, Kenneth J. Arrow & Gerard Debreu, *Existence of an Equilibrium for a Competitive Market*, 22 Econometrica 265, 265-90 (1954).

26. *See* discussion at *supra* note 7 and accompanying text.

27. *See* Bill Provencher & Oscar Burt, *A Private Property Rights Regime for the Commons: The Case for Groundwater*, 76 Am. J. Agric. Econ. 875, 876-77 (1994). These authors actually refer to the time preference discrepancy externality as the risk externality; however, this author feels the former name is a more fitting description of the economics underlying the problem.

28. *See* Griffin, *supra* note 1, at 111.

also cause the cost of pumping to rise more rapidly than is optimal.

Accordingly, one goal of government groundwater regulation should be the mitigation of externalities. To achieve an efficient allocation of any externality-accompanied resource, extractors and consumers—not society—must pay the cost of the externality. If a system fails to eliminate externalities (such as the pumping cost or extraction rate externality), the regime is inefficient.

III. Property Rights Systems and Utah Groundwater Law

A. Groundwater Allocation Regimes

In most parts of the United States, groundwater is owned by respective state governments, and the right to extract is allocated to different users through varying property rights systems.[29] Therefore, the right to extract groundwater is an usufructuary right. As mentioned above, government management is required because groundwater is a common-pool resource. That is, the failure to regulate groundwater use will lead to the premature extinction of nonrenewable aquifers. However, not all regulatory policies are created equal. Inefficient regulations may actually diminish social welfare. Nearly each system introduces both effective and inferior policies. Overall efficiency can be reviewed using the metrics defined in Section II. Ronald Griffin provides an excellent overview of the most influential groundwater allocation systems.[30] A brief summary is provided here.

Absolute Ownership Doctrine – This allocation system is found in parts of Indiana, Texas, and Vermont.[31] According to this doctrine, owners of overlying land can pump as much groundwater as desired.[32] However, because multiple properties may overlie one aquifer, there is an incentive to pump more water than is necessary in order to preclude the access of neighboring miners. Users pump until water has no worth to them, and economic rents dissipate.[33]

Reasonable Use Doctrine – This is a form of riparianism that is similar to absolute ownership in that overlying landowners have the property right. However, it differs from absolute ownership because users can only pump a reasonable amount of water.[34] Nevertheless, this system is only a minor improvement over absolute ownership because reasonability is a fairly subjective measure. Inefficiency still abounds because such laws do little to alleviate the pumping cost externality.

Correlative Rights – This system is prevalent in California.[35] Under this regime, users are similarly subject to the reasonable use criteria. Conversely, a cap is placed to limit the total quantity of mined groundwater such that extractions do not surpass "safe annual yields."[36] Unfortunately, in areas where such laws appear, local authorities rarely monitor total water withdrawals.[37] Because the cap is haphazardly enforced, groundwater in such systems is still classifiable as a common-pool resource[38]; therefore, it is overextracted.

Prior Appropriations Doctrine – While this system is an improvement over the regimes mentioned above, it still fails to achieve efficiency as defined in Section II. According to this system, "appropriators shall have priority among themselves according to the dates of their respective appropriations."[39] In many of the states that utilize prior appropriative systems, water rights are quantified and transferable in the form of permits (also called deeds or rights).[40] Consequently, prior appropriative systems represent a major improvement over other arrangements because the right to access groundwater is salable—not just the water itself. Nevertheless, owners of extraction permits do not have the same degree of ownership over groundwater as most enjoy in conjunction with normal market goods. Extraction permits must be sold according to government regulations.[41] Also, permit owners do not have the authority to destroy groundwater deposits.[42] Nonetheless, permits allow those who can extract aquifer-bound water at the lowest cost to do so. In a competitive market, lower costs will be passed on to water consumers. Permits play an essential role in allowing movements toward marginal net benefit equalization (as seen in Equation 1) and efficiency. However, the effectiveness of these systems is often hampered by a number of provisos that either limit the tradability of permits or introduce externalities. Forfeiture clauses, limits on transferability, and beneficial use rankings are a few of the inefficient constraints. These are more fully discussed below. In the western United States, most states' groundwater laws fall under this distinction.[43]

The Vernon Smith System[44] – Nobel Laureate Vernon Smith proposed a system that divides groundwater property rights into two types of permits. Type 1 permits entitle the owner to the use of a fixed amount of the annual aquifer recharge. Type 2 permits give the owner access to a fixed amount of the current stock of groundwater. Both are fully transferable, and unused portions of Type 1 permits can be converted to Type 2 permits. Also, such deeds have no expiration. Full transferability allows efficiency through the equating of marginal net benefits, and the lack of expiration

29. *See* Gary Bryner & Elizabeth Purcell, Groundwater Law Sourcebook of the Western United States 5 (2003), *available at* http://www.colorado.edu/law/centers/nrlc/pubs.htm [hereinafter Bryner & Purcell].

30. Griffin, *supra* note 1, at 131-36. For an excellent summary of groundwater laws in the western United States, see Bryner & Purcell, *supra* note 29. For a review of groundwater laws in general, see William Goldfarb, Water Law 42-48 (2d ed. 1988) [hereinafter Goldfarb].

31. *See* Griffin, *supra* note 1, at 132; Goldfarb, *supra* note 30, at 43.

32. *See* Bryner & Purcell, *supra* note 29, at 5.

33. Economists often use the word rents to describe the increased market value of natural resources that results from their limited availability. *See* Dictionary of Modern Economics, *supra* note 7, at 121.

34. *See* Bryner & Purcell, *supra* note 29, at 5.

35. *See* Goldfarb, *supra* note 30, at 44.

36. *Id.* at 45.

37. *See* Griffin, *supra* note 1, at 134 (citing Zachary A. Smith, Groundwater in the West 59 (1989)).

38. *See* discussion at *supra* note 7 and accompanying text.

39. Utah Code Ann. §73-3-21 (1953). *See also* Bryner & Purcell, *supra* note 29, at 5.

40. *See* Goldfarb, *supra* note 30, at 45-48.

41. *See infra* note 77.

42. States typically mandate that extracted groundwater must be used beneficially. *See infra* note 72.

43. *See* Bryner & Purcell, *supra* note 29, at 5.

44. This section provides a brief summary of a paper written by Vernon Smith. For the entire article, see Vernon L. Smith, *Water Deeds: A Proposed Solution to the Water Valuation Problem*, 26 Ariz. Rev. 7, 7-10 (1977). While Vernon Smith won the Nobel Prize primarily for research in other areas of economics, the ideas put forth in this Article provide an excellent example of his ingenuity.

mitigates the time preference externality. While some additional externalities may persist, this system has the potential to bring about large steps toward economic efficiency, i.e., Pareto improvements. However, this regime has yet to be applied.[45]

B. Utah Groundwater Law and the Cache County Management Plan

In Utah, as in many states in the West, water is owned by the government and leased to users through deeds.[46] Groundwater extraction rights are called "recovery permits."[47] Utah groundwater and surface water laws fall under the category of prior appropriations.[48] Groundwater accounts for two-thirds of public water use in Utah.[49] Except in a few cases, laws do not distinguish between the two water resources.[50]

Water access permits must be approved by the State Engineer and are subject to appeals by Utah citizens.[51] These recovery permits are typically valid for 50 years,[52] and they can be forfeited if the extracted water is not used "beneficially."[53] While these rights are transferable, i.e., salable,[54] users who purchase permits must use any extracted water in the manner specified by the original appropriation.[55] All wells that are deeper than 30 feet must be approved by the State Engineer.[56] Such wells are subject to regulation.[57] Applications for withdrawals must provide evidence that the water will be put to "beneficial use" (as defined by the State Engineer).[58] Domestic use has priority over agricultural use, which has priority over other uses.[59] Within the various categories of use, first in time is first in right[60]; that is, holders of older permits have priority over those with newer permits. Interstate water transfers are allowed; however, an application process must be completed first.[61]

The State Engineer has instituted management plans in many areas of Utah.[62] These plans regulate and oversee water consumption in areas where yearly water extractions approach unsafe levels.[63] Management plans typically entail the appointment of a local water commissioner. A management plan has been established in Cache County,[64] and county officials manage both groundwater and surface water permits conjunctively.[65] Conjunctive use is important because both groundwater and surface water levels are inextricably linked.[66] Cache County has a rather abundant allotment of groundwater, and only about 12.5 % of the current recharge is being withdrawn.[67]

Though it would appear that Cache Valley's current withdrawals are far below a maximal level, it is important to consider two points. Because Cache Valley's groundwater and surface water are heavily interrelated, additional groundwater withdrawals will interfere with current surface water right appropriations. The State Engineer estimates that an additional 25,000 acre-feet (AF) of water can be withdrawn without negatively affecting the rights of current users.[68] However, it is possible that further withdrawals beyond this limit will affect surface water users. Also, it has been projected that population growth will necessitate the use of an additional 15,000-25,000 AF of water by the year 2020.[69] Therefore, although it is now sensible to meet Cache Valley's growing water demand by expanding the annual extraction rate, this will not always be the case. It is likely that it will no longer be practical to increase the mining rate in less than 20 years. Hence, it is wise to implement an efficient property rights system now to accommodate for this impending threshold.

IV. Sources of Inefficiency in Prior Appropriative Systems

As mentioned above, Utah employs the prior appropriations property rights system for groundwater management. In this section, the metrics developed in Section II are applied to prior appropriative allocations to identify inefficient aspects of such systems. An efficient distribution of groundwater is one such that no other allocation exists whereby someone can be made better off without lowering at least one person's total satisfaction.[70] This requires the equalization of MNBs derived from groundwater consumption, as shown in Equation 1. It is extremely unlikely that an arbitrary assignment of groundwater rights would result in equal marginal net benefits. Therefore, most initial allotments result in suboptimal levels of social welfare, regardless of the allocation system in place. However, as noted in the auction example, if users are allowed to trade and bid on groundwater permits, the resulting allocation will be efficient. The transfer of groundwater rights allows movements toward efficiency. Consequently, the lowering of barriers to trade is desirable.

45. *See* Griffin, *supra* note 1, at 135.
46. Utah Code Ann. §§73-1-1 (1953), 73-1-5 (1953), 73-1-10(1)(a) (2003). For an excellent review of important aspects in Utah groundwater law, see Bryner & Purcell, *supra* note 29, at 52-54.
47. Utah Code Ann. §§73-3b-102(4) (1991), 73-3b-103(3) (1991).
48. *See* Bryner & Purcell, *supra* note 29, at 52-54.
49. *See* Water Resources 1990, *supra* note 12.
50. *See* Bryner & Purcell, *supra* note 29, at 6. For a delineation of a few of the differences between groundwater and surface water laws, see Utah Code Ann. §73-3b (2007).
51. Utah Code Ann. §§73-2-1(3)-(8) (2007), 73-3-7 (1995).
52. *Id.* §73-3-12(3)(a)-(c) (2007).
53. *Id.* §73-1-4(1)-(6) (2007).
54. *Id.* §73-3b-207(1) (1991).
55. *Id.* §73-3b-106(2) (1991). Applications for change of use may be submitted; however, such changes are subject to the State Engineer's discretion. *See id.* §73-3-3(2)-(4) (2005).
56. *See* Utah Div. of Water Rights, State of Utah Water Well Handbook (2004), *available at* http://nrwrt1.nr.state.ut.us/wellinfo/handbook.pdf.
57. Utah Code Ann. §73-3-25(1) (2004).
58. *Id.* §§73-1-3 (1953), 73-1-4(1)(a) (2007).
59. *Id.* §73-3-21 (1953).
60. Goldfarb, *supra* note 30, at 45; *see also* Utah Code Ann. §73-3-21 (1953).
61. Utah Code Ann. §73-3a-106 (1991).
62. For a review of the laws granting authorization to the State Engineer for the organization of groundwater management plans, see *id.* §73-2-17 (1969). For a review of the laws directing the administration of such plans, see *id.* §73-5-15 (2007).
63. Bryner & Purcell, *supra* note 29, at 53.
64. *See* Water Resources 1999, *supra* note 10, at 1-5.
65. *See id.* at 1.
66. *See id.*
67. *Id.* at 2.
68. *Id.* at 4.
69. Trevor Hughes, *Cache County Water Demand/Supply Model* (Final report to Utah Division of Water Resources, Utah State Univ., Dec. 1996).
70. *See supra* notes 13 and 14.

Unfortunately, many groundwater allotment systems provide little incentive to trade water rights. Some disallow trade altogether. Even prior appropriative systems fail to establish efficient groundwater permit markets.[71] Some of the trade barriers found in these systems include same use requirements, beneficial use stipulations, and high transaction costs. When such trade restrictions are extant, MNB equalization is unlikely to occur, and society's wellness is not maximized.

State groundwater laws often include the stipulation that owners of water extraction permits must use any mined water beneficially.[72] Beneficial use hierarchies are included in certain state laws.[73] These hierarchies create predetermined listings that legally rank groundwater functions according to importance. Policymakers create these laws to assign priority to the various uses of groundwater. Priority rankings provide the basis for water permit allocations in certain states. In other states, these listings supplement the first in time first in right policy.[74] According to such rankings, domestic use often has priority over farm use, which has preference over corporate use.[75] Beneficial use laws seem to originate from the fear that agricultural or corporate water demands could prevent households from receiving drinking water. This concern overlooks a fundamental economic truth: those who receive the maximum benefit from groundwater consumption will pay the most for the right to access it.

Beneficial use rankings can only maximize social welfare if groundwater always imparts more benefits to a specific group than to all other water users (such as households and non-households). However, this is not the case because of decreasing marginal utility—the idea that as more of the same good is received, the less satisfaction subsequent units provide. While the first units of groundwater likely provide the greatest social benefit when consumed by households (due to the life-sustaining nature of water), successive units may afford more benefits if given to the agricultural sector for the production of food. Beneficial use rankings ensure initial allocations will not result in equalized marginal net benefits and are thus inefficient. Though trade could overcome uneconomical initial allocations, state laws often specify that permit owners can only trade water deeds to users who are committed to using water for the same purpose.[76] Therefore, restricted trading allows the problem to perpetuate.

Furthermore, high transaction costs—costs exterior to a traded good's actual price—create disincentives to trade. They also diminish benefits gained through exchange. Groundwater transaction costs can materialize in the form of transportation expenses, government imposed costs, i.e., long wait periods and excessive fees and third-party appeals. Some states require individuals to receive permission from their respective state governments in order to purchase permits from other third-party users.[77] Objectors can file petitions to prevent or delay such transactions.[78] While the appeals process may justly protect certain water users from having their access unfairly hindered, the process can also be used to perniciously block competition. Resulting legal fees and court rulings could impede allocations that would result in improved social welfare. Economists call this self-interested behavior rent-seeking. Rent-seeking is obviously not beneficial for society as a whole.

As noted above, the extraction rate of groundwater is dependent on time preferences—the preference for current consumption in place of future consumption. The social time preference determines groundwater's efficient withdrawal rate. If personal time preferences diverge from the social time preference, inefficient extraction ensues because private users extract groundwater at a rate that differs from the socially optimal rate. Inefficient private mining rates abound if property right owners are uncertain whether they will have continued access to groundwater.

The legally imposed expiration of groundwater rights is one common instigator of uncertainty. Many states stipulate that permits are only allocated for a specific period of time and are revocable if unused.[79] The right to extract groundwater is forfeited once the time period has passed. As expiration nears, a permit owner's motivation to conserve groundwater diminishes (unless the permit is renewed). An extractor that will soon lose aquifer access has little incentive to preserve water deposits. Impending expiration periods provide a compelling reason for users to amplify their rates of water extraction. This creates diverging time preferences because private users maximize personal benefits by increasing their mining rates to levels that are above the socially optimal rate. Hence, forfeiture periods create the deviating time preference externality and are inefficient.

V. Recommended Reforms in Utah Groundwater Law

A. Remove Barriers to Trade

Utah groundwater allocations are frequently suboptimal because it is difficult to transfer groundwater rights. In order for groundwater permit transfers to occur, those involved in the transaction must first submit a request to the State Engineer.[80] The State Engineer is then required to post the application in a newspaper so that objectors can appeal.[81] Because it is fairly easy to delay (if not prevent) the appropriation of water permits,[82] there is an incentive for those who strategically oppose a trade to file a protest. Some may attempt to block competition for personal gain. This rent-seeking behavior increases certain users' private benefits;

71. *See* Griffin, *supra* note 1, at 134-35.

72. *See* Bryner & Purcell, *supra* note 29, at 5; Goldfarb, *supra* note 30, at 35-37.

73. *See* Bryner & Purcell, *supra* note 29, at 14 (California), 36 (Montana), 52 (Utah).

74. Goldfarb, *supra* note 30, at 45. For the specific laws in Utah, see Utah Code Ann. §73-3-21 (1953).

75. This is the ranking that exists in Utah. *See* Utah Code Ann. §73-3-21 (1953).

76. *See* Bryner & Purcell, *supra* note 29, at 45 (New Mexico), 54 (Utah).

77. *See id.* at 11 (Arizona), 29 (Idaho), 53 (Utah), 68 (Wyoming). For a reference to the specific laws applicable in Utah, see *infra* note 80.

78. *See* Bryner & Purcell, *supra* note 29, at 30 (Idaho), 39 (Nevada), 43 (New Mexico), 47 (Oregon), 52 (Utah), 66 (Wyoming).

79. *See id.* at 7 (Arizona), 30 (Idaho), 43 (New Mexico), 46 (Oregon), 55 (Washington). For forfeiture laws in Utah, see Utah Code Ann. §73-1-4(1)-(6) (2007).

80. Utah Code Ann. §73-3b-207(1)-(2) (1991).

81. *Id.* §§73-3-6(1)(a)-(b) (2003), 73-3-7 (1995).

82. "Any person interested may file a protest" to obstruct an acquisition. *Id.* §73-3-7(1) (1995); *see also* Bryner & Purcell, *supra* note 29, at 52.

however, it diminishes aggregate welfare. While appeals can play an important role in protecting individual rights, these appeals are easily misused for personal reasons. Therefore, the obstruction of water right transfers should be more difficult. This would increase Utah's benefits derived from groundwater. Perhaps a feasible solution would be a requirement mandating that objectors provide overwhelming evidence demonstrating that the proposed transfer would have negative economic impacts on society (not just the objector).

High transaction costs also create trade disincentives. The repeated theme of this Article is that social welfare is maximized when property right transfers are allowed. Gains from trade provide the motivation for engaging in transfers. However, costs that are exterior to permit prices erode gains from trade. Transaction costs included in Utah groundwater laws include transfer fees,[83] waiting periods,[84] and the above-mentioned court appeals process. Difficult interstate water transfer requirements constitute another form of transaction costs. For example, current laws make water transfers from Utah to Nevada rather difficult,[85] even if it is found that both parties benefit from the trade. An opponent to the transaction can stall the process by filing an appeal with the State Engineer.[86] Also, the potential buyer in Nevada would need to prove that it intends to use the water beneficially and for the use specified by the deed's original appropriation (if the deed is transferred rather than created).[87] These stringent stipulations deter transfers. Because trade makes efficiency possible, barriers to trade, including transaction costs, promote inefficiency. Therefore, barriers to trade should be eliminated to the greatest extent possible.

B. Disband Beneficial Use Hierarchies

Utah assigns rights for naturally flowing water according to the time of initial appropriation.[88] Conversely, water diverted from its natural flow is subject to the beneficial use hierarchy.[89] According to this ranking, domestic consumption takes precedence over agricultural use, and agricultural use has a priority over corporate use. While the beneficial use rankings in Utah do not apply to all water rights, this hierarchy can have significant impacts on efficiency. For example, the growth of a municipality may necessitate the acquisition of additional groundwater. Policymakers could divert groundwater from its natural flow to meet the increased demand. In this municipality, all rights assigned to new users would be subject to the beneficial use hierarchy.

As noted above, beneficial use hierarchies subvert efficient allocations by disallowing equalized marginal net benefits. That is, because of such rankings, the benefits certain groundwater users receive is less than the amount other users could potentially receive under alternative allocations. This would become especially apparent during severe droughts. If some users are allowed to consume water until surfeited while others must wait, society's net benefits will not be maximized. Few would argue that an allocation that always allows residents to water their lawns before farmers can irrigate their fields is efficient. Despite this, such beneficial use hierarchies persist because Utah groundwater law fails to specify the extent to which domestic users have priority over agricultural users (except through the ambiguous "without unnecessary waste" clause).[90]

If trade is unhampered and beneficial use systems are disbanded, the market will allocate water to those who derive the most value from its use. This occurs because those who receive the most benefits from water will be willing to pay the most for it. As a result, such users will purchase the right from others who do not value water to the same degree. Post-trade allocations maximize societal well-being far more effectively than mandates giving domestic users perpetual priority. Properly regulated markets will ensure that all have access to groundwater at an optimal price.

C. Eliminate Permit Forfeitures

In Utah, groundwater rights are typically forfeited after a period of 50 years.[91] Additionally, rights may be taken away if the State Engineers deems that certain users are not using groundwater beneficially.[92] Both of these regulations can cause similar problems. Because of the temporary ownership of water rights, incentives to conserve groundwater dissolve as the 50-year time limit approaches. Overextraction likely occurs. Furthermore, because groundwater rights can be confiscated if not used beneficially, additional overextraction will occur to avoid forfeiture. Unfortunately, nonuse is often deemed to be nonbeneficial.[93] Therefore, though the conservation of groundwater may be beneficial for society, private users have a strong motivation to continually mine groundwater in order to avoid the revocation of permits. Consequently, the removal of time limits and confiscation clauses is an important step toward efficient groundwater allocations in Utah.

While some may feel that confiscation is necessary if water extractors poorly manage water, one final point must be emphasized. If groundwater permit trading is allowed, and healthy permit markets exist, any wasteful use (deliberate or otherwise) of groundwater is akin to destroying money. Such behavior is irrational. If an individual cannot mine water efficiently, that person will sell the permit to a more effective extractor. The liberation of groundwater markets through freely tradable permits will maximize social welfare if externalities are mitigated. Therefore, the role of state governments in groundwater management is to: (1) ensure that a sufficient infrastructure exists such that permit trading can thrive; and (2) eliminate externalities to the greatest degree possible.

83. Utah Code Ann. §73-2-14(1)(d) (2007).

84. Wait periods are an inevitable consequence of the convoluted permit transfer application process. *See id.* §73-3-3 (2005).

85. For the stringent laws concerning interstate transfers, see *id.* §§73-3a-107 (2003), 73-3a-108 (1991), and 73-3a-109 (1991).

86. Interstate transfers are appealed in accordance with the intrastate transfer appeal process. *See id.* §73-3a-105(1) (1991). For an examination of the appeals process, see *id.* §73-3-7 (1995).

87. *See id.* §73-3a-109(2) (1991).

88. *Id.* §73-3-21 (1953).

89. *See* Bountiful City v. De Luca, 77 Utah 107, 292 P. 194, 72 A.L.R. 657 (1930).

90. Utah Code Ann. §73-3-21 (1953).

91. *Id.* §73-3-12(3)(a)-(c) (2007).

92. *Id.* §73-1-4(1)-(6) (2007).

93. *Id.* §73-1-4(3) (2007).

VI. Conclusions

As noted in this Article, the demand for groundwater in Cache Valley is projected to increase over the next 20 years. Because of the growing demand, more requests will be made for groundwater extraction permits. However, Utah's current groundwater allocation laws are economically inferior for a number of reasons. Therefore, they may be unable to meet the growing demand for groundwater. Beneficial use rankings, high transaction costs, permit transfer difficulties, and forfeiture clauses are some of the main causes of inefficiency. As a result of the inadequacy in Utah groundwater law, the state should investigate the prospect of adopting better groundwater allocation laws in order to prepare for future stresses. Such laws will increase the overall welfare of society. If Utah is to remain a prior appropriations state, certain actions can improve the efficacy of groundwater law. These steps include the disbandment of beneficial use hierarchies, increased freedom in permit trading, and the elimination of deed expiration periods. Through the medium of efficient laws and policies, the state should endeavor to: (1) ensure the existence of a healthy market for groundwater recovery permits; and (2) mitigate the costs extractors place on society.