"BECAUSE THAT'S WHERE THE WATER IS": RETIRING CURRENT WATER USES TO ACHIEVE THE SAFE-YIELD OBJECTIVE OF THE ARIZONA GROUNDWATER MANAGEMENT ACT

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I. INTRODUCTION

The major battles over groundwater in Arizona seem to be over.[1]

Would that it were so. In reality, Arizona's groundwater reserves are dwindling while the population base is rapidly expanding. Already, Arizonans annually consume vastly more groundwater than Mother Nature recharges into the aquifers. The competition for water, a staple theme in western United States history, raises serious conflicts among Arizona's water users. Rural Arizona perceives the municipalities' purchase of rural land to obtain groundwater as threatening their economic independence and way of life. Agricultural irrigators resent that cities and mines act in disregard of agriculture's important role in Arizona. Prior appropriators of surface water find that groundwater wells are interfering with surface water flows. Water users whose rights derive from Arizona law oppose federal agencies asserting federal water rights that may take priority. And unresolved and unquantified federally reserved Indian water rights cast a pall over nearly all water rights in Arizona.

Opportunities for water development projects offer no hope of satisfying the demands of Arizona water users. New dam sites face safety problems,

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1. Z. SMITH, GROUNDWATER IN THE WEST 47 (1989).

funding obstacles, and environmental objections. The Central Arizona Project (CAP) may temporarily slake the state's thirst, but will not solve the long-term problems. In short, future water demand will substantially exceed water supply, assuring debate and conflict over allocating rights to use water in Arizona.

The tenth anniversary of the seminal Arizona Groundwater Management Act ("the Act" or GMA) provides a suitable occasion to take stock of its accomplishments and the unsolved problems. This article explores ways to fulfill the policy objectives of the GMA. It begins by identifying "safe-yield," an equilibrium between groundwater withdrawal and recharge, as the cornerstone of GMA policy. After defending the wisdom of this goal, it examines avenues for achieving safe-yield and concludes that water conservation programs and water augmentation options are important, but not sufficient to produce safe-yield. Only a program that involves retiring current uses offers hope for achieving safe-yield.

The article next examines current water use in Arizona. Because agricultural irrigation consumes eighty-five percent of Arizona's annual water use, one must consider equitable and efficient methods for reducing this consumption if one is serious about achieving safe-yield. Although agriculture historically played a dominant role in Arizona's economy, economic and demographic changes have reduced the overall contribution of agriculture to the state's economy to approximately two percent.

Finally, this article proposes a method for encouraging the purchase and retirement of agricultural water rights. Under the GMA, new developments in so-called Active Management Areas (AMAs)[2] must demonstrate an assured water supply. In order to satisfy this condition, new developments should be required to purchase and retire existing rights.[3]

II. POLICY GOALS OF THE ARIZONA GROUNDWATER MANAGEMENT ACT

In the late 1970's, faced with chronic overdrafting of the state's groundwater reserves, threatened by federal officials with loss of funding for the much-coveted CAP, and pushed to a crisis by an Arizona Supreme Court

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2. The Act created four AMAs — Phoenix, Tucson, Prescott, and Pinal — that accounted for sixty-nine percent of the State's total overdraft and included over eighty percent of the State's population. *See* Johnson, *Summary of the 1980 Arizona Groundwater Management Act* (State Bar of Arizona 1981).

3. This article focuses on Arizona water law, but its analysis and proposal could work well elsewhere. In every western state, agricultural irrigation consumes between eighty and ninety percent of each state's water. *See* M. REISNER & S. BATES, OVERTAPPED OASIS 30 (1990). As population in the West has increased and as competing pressures for a finite resource have intensified, proposals have surfaced to encourage the highest value use of water. Economists, lawyers, and public policy specialists have produced a considerable body of literature on this idea, dubbed "water marketing." *See, e.g., Water Transfer Symposium*, 31 ARIZ. L. REV. 697 (1989); B. COLBY, D. SALIBA & D. BUSH, WATER MARKETS IN THEORY AND PRACTICE: MARKET TRANSFERS, WATER VALUES AND PUBLIC POLICY (1987); R. WAHL, MARKETS FOR FEDERAL WATER: SUBSIDIES, PROPERTY RIGHTS AND THE BUREAU OF RECLAMATION (1989); Gould, *Transfer of Water Rights*, 29 NAT. RESOURCES J. 457 (1989); Gould, *Water Rights Transfers and Third-Party Effects*, 23 LAND & WATER L. REV. 1 (1988). As support for these ideas has grown, one problem has been how to transform the conceptual

ruling, leaders of the Arizona Legislature told the state's major water interests that, if they could agree on a draft of a groundwater code, the Legislature would pass it without amendment. Between 1977 and 1980, a Groundwater Study Commission, composed of key legislators and representatives of major water interests, met in secret sessions to draft a groundwater code. In 1980, a series of lengthy meetings produced an agreed-upon bill, thanks largely to the intervention and skillful mediation of then-Governor Bruce Babbitt.[4] The old system allowed reasonable use of unlimited quantities of groundwater. The GMA established a system of quantified groundwater rights that protected all existing users within AMAs and made most rights transferable. Other noteworthy features of the Act include: a permit system that restricts initiating new groundwater uses within AMAs; strong management by a new state agency, the Department of Water Resources (DWR); and an insistence on water conservation.

The GMA operates like a ratchet and moves only in one direction: controlling water use. The Act provides for DWR to develop a series of Management Plans that, over time, ideally will reduce the quantity of water used. Within AMAs, the Act prohibits irrigating new lands, encourages a shift from irrigation to less consumptive non-irrigation uses, and prohibits a shift from non-irrigation uses to irrigation.

The first section of the Act, the Declaration of Policy, identifies the Act's factual predicate. "[T]he withdrawal of groundwater is greatly in excess of the safe annual yield and . . . this is threatening to destroy the economy [of parts of Arizona] and to do substantial injury to the general economy and welfare of this state and its citizens."[5] The public policy supporting the Act is that "it is necessary to conserve, protect and allocate the use of groundwater resources of the state. . . ."[6]

In conjunction with the Declaration of Policy, safe-yield might be understood to mean safe *annual* yield. The Act, however, defines safe-yield as a "groundwater management goal which attempts to achieve and thereafter maintain a long-term balance between the annual amount of groundwater

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framework into a concrete and viable set of rules that encourages water marketing. This article proposes one solution to that problem.

4. For studies of the history and mechanics of the GMA, see generally Connall, *A History of the Arizona Groundwater Management Act*, 1982 ARIZ. ST. L.J. 313; Doyle, *The Transportation Provisions of Arizona's 1980 Groundwater Management Act: A Proposed Definition of Compensable Injury*, 25 ARIZ. L. REV. 655 (1983); Higdon & Thompson, *The 1980 Arizona Groundwater Management Code*, 1980 ARIZ. ST. L.J. 621; Holub, *Groundwater Rights In Arizona — A New Property Right Whose Value Is Being Recognized*, 21 ARIZ. B.J. 8 (Dec.-Jan. 1986); J. Johnson, Summary Of The 1980 Arizona Groundwater Management Act (Including 1981 Amendments) (State Bar of Arizona Continuing Legal Education) (1981); Kyl, *The 1980 Arizona Groundwater Management Act: From Inception to Current Constitutional Challenge*, 53 U. COLO. L. REV. 471 (1982); McNulty & Woodard, *Arizona Water Issues: Contrasting Economic and Legal Perspectives*, 32 ARIZ. REV. 1 (Fall 1984); Pontius, *Groundwater Management in Arizona: A New Set of Rules*, 16 ARIZ. B.J. 28 (Oct. 1980); Rieke, *Arizona Water Law*, 2 ARIZ. ST. B. REAL PROP. SEC. J. 1 (Spring 1988); Weschler & Ingram, *Arizona Groundwater Reform: The Forces of Change*, 2 Sw. REV. 13 (Summer 1982); Woodard & Checchio, *The Legal Framework for Water Transfers in Arizona*, 31 ARIZ. L. REV. 721 (1989); Note, *The Right to Use Groundwater in Arizona After Chino Valley II and Cherry v. Steiner*, 25 ARIZ. L. REV. 473 (1983).

5. ARIZ. REV. STAT. ANN. § 45-401(A) (1987).

withdrawn in an active management area and the annual amount of natural and artificial groundwater recharge in the active management area."[7] Therefore, safe-yield is to be assessed on an AMA-wide basis over the long term. The Act sets safe-yield as a target for the Tucson, Phoenix and Prescott AMAs. For these AMAs, the management goal for DWR is "safe-yield by January 1, 2025 or such earlier date as may be determined by the director."[8] For the Pinal AMA, the Legislature opted to allow non-irrigation uses to develop while preserving agricultural uses, but only so long as it is feasible to do so. The ultimate necessity is to protect water supplies for future non-irrigation uses.[9]

Attacks have recently been leveled against the idea of safe-yield as an important goal of the GMA. In a much publicized Performance Audit of DWR, the Auditor General of Arizona suggested that "[t]he safe-yield goal may not be a realistic and appropriate basis for planning."[10] The Auditor General concluded that the Management Plans for the Phoenix and Tucson AMAs will fail to achieve safe-yield and "may not be necessary hydrologically because of the large amounts of groundwater in storage beneath the Phoenix and Tucson AMAs."[11] The Auditor General described "the large amounts" as sufficient for 500-700 years.

Contrary to these criticisms, the safe-yield goal is a sensible objective for philosophical, moral, environmental, ecological, political, and economic reasons.[12] First, the quid-pro-quo for the Carter Administration's funding for the CAP was Arizona's enactment of a groundwater code that would eliminate groundwater mining.[13] Having obtained billions of dollars in federal funds to construct the CAP, the state ought not repudiate its part of the bargain. Furthermore, the Auditor General's frame of reference is short-sighted. Five to seven hundred years is a minuscule fraction of the geological time that it took the earth to produce the groundwater that Arizona is quickly mining. The last fifty years of groundwater withdrawals in the Phoenix AMA reduced the amount in storage by thirty-three percent, or 80 million acre feet (maf).[14] In the 1970's, Arizona's water use exceeded dependable supply by 2.2 to 2.5 maf a year.[15] At this rate, the Phoenix-area aquifers would be dry in 100 years. What happens after the common supply is exhausted? Does the present generation have a stewardship obligation to future generations not to exhaust a supply bequeathed by past generations? In the Amish community, there is a

6. *Id.* § 45-401(B).
7. *Id.* § 45-561(7) (Supp. 1990).
8. *Id.* § 45-562(A).
9. *Id.* § 45-562(B).
10. Performance Audit of the Department of Water Resources and Arizona Water Commission, Off. Auditor General 14 (Aug. 1989).
11. *Id.* at 15.
12. *See generally* Guruswamy, *Global Warming: Integrating United States and International Law*, 32 ARIZ. L. REV. 222, 246-51 (1990); WORLD COMMISSION ON ENVIRONMENT AND DEVELOPMENT, OUR COMMON FUTURE (1987).
13. Connall, *supra* note 4, at 329.
14. *See* DWR Responses to Auditor General's Findings 1, *reprinted in* Performance Audit of the Department of Water Resources and Arizona Water Commission, Off. Auditor General (Aug. 1989). An acre foot of water is 326,000 gallons.
15. Arizona Groundwater Management Study Commission, Final Report I-3 (June 1980); ARIZONA WATER COMMISSION, ALTERNATIVE FUTURES 3 (1977).

proverb to this effect: "We don't inherit the land, we borrow it from our children."[16]

Perhaps the groundwater in the Phoenix and Tucson basins will last 500-700 years. Perhaps not. While DWR's estimates of present aquifer capacity deserve considerable deference, all projections of water use a half millennium into the future rest on numerous debatable assumptions. (In 1492, could Christopher Columbus have projected Arizona's groundwater consumption in 1992?) The Auditor General's figures assume that Arizona will get its full CAP allotment and that complete implementation of the GMA will be achieved. Over the next 500 years, how much natural recharge will rainfall contribute? How much will Arizona's population increase? How much groundwater will be unfit for human consumption or agricultural irrigation due to natural causes or environmental contamination? Policy-makers ought to be conservative, erring on the side of caution, about assumptions on the available supply of the essence of life. Analogies to mining fossil fuels, such as oil, are misplaced because alternative sources of energy, such as solar or hydroelectric, are available.

Practical and economic reasons also support the safe-yield goal. Energy costs for pumping groundwater are substantial. As the water table declines, the cost of mining water increases.[17] All water users will bear this burden, but agriculture may be most affected. Sharp increases in energy costs may drive many farmers out of business,[18] but all segments of the Arizona economy have an interest in controlling water costs.[19] A final practical point is that the safe-yield goal is the law; jettisoning it would require legislative action.

III. METHODS FOR ACHIEVING SAFE YIELD

The Act provides the Department of Water Resources three principal management tools for achieving safe-yield: conservation requirements, water augmentation funds, and the assured water supply program.[20] This section of the article will consider the Act's conservation program and proposals for water supply augmentation. The emphasis in policy making has focused on

16. *See* J. HOSTELLER, AMISH SOCIETY 117 (1980); D. KRAYBILL, THE RIDDLE OF AMISH CULTURE 188-89 (1989).

17. *See* M. Evans, An Assessment of the Impact of the Arizona Groundwater Management in the Phoenix Active Management Area, ch. 5, at 11-14 (1990) (unpublished MA thesis, University of Arizona).

18. The Texas High Plains irrigators depend almost entirely on the overdrafted Ogallala Aquifer for their irrigation supply. In the late 1970's, energy prices soared and High Plains farmers realized that they could not afford to pump water indefinitely from the dwindling aquifer. In response, the farmers embarked on an entirely self-financed conservation effort. After ten years, there has been a region-wide cutback in irrigation water use that ranges between twenty-five and forty percent. *See* M. REISNER & S. BATES, *supra* note 3, at 115-16.

19. Mining groundwater causes environmental harm along riparian areas by depleting hydrologically connected surface flows and in sensitive areas by subsidence. Subsidence threatens the physical integrity of aquifers, reducing the capacity and impairing recharge. Hydrologists suggest that below a certain level in an aquifer, the quality of the water deteriorates substantially, becoming saline or even unpotable. *See* D. TODD, GROUND WATER HYDROLOGY 195-96 (1967); R. FREEZE & J. CHERRY, GROUNDWATER 384-457 (1979).

20. Two additional management tools have not yet had an impact. Beginning in the year 2006, the GMA authorizes DWR to establish a program for purchasing and retiring agricultural rights. *See* ARIZ. REV. STAT. ANN. § 45-566(A)(8) (Supp. 1990). In 1990, the

these two options. Nevertheless, it has become apparent that these tools will not achieve safe-yield.

A. Conservation

With respect to conservation, the Act anticipates that the Management Plans will move all water users toward more efficient uses between 1980 and 2025. The Act provides the structure of these successive plans, requires a "continuing mandatory conservation program" for all groundwater users, and leaves the details of the plans to implementation by DWR.[21]

During the first management period, from 1980 to 1990, the Act required DWR to move ahead on conservation by establishing an "irrigation water duty" for each farm in an AMA, that fixed the number of acres a farmer could irrigate and the amount of water a farmer could apply. The irrigation water duty is set by calculating the amount of water reasonably required to irrigate the crops historically grown on the particular farm and assumes that the farm uses "reasonable" conservation methods.[22] For municipal users, the Act expected DWR to mandate "reasonable reductions in per capita use" and other "appropriate" conservation measures. Note that the emphasis is on per capita use, not upon the total quantity of water used or provided by a particular water provider. For industrial users, the conservation program required use of "the latest commercially available conservation technology consistent with reasonable economic return."[23] Finally, water providers must use "[e]conomically reasonable conservation [methods]" for the distribution of groundwater.[24]

The ratchet tightens during the second management period from 1990 to 2000. The Act provides that DWR establish a new irrigation water duty for each farm, a standard that assumes "the maximum conservation consistent with prudent long-term farm management practices within areas of similar farming conditions."[25] Municipal water providers must achieve "additional reasonable reductions in per capita use."[26] For industrial users, the Act changes the standard subtly to permit DWR to require allocation-based conservation as opposed to requiring conservation based only on technological developments.[27]

In the third management period, from 2000 to 2010, in setting the irrigation water duty for each farm, DWR may adjust downward the highest water duties within a sub-basin to correspond to the middle range for that sub-basin.[28] For municipal users, the ratchet tightens further as DWR may require additional reductions in per capita use. The standard for industrial users remains the same, but as new technologies emerge, the effect may be to con-

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Legislature passed legislation establishing a conservation assistance fund. *See* H.B. 2042, 39th Leg., 2d Reg. Sess. (1990).

21. ARIZ. REV. STAT. ANN. § 45-563 (1987).

22. *Id.* § 45-564(A)(1) (Supp. 1990). "Irrigation water duty" is defined as "the amount of water in acre-feet per acre that is reasonable to apply to irrigated land in a farm unit during the accounting period." *Id.* § 45-402(21).

23. *Id.* § 45-564(A)(2).

24. *Id.* § 45-564(A)(3).

25. *Id.* § 45-565(A)(1).

26. *Id.* § 45-565(A)(2).

27. *Id.*

serve additional water. An important addition to the conservation methods available to DWR during the third management plan is the option to create a program for the purchase and retirement of grandfathered rights. This program may not begin until the year 2006.[29]

In the fourth management period, between 2010 and 2020, DWR is directed to tighten further conservation requirements "where feasible."[30] The final management period, between 2020 and 2025, when safe-yield is to be met in the Phoenix, Prescott, and Tucson AMAs, continues the same standards from earlier management periods.[31]

The conservation measures of the Act sensibly require all users to take steps to use groundwater efficiently. These measures are critical ingredients in the total package of groundwater policy in Arizona. Nevertheless, DWR's own projections about water consumption in the year 2025, comments from DWR lawyers, research by University of Arizona Department of Economics graduate students, and observations by knowledgeable water lawyers suggest that the conservation requirements for municipalities and for agriculture will have a relatively modest impact on moving toward safe-yield.

Two weaknesses are inherent in the conservation program. First, the municipal conservation measures of the Act simply do not address the quantity of groundwater being used because the measures are not resource based. In enacting the GMA, the Legislature was sensitive to the impacts on present municipal, industrial, and agricultural users. Not wanting to wreak havoc on the Arizona economy by preventing anticipated growth, the Legislature grandfathered in major existing water users. The conservation requirements do not limit the total quantity of groundwater being pumped; instead, they mandate more efficient use by every groundwater user. There is no cap on the number of groundwater users, whether they be irrigators, urban residents, or industrial users.[32] Although the GMA mandates reductions in municipal gallons per capita per day (GPCPD) usage, it does not limit population growth.[33] As the population of Arizona increases, every new business and each new consumer will place additional strains on the resources available.

The second problem with the conservation requirements is simply that they may not be very effective. A recent thesis by University of Arizona graduate student Mark Evans suggests, at least with respect to irrigators in the Phoenix AMA, that the conservation requirements are having only a marginal impact. In some sections of the Phoenix AMA, municipal and residential

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28. *Id.* § 45-566(A)(1).
29. *Id.* § 45-566(A)(7).
30. *Id.* § 45-567(A).
31. *Id.* § 45-568.
32. There is a prohibition on expanding farm acreage in AMAs. *See* ARIZ. REV. STAT. ANN. § 45-452(A) (Supp. 1990).
33. According to water law attorney Michael McNulty, the debate over per capita per day (PCPD) rates is a particularly curious one because the ultimate issue involves the methodology of the United States Census Bureau. If one assumes a household per capita figure of 2.9 persons per household as opposed to 2.8 persons per household, that translates into a substantial differential for PCPD rates. Surely it cannot be productive Arizona water policy to spend considerable energy debating Census Bureau methodology. And yet, municipalities and service area providers have hired statisticians to telephone residences in an attempt to rebut the per capita assumption about an area's population.

conservation may perversely make it cheaper for agriculture to pump additional water by elevating the water table. Evans concluded that, even assuming agriculture fully complies with DWR's conservation plans, "the resulting reduction in overdraft is not very large."[34]

In the Second Management Plan, DWR used an eighty-five percent efficiency ratio to calculate irrigation water duties,[35] and concluded that laser leveling of farmland is reasonable for agriculture and would produce an eighty-five percent efficiency with proper management. DWR justifies laser leveling because the water saved by employing this technology, the increase in crop yields, and other factors would more than offset its cost. The Salt River Project (SRP), however, recently argued that laser leveling may not produce this efficiency and that DWR's figures are inaccurate.[36] SRP questions why, if laser leveling is so obviously economically efficient, all farmers are not moving to it. Almost 2,000 irrigators have objected to the plan and have sought administrative review of their irrigation water duties,[37] suggesting that many farmers doubt they can achieve the efficiencies DWR is mandating.

Evans believes that agriculture is already conserving water. Because electricity charges for pumping are substantial and agriculture has a vested interest in saving dollars, he thinks that farmers are attempting to conserve water in order to lower their utility bills. Given this context, Evans suggests that the "Second Management Plan conservation measures will have little impact on either agricultural water use or agricultural income."[38]

Another factor that may limit the effect of agricultural conservation is the method for calculating the annual groundwater allotment of irrigators. The formula multiplies the irrigation water duty by the *highest* number of acres historically irrigated in any one year. This methodology results in allotting more water than necessary to irrigate the number of acres normally irrigated.[39] Additionally, for Irrigation Grandfathered Rights (IGRs), the GMA used the period from 1975 to 1980 as a benchmark. These were historically high water use years. Several years of drought (although one year was a very wet year) and high prices in the irrigation-intensive cotton industry encouraged heavy

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34. M. Evans, *supra* note 17, ch. 8, at 224.

35. DWR establishes irrigation water duties on average annual efficiencies, which it determines by taking the total amount of water needed to satisfy the consumptive needs of the crops historically grown and dividing that figure by the target irrigation efficiency. This calculation yields the irrigation efficiency expressed as a ratio.

36. *See* J. Daubert & H. Ayer, "Laser Leveling and Farm Profits," Technical Bull. No. 244, Univ. of Ariz. College of Agriculture (June 1982); A. Halderman, Final Report: Agricultural Conservation Program Studies; Support of SRP Agricultural Shareholders; Second Management Period Water Allotments; May 1 through October 31, 1989 (Oct. 27, 1989). However, water costs of SRP water are not representative of water costs for farmers as a whole.

37. Telephone interview with Steve Rossi, DWR Water Resource Specialist (Feb. 8, 1991); DWR Tucson AMA Groundwater Users Advisory Council Minutes 5 (Apr. 27, 1990).

38. M. Evans, *supra* note 17, ch. 7, at 8. *See generally* R. POSNER, ECONOMIC ANALYSIS OF THE LAW (2d ed. 1977).

39. *See* ARIZ. REV. STAT. ANN. §§ 45-402, -465, -564-68 (Supp. 1990); Ferris, *The Arizona Groundwater Code: The First Ten Years*, in ARIZONA'S WATER LAW: OVERVIEW AND CURRENT TOPICS 129, 149 (State Bar of Arizona 1990). Despite this favorable treatment, irrigators have filed almost 2,000 requests, ninety-four percent of all requests for administrative review, to modify irrigation water duties.

water consumption.[40] In defining "irrigation acres," DWR also "deemed" much acreage to have been historically irrigated, that actually was not. Thus, IGRs have a "paper rights" quality to them: they begin with amounts that often exceed actual beneficial use and consumption.

The Code compounds the problem by allowing an irrigator 100 percent credit for the difference between annual water use and the maximum annual groundwater allotment.[41] The idea is to encourage farmers to conserve water by allowing farmers who conserve in one year to use that water in a subsequent year. These so-called "flexibility accounts" make good sense on paper, but in reality have resulted in irrigators obtaining rights to use approximately 3,000,000 acre feet (af) over and above their current water duties.[42] The combination of water duty allotments and flexibility credits led Kathleen Ferris, former Director of DWR and a prominent Arizona water lawyer, to conclude that "conservation requirements for some farmers are meaningless."[43] IGR rights are designed to be a *maximum* amount of water, an aberration not a norm, that takes into account drought or other conditions that might cause an irrigator to exceed a reasonable annual average. These GMA provisions have converted a maximum into a baseline amount. An irrigator using anything less than this maximum receives 100 percent credit for his or her flexibility account.

University of Arizona Department of Agricultural Economics instructor Bruce Peacock has studied overdraft projections in the Phoenix AMA. He too concludes that agricultural conservation will achieve only minimal savings. On the other hand, there may be a substantial reduction in groundwater overdraft from non-agricultural conservation.[44] Peacock's research with respect to DWR's enforcement mechanisms in the Phoenix AMA is also sobering. He concludes that, despite the good efforts of DWR to enforce the GMA, these enforcement methods have a minimal impact on water use because farmers already have a financial incentive to conserve.[45] Peacock's research indicates that the Phoenix AMA will not reach safe-yield by 2025 and, indeed, that the overdraft is likely to increase from 1990 to 2025.[46] Experienced water lawyers have also expressed grave doubts that the conservation program will be

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40. VALLEY NATIONAL BANK OF ARIZONA, ARIZONA STATISTICAL REVIEW 76 (Dec. 1989). Beginning in 1973, the per-pound price of cotton soared. In 1972, farmers received only 27.3 cents per pound for upland cotton. In 1973, the price jumped to 44.6 cents per pound. By 1980, farmers were receiving 74.7 cents per pound for upland cotton. OFFICE OF PUBLIC AFFAIRS, U.S. DEP'T AGRICULTURE, FACT BOOK OF U.S. AGRICULTURE 133 (1989). During the same time period, government price-support payments for American upland cotton went from 38 cents per pound in 1975, to 58.4 cents in 1980. U.S. DEP'T AGRICULTURE, AGRICULTURAL STATISTICS 63 (1989).

41. *See* ARIZ. REV. STAT. ANN. § 45-467(C)(2) (Supp. 1990); DWR Rule 12-15-1009.

42. At the end of 1989, DWR's calculations indicated that farmers' flexibility accounts showed credits of 3,112,075 af, including 1,861,267 af in the Phoenix AMA. Telephone interview with Steve Rossi, DWR Water Resource Specialist (Feb. 13, 1991).

43. Ferris, *supra* note 39, at 149.

44. Peacock's figures assume that all sectors completely achieve DWR's conservation goals. B. Peacock, Complying with Arizona's Groundwater Management Act: Implications for Agriculture (1990) (unfinished dissertation, Ph.D. Econ).

45. *Id.*

46. *Id.*

effective.[47] DWR's own analysis of the Second Management Plan suggests that Maricopa County will not achieve safe-yield by 2025. The figures project a Phoenix AMA overdraft in 2025 ranging between 358,000 af and 592,000 af per year.[48] Additional measures are necessary to achieve safe-yield.

I am not criticizing DWR for these results. After all, the agency must act within parameters set by the GMA. Draconian agricultural conservation requirements would drive agriculture out of business and conflict with the GMA provision that DWR allow for "prudent long-term management," a standard that obviously implies an agricultural industry in Arizona. For municipal conservation requirements, the Department must struggle with the reality that the GMA set absolutely no upper limit on the number of residents who may receive water from a municipality's water provider. The GMA's focus is on reducing per capita use, but population increases will probably offset any savings obtained from a reduction in per capita use. Finally, DWR hoped to implement another conservation program, the reuse of effluent, but a 1989 Arizona Supreme Court decision has temporarily derailed this option.[49]

B. Supply Augmentation

A second management tool available to DWR concerns augmentation of supply. The Act contains several provisions that would generate funds for acquiring additional water supplies.[50] The Act provides that the Department will collect an annual groundwater withdrawal fee from all persons withdrawing groundwater in an Active Management Area. However, the fee shall not exceed $5 per acre foot, $2 of which may go toward augmentation of the water supply of the AMA by importation, storage or artificial recharge.[51] The monies go into separate augmentation funds maintained by the state treasurer for each AMA.[52]

The dominant augmentation source presently anticipated, of course, is the Central Arizona Project (CAP). As the CAP comes on line, some now hope, as others have for generations, that Arizona's water problems will be solved. However, the CAP canal, due to the hydrologic capacity of the ditch, will never carry more than 2.2 maf per year. Arizona's entire allotment of Colorado River water is 2.8 maf (plus fifty percent of any surplus) and existing water users along the River have priority, thus reducing the CAP portion of

47. *See generally* Ferris, *supra* note 39, at 129; Kopp, *Assured Water Supply Rules: The Challenge, the Issues, the Process*, in ARIZONA'S WATER LAW: OVERVIEW AND CURRENT TOPICS 543 (State Bar of Arizona 1990).

48. Ariz. Dep't of Water Resources, *Second Management Plan Programs to Reduce Overdraft Significantly*, 2 WATER PLANNING NEWS 3 (Winter/Spring 1988); Dep't of Water Resources Planning Division Memorandum from Dennis W. Sundie to Larry Linser (January 16, 1990) (discussing draft outline of Basin Profiles for the state water assessment).

49. *See* Arizona Public Service v. Long, 160 Ariz. 429, 773 P.2d 988 (1988). Even before *Long*, the GMA permitted DWR only limited, if any, authority to *require* the reuse of effluent. The Second Management Plan does provide incentives for the voluntary reuse of effluent.

50. ARIZ. REV. STAT. ANN. §§ 45-611(2), -613, -615 (Supp. 1990).

51. *See id.* §§ 45-561(1), -611(2) (Supp. 1990).

52. *See id.* § 45-615(1).

Arizona's allotment to 1.5 maf.[53] Even assuming the CAP delivers this amount, DWR projections for state-wide water use in the year 2025 predict a deficit.

Yet, legal, political, economic, and environmental developments seem likely to result either in the CAP delivering even less water or in CAP water being used to settle Indian water claims. Many federally reserved Indian water rights are unresolved and unquantified.[54] Estimates of potential water rights for the Navajo Nation range from 2 maf to 15 maf.[55] The United States Secretary of the Interior has contracted with various Indian tribes to provide approximately 310,000 af of CAP water for tribal purposes.[56] This figure will likely increase as other Indian claims are settled. For tribes whose reservations are not located along the Colorado River, the reserved rights claims are to waters currently being used by non-Indians. The pattern of recent settlement agreements (for example, the Ak-Chin agreement) is for the tribe to relinquish its claim to surface water in exchange for a commitment of CAP water.[57]

Other factors may result in shortages for the CAP. First, the annual river flow may have been over-estimated. The Colorado River Compact directs the Upper Basin states to deliver on average 7.5 maf each year to the Lower Basin states. The assumption behind the Compact was that the Colorado River typically carried 15 maf. University of Arizona Tree Ring Laboratory studies, however, indicate that the average annual flow of the Colorado over several hundred years is 13.2 maf, a 1.8 maf shortfall.[58] Second, global warming may affect river flows. The apparent increase in the earth's temperature, possibly due to the greenhouse effect, may diminish runoff in the Rocky Mountains which, in turn, would further reduce the flow in the Colorado River.[59] Third, economic development by Indian tribes or in Upper Colorado River Basin states, including completion of the Central Utah Project, may result in the rightful diversion of additional Colorado River water that now flows downstream to be diverted by Lower Basin states. In this connection, private investment groups recently proposed that Upper Basin states sell or lease their currently-unexercised Colorado River water rights to southern California cities, an idea that has received some congressional support.[60] California and Arizona currently divert this water as surplus.

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53. *See* D. GETCHES, WATER ALLOCATION DURING DROUGHT IN ARIZONA AND SOUTHERN CALIFORNIA: LEGAL AND INSTITUTIONAL RESPONSES 64 (Natural Resources Law Center Research Report Series 1991).

54. *See* M. Wallace, Summary of Indian Claims in Arizona, Table 1 (1990) (unpublished manuscript).

55. *See* Getches, *Competing Demands for the Colorado River*, 56 U. COLO. L. REV. 413, 439 (1985); D. GETCHES, *supra* note 53, at 20 n.14; Bach & Taylor, *Navaho Water Rights: Pulling the Plug on the Colorado River?*, 20 NAT. RESOURCES J. 71, 74 (1980).

56. *See* Central Arizona Project, Arizona; Water Allocations and Water Service Contracting; Record of Decision, 48 Fed. Reg. 12,447 (1983).

57. *See* Wallace, *supra* note 54.

58. Stockton & Jacoby, *Long Term Surface Water Supply and Streamflow Trends in the Upper Colorado River Basin*, LAKE POWELL RESEARCH PROJECT BULLETIN No. 18 (March 1976).

59. *See* C. Stockton, D. Meko & W. Boggess, Drought History and Reconstructions from Tree Rings 13-14 (July 1989) (unpublished manuscript); J. Leshy, Global Warming and the Arizona Groundwater Management Act (Nov. 22, 1989) (unpublished manuscript).

60. *See* Miller, *Udall treated 'shabbily,' Colo. congressman says*, Ariz. Daily Star, Feb. 17, 1991, at B11, col. 1; Moulton, *Wyoming to L.A. Water Leasing Discussed*, Wyoming

Although the legality of such transfers remains uncertain, should San Diego, for example, obtain such rights, the water would come from CAP diversions in Arizona.[61]

Under the Colorado River Compact, these shortages do not reduce Lower Basin entitlements. They would come entirely from the Upper Basin's allotments.[62] But a future Congress may dictate that the Upper and Lower Basins share the shortfalls. Under current law, any reduction in water for the Lower Basin comes from Arizona's allotment. In a political compromise between the Arizona and California congressional delegations, Arizona accepted the lowest priority for Colorado River water from the CAP in exchange for California's congressional support for funding the project.[63] Arizona cannot improve this priority without California's support. Given California's population boom with attendant increases in its congressional delegation, its unquenched thirst for water, and the five-year drought now plaguing the state, the California congressional delegation almost surely will block any change in Arizona's priority that takes even one drop of water from California's allotment.

Perhaps none of this will come to pass. On the other hand, these forces may result in the CAP delivering far less than 1.5 maf annually to Arizona. The Bureau of Reclamation apparently projects some shortages. Its "firm water supply," which is the amount allocated for municipal and industrial uses, is 640,000 af.[64] Only water above this amount is available for agricultural use. The Bureau seems to anticipate that the canal may not carry more than 640,000 af.

Other augmentation programs have been mentioned. They include the construction of additional dams, the purchase or lease of Indian water rights, watershed management, recharge of surplus Colorado River water, and weather modification. Although these proposals have sparked some interest, they will not provide sufficient water, either individually or collectively, to achieve safe-yield.[65]

Star, July 21, 1990, at B1, col. 1. *See also* Babbitt, *Introduction: Down the Imperiled Colorado*, 25 WYO. LAND & WATER L. REV. 1 (1990).

61. *See* Getches, *Competing Demands for the Colorado River*, 56 U. COLO. L. REV. 413, 475 (1985); R. WAHL, MARKETS FOR FEDERAL WATER, esp. ch. 10, "The Prospects for Leasing Compact Rights on the Colorado River," at 271 (1989).

Other scenarios may impact the CAP. The Colorado River Compact mandates the Upper Basin to provide 75 maf every ten years at Lee's Ferry. In the hundreds of miles of rivers and lakes between Lee's Ferry and the Mexican border, substantial evaporation losses occur. From whose allotment will these losses come?

Recent development in Nevada along the Colorado River has relied on groundwater for supplies. Pumping of hydrologically-connected groundwater diminishes Colorado River surface flows.

62. *See* Colorado River Compact, 43 U.S.C. § 617(a) (1988). An exception to this principle is Indian rights which are charged against the state where the reservation is located. *See* D. GETCHES, *supra* note 53, at 19.

63. Colorado River Storage Project, 43 U.S.C. § 620 (1982); Colorado River Basin Project Act, 43 U.S.C. §§ 1501-56 (1988); M. REISNER, CADILLAC DESERT 305 (1986).

64. *See* Central Arizona Project, Arizona; Water Allocations and Water Service Contracting; Record of Decision, 48 Fed. Reg. 12,447 (1983).

65. *See, e.g.*, ADWR Agenda and News Release, The Role of Weather Modification in Arizona's Augmentation Program (Feb. 19, 1988); M. Wallace, Sources of Supply for

DWR ought to continue to put its best efforts into both the conservation program and augmentation ideas. Nevertheless, these two methods cannot bring the state into safe-yield. They will fall woefully short. Only an additional program of retiring current uses offers the possibility of achieving safe-yield.

IV. "BECAUSE THAT'S WHERE THE WATER IS"

In an apocryphal anecdote, the infamous bank robber Willie Sutton was asked why he robbed banks. He responded, "Because that's where the money is." In Arizona water management, the focus must be on agricultural water use "because that's where the water is." Agricultural irrigation annually consumes eighty-five percent of the state's water. In 1985, the most recent year for which data is available, agriculture consumed 6,120,000 af of Arizona's total water consumption of 7,200,000 af.[66] If we are serious about achieving safe-yield, we must find ways to reduce the amount of water used for irrigation. If done equitably, the agricultural community may support a program to purchase and retire agricultural water rights. Many farmers and irrigation districts apparently are eager to sell their land and/or water rights to cities and developers.[67]

Cities, developers and mining interests, on the other hand, may oppose this plan. One of the most famous lines in Arizona water lore, from the period that led to passage of the GMA, is attributed to Tucson attorney Tom Chandler (but borrowed without attribution by most everyone): "We do not want the farmers retiring to La Jolla and raising martinis." The line reflects the opposition of the cities and the mines to the idea of purchasing and retiring agricultural water rights. The cities and mines blamed Arizona's water woes on what they considered agriculture's profligate water use. They did not want the GMA to reward the farmers. However, from the long-term, public-policy perspective of achieving an equilibrium between groundwater pumping and recharge, it is sound policy to provide farmers with exactly that option. DWR policy from now until 2025 ought to encourage the purchase and retirement of agricultural water rights.

V. THE CHANGING ROLE OF AGRICULTURE IN ARIZONA'S ECONOMY

Would reducing irrigation profoundly alter Arizona's economy? It is sometimes said that Arizona's economy depends on the "four C's": cotton, copper, climate, and cattle. The substantial role of cotton, and of irrigated agriculture generally, in Arizona's economy is relatively recent. In 1889, only 65,000 acres were irrigated by a combination of surface and groundwater

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Arizona's Indian Tribes (1990) (unpublished manuscript); Central Arizona Project Association, *Reclamation Reform Act Subverts CAP*, 21 WATERGRAM 1, 2 (1989).

66. VALLEY NATIONAL BANK OF ARIZONA, *supra* note 40, at 48.

67. *See* Ferris, *supra* note 39, at 147; Woodard & Checchio, *supra* note 4, at 727. Former Arizona Governor Bruce Babbitt seems to support the idea that agriculture must yield some of its water for the growing cities and urban areas and for the protection of wilderness and wildlife. *See* M. REISER & S. BATES, *supra* note 3, at xi-xii (foreword by Bruce Babbitt).

supplies.[68] Irrigation mushroomed with the development of turbine pumps that permitted pumping large quantities of groundwater from lower water tables. Irrigation demand for water in Arizona rose from approximately 1.5 maf in 1940 to 4.8 maf in 1953.[69]

A 1960 comparison of the major sources of Arizona income, including tourism, agriculture, mining and manufacturing, shows that agriculture produced $439,570,000 of a total state income of $1,955,082,000, or almost twenty-five percent. In 1970, the value of the output from crops and livestock was second only to manufacturing in Arizona's economy.[70] Cotton emerged as the major crop in Arizona, thanks to the climate and the development of particular varieties of cotton, especially pima cotton. By 1988, however, the relative role of agriculture had declined dramatically.[71]

Changes in Arizona's economy and demographics account for this shift. The population nearly tripled from 1,302,161 in 1960, to 3,548,400 in 1988.[72] In 1987, agricultural and forestry jobs only provided employment for approximately one percent of Arizona's workers and wages of approximately 0.3 percent of the total state personal income.[73] Net farm income was approximately one percent of the total personal income for the state.[74] In 1988, the value of Arizona's agricultural exports was approximately 2.5 percent of the state's total exports. These figures make it difficult to justify agribusiness, which contributes such a small percentage to Arizona's economy, consuming such a disproportionately large percentage of the state's groundwater.[75] One might defend this allocation if farmers used the water to grow food for the rest of society. But, the overwhelming majority of Arizona's irrigated acreage is planted with cotton and hay.[76] Moreover, most Arizona crops grow quite nicely in other states, where it is not necessary to irrigate, raising further doubts about the wisdom of using so much water for irrigation.[77]

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68. D. MANN, THE POLITICS OF WATER IN ARIZONA 44 (1963).
69. *Id.* at 44.
70. Hillman, *Farming and Ranching*, in ARIZONA: ITS PEOPLE AND RESOURCES 257 (1972).
71. VALLEY NATIONAL BANK OF ARIZONA, *supra* note 40, at 1.
72. *Id.* at 7-8.
73. *Id.* at 3, 31.
74. *Id.* at 3; ARIZONA AGRICULTURAL STATISTICS SERVICE, 1988 ARIZONA AGRICULTURAL STATISTICS 4 (July 1989).
75. At the same time, one should appreciate the relative value of crops grown and of agricultural land in Arizona compared to other sections of the country. Most government statistics indicate that Arizona's agricultural land produces a greater quantity per acre than the national average. Some crops are relatively valuable, including citrus, fruits, and vegetables. Nationally, between 1971 and 1973, irrigated acreage amounted to only twelve percent of the national croplands, yet produced nearly twenty-seven percent of the total value of all agricultural production. *See* Irrigation Water Use and Management (An Interagency Task Force Report), U.S. Dept. of Interior, U.S. Dept. of Agric., Environmental Protection Agency 14 (June, 1979). In addition, the economic and social value of agriculture is not confined to the salaries paid to employees or the money generated by the sales of crops. Farms require fertilizer, equipment, seed, pesticides, and so on. Farmers patronize local restaurants, gas stations, markets and other such services that contribute to the value of Arizona's agricultural production.
76. *See* 1988 ARIZONA AGRICULTURAL STATISTICS, *supra* note 74, at 8.
77. In 1987, cash receipts (including net CCC loans) for the Arizona cotton crop were approximately $339 million. Cash receipts for the 1987 Mississippi cotton crop were approximately $532 million. OFFICE OF PUBLIC AFFAIRS, U.S. DEP'T. AGRIC., FACT BOOK OF U.S.

One might speculate that irrigation will decrease through pressures currently in place.[78] Several factors may produce this result: (1) the GMA provisions discourage irrigation; (2) a declining water table increases farmers' energy costs; and (3) the path of urban development converts land from agricultural to residential and industrial uses. As of 1988, there were 8,100 farms and ranches in Arizona (down from 8,300 in 1984).[79] DWR data, and research by Susanna Eden and Mary Wallace of the University of Arizona Water Resources Research Center, suggest that some reduction in irrigation water use has occurred and probably will continue.

What is the causal explanation for this decline? DWR's newsletter suggests that the decrease in agricultural water use is due primarily to reduced federal farm subsidies, lower crop prices, and higher irrigation efficiencies.[80] Yet various federal government payment programs still encourage farming in Arizona. In 1987, Arizona farmers received over $97,000,000 in government payments, including $78,973,000 for cotton.[81] One might think that there is a decline in the amount of irrigated acreage in Arizona but some statistics refute this conclusion. Between 1984 and 1988, the number of planted and harvested acres of American pima cotton rose from 50,000 acres to 128,000 acres. In Maricopa County, the number went from 13,900 to 33,400. In Pima County, the number grew from approximately 1,200 to 5,300.[82] Between 1984 and 1988, the number of acres planted with *all* varieties of cotton remained stable.[83] In 1988, almost one million acres were under irrigation in Arizona, including over 300,000 acres in Maricopa County and 17,000 in Pima County.[84] Of the one million acres, almost half were devoted to cotton.[85] These figures suggest a continuing and substantial role of irrigation in Arizona.

Decisions to irrigate appear largely due to factors that have nothing to do with DWR or the GMA. World market prices for crops, federal farm support programs, and the cost of input factors such as capital, fertilizers, pesticides, and farm labor have more influence on farmers' decisions than do questions of water law. A water lawyer once asked his irrigator client how he decided which crop to plant. The farmer thought for a moment and then, with a twinkle in his eye, responded, "First, I look up at the snowpack in the

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AGRICULTURE 126 (Aug. 1989). In Arizona, very little cropland is not irrigated. By contrast, only five percent to twenty-four percent of the cropland in Mississippi is irrigated. U.S. Water News, Aug., 1990, at 1 (table). *See also* Evans, *Central Valley Project Water Guzzlers Under Fire*, 14 HEADWATERS 11 (Jul.-Aug. 1990).

78. Barbara Markham, chief counsel for DWR, found that in 1985 in the Phoenix AMA, 58.9 percent of the water was used by non-Indian agriculture while eight percent was used by Indian agriculture, for a total of sixty-six percent. Markham, *The Second Management Plans*, in ARIZONA'S WATER LAW: OVERVIEW AND CURRENT TOPICS 151 (State Bar of Arizona 1990). DWR expects this figure to be reduced to thirty-five percent by 2025. The Second Management Plan has data concerning the natural rate of retirement of lands in the Phoenix AMA.

79. 1988 ARIZONA AGRICULTURAL STATISTICS, *supra* note 74, at 2.

80. Arizona Dep't of Water Resources, *supra* note 48, at 2.

81. 1988 ARIZONA AGRICULTURAL STATISTICS, *supra* note 74, at 7.

82. *Id.* at 14-15.

83. *Id.* at 16-17. However, in Maricopa County, the number of acres declined from approximately 200,000 to 180,000 and in Pima County from over 16,000 to just under 15,000. *See id.*

84. VALLEY NATIONAL BANK OF ARIZONA, *supra* note 40, at 43.

85. *Id.* at 45.

mountains. Then, I look to see the flow level in the river. Finally, I find out what crops the federal government is subsidizing." Much recent commentary criticizes the federal crop support programs,[86] but passage of the 1990 Farm Bill indicates that the agricultural lobby possesses considerable political power. Major reductions in subsidy levels are not imminent.

Arizona water law also encourages growing crops that require intensive irrigation, in part because the resource itself is free. Traditional surface water doctrine of prior appropriation permits farmers to divert limitless quantities of water so long as they apply the water to a beneficial use. Traditional groundwater law also allows one to pump whatever quantity one wishes so long as it is put to a reasonable use. The pumper must bear only the costs of the pumping. Under the GMA, the reasonable use doctrine continues to apply to all areas of the state outside AMAs.[87] Even within AMAs, as noted above, the Act extended grandfathered protection to existing irrigation uses. Existing water law thus facilitates using water for irrigation.

Another incentive to agriculture in Arizona is the availability of below market value surface water and electric energy from Bureau of Reclamation projects. Arizona farmers derive huge benefits from the federal government, through the Bureau of Reclamation, because fifty-three percent of irrigated acreage in Arizona is served by Bureau projects.[88] Legislation in Congress would halt providing subsidized Bureau water to wealthy farmers.[89] Ongoing debate about the Bureau's future direction has revolved around several issues: whether reclamation law unnecessarily impedes the voluntary transfer of water rights; whether lessors of Bureau water may sell these rights and make a profit; and whether the Bureau has a role in encouraging water transfers.[90]

The combination of free groundwater, subsidized surface water, and farm support programs makes it economically viable to grow some crops in Arizona. For the foreseeable future, these market forces and government policies are unlikely to produce a substantial reduction in irrigation in Arizona.

The role of agriculture in Arizona's economy has changed profoundly. Once a major ingredient in the state's economy, agriculture has declined as manufacturing, tourism and other urban economic enterprises have developed. But agricultural water use has not changed dramatically in absolute terms. Reliance on current market forces and federal government policies to reduce agricultural irrigation would place Arizona's water future in the hands of Bureau of Reclamation water and electric power prices, Department of

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86. *See, e.g.*, J. BOVARD, THE FARM FIASCO (1989); Goodgame, *Getting Farmers off the Dole*, TIME, July 16, 1990, at 26; O'Rourke, *Manuregate*, ROLLING STONE, July 12-16, 1990, at 45; M. REISNER & S. BATES, *supra* note 3, at 125; Reisner, *The Big Thirst*, N.Y. Times, Oct. 28, 1990 (Magazine), at 36.

87. In three areas of the State — Douglas, Joseph City, and Harquahala Irrigation Non-Expansion Areas — only land with a recent history of cultivation may be irrigated. *See* ARIZ. REV. STAT. ANN. §§ 45-431, -439 (1987 & Supp. 1990).

88. M. REISNER & S. BATES, *supra* note 3, at 25 (general data on BR).

89. *House OKs bill to 'stop raid' on subsidized water in West*, Ariz. Daily Star, June 17, 1990, at A6, col. 1.

90. WESTERN GOVERNORS' ASSOCIATION WATER EFFICIENCY WORKING GROUP, WATER EFFICIENCY: OPPORTUNITIES FOR ACTION (1987) (report to the Western Governors' Association). *See also Interior's Policy of Voluntary Water Transactions: The Two-Year Record*, 4 WATER STRATEGIST 1 (Jan. 1991).

Agriculture commodities support programs, and the vagaries of market prices for crops. The State of Arizona cannot afford to have so little control.

VI. METHODS FOR PURCHASING AND RETIRING AGRICULTURAL WATER RIGHTS

Arizona clearly will face a water crisis. Augmentation programs and reasonable conservation methods will not, by themselves, eliminate groundwater mining. As ambitious and as creative as the GMA is, it may contain the seeds of its own destruction. By protecting essentially all existing groundwater users and by potentially allowing for limitless growth, the Act may frustrate its safe-yield objective.[91] Quite simply, without a reduction in agricultural water use, Arizona will not achieve safe-yield. The question becomes how to administer the Act to reduce irrigation.

In response to this challenge, I offer some tentative ideas for reducing irrigation use. As Arizona's population increases, new people and businesses place additional demands on the state's water resources. To offset these pressures, new development should be required to purchase and retire existing water rights. By conditioning new water uses on achieving a net reduction in water consumption, Arizona can move toward safe-yield.

A controversial provision under the GMA is the assured water supply requirement.[92] A developer, of a residential community, industrial park, or whatever, must obtain a Certificate of Assured Water Supply (CAWS or certificate) from the Department of Water Resources, or obtain service from a water provider with a "designated" or "deemed" supply, in order to have the subdivision plat approved. The service areas of cities and towns will be deemed to have an Assured Water Supply (AWS) so long as the municipality has entered into a contract to acquire CAP water. This provision will protect the municipality through the year 2000. However, beginning in 2001, a municipality's AWS is open to review by DWR. No longer will it be designated or deemed.[93] Perhaps no one in Arizona is happy with the AWS provisions, least of all the administrators and lawyers at DWR who have been sharply criticized for draft rules proposed in November 1988, but subsequently withdrawn.[94]

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91. Opponents of growth may object that this article facilitates and encourages urban development. However, the GMA anticipated, protected, and provided for population increases. If local communities wish to resist development, local planning and zoning institutions will respond to community pressures. It would be folly, however, to permit development to proceed without assuring an adequate water supply.

Similarly, some California environmentalists would rather have farmers use the water than to save it for yet another housing development. Irrigated pasture at least is open space. *See* Reisner, *supra* note 86, at 60. However, this position assumes that, if farmers use the water, development will not occur. This linkage is a terribly important, but unproven supposition on which to allow a scarce resource to be consumed.

92. ARIZ. REV. STAT. ANN. § 45-576 (1987 & Supp. 1990).

93. *Id.* § 45-576(I). Cities with a "deemed" AWS will remain "deemed" until DWR completes its review and takes action, a process that could take two or more years for some cities.

94. *See* DWR Assured and Adequate Water Supplies, Draft Rules R12-15-701, Nov. 4, 1988, *reprinted in* Oppenfeld, *Adequate and Assured Water Supplies*, in ARIZONA'S WATER LAW: OVERVIEW AND CURRENT TOPICS 399, 523 (State Bar of Arizona 1990).

Provisions in the Act requiring an AWS to be consistent with the management goal and calling for an expiration of "deemed" status in 2001 create an impetus for cities to purchase "water farms" in western Arizona. By purchasing groundwater rights outside of an AMA, the cities have calculated that this water may be used to demonstrate an AWS after the year 2000, when the cities will no longer be deemed to have an AWS. Thus, a city's decision to acquire a water farm is not premised in any way on the amount of water in the aquifer beneath the city. Contingency planning to satisfy an administrative obstacle prompts these decisions.

The draft AWS rules outraged developers who successfully persuaded DWR to withdraw them and to establish a committee to evaluate the economic impacts of the rules. One provision in the draft rules drew special fire from developers. It precisely limited how much groundwater, measured in terms of acre-foot per acre to be developed, could be used to demonstrate an AWS.[95] Developers charged that the rules effectively operated as down-zoning regulations that are properly the affair of the local planning and zoning agency, not DWR.[96]

It is worth noting the exact character of a certificate of assured water supply obtained by a developer. This certificate allows development to proceed independently from grandfathered rights or service area rights for cities and towns. Certificates are not technically water rights but, once obtained, they effectively permit a developer to drill new groundwater wells within AMAs.[97] The proposed rules limited the amount of water for this type of right to 1/4 or 1/2 acre foot per acre (af/a) effectively limiting the number of residences per acre that may be built. Developers were indignant when they realized that DWR had restricted the water right on land zoned for, say, six residences per acre to two residences per acre.

DWR responded by arguing that AWS rules only restricted the amount of groundwater that a development might use. They did not limit the amount of alternative sources of water. Other options include purchasing CAP water, utilizing water farms outside the AMA, obtaining a water service agreement with a city with a CAP allocation, obtaining a water service agreement with a city that has surface water rights from irrigation districts, and obtaining rights to the use of effluent.[98] For many developments outside a municipality's service area, however, these augmentation options are impractical because the

95. *Id.* at 521.

96. Oppenfeld, *supra* note 94, at 399.

97. CAWS normally involve land outside service areas of municipalities. However, they are also required for developments in the service areas of providers who are not designated or deemed to have an AWS. *See* ARIZ. REV. STAT. ANN. § 45-576 (1987 & Supp. 1990). In a desert development outside the service area boundaries of a city, town, or private water company, obtaining a CAWS allows for creation of a new service area provider. The process of creating a new service area begins by the developer either retiring an Irrigation Grandfathered Right thus converting it to a Type 1 right or by purchasing a Type 2 right. *See infra* note 100. These water rights serve as service area rights so long as the quantity of the right is adequate to supply the service area for one year. Having created a service area right, the CAWS permits the development to expand to provide water for all users. AWS rights are not limited in quantity to the amount specified in the application for an AWS. Once DWR grants a CAWS, the GMA provides no mechanism for revocation.

98. Oppenfeld, *supra* note 94, at 465.

development is not large enough to warrant construction of a transport system.[99]

The draft rules restricted the amount of groundwater that could be applied even on previously irrigated land. Developers truly became enraged when the project being proposed involved retiring agricultural land. Under the GMA, this would normally involve converting an Irrigation Grandfathered Right into a Type 1 right.[100] The maximum amount of water that could be conveyed or converted is three af/a. The draft rules restricted the amount of groundwater that a developer could apply even when the source of that water was an IGR that the developer purchased. Although DWR offered a slight incentive to develop irrigated lands,[101] the incentive was woefully inadequate to shape significantly which particular parcels are in fact developed. As the old real estate adage goes, the three most important things about developing a piece of real estate are: location, location, and location.

The AWS rules even managed to offend the agricultural community. Because developers were able to apply only a portion of the IGR rights, farmers recognized that these rights became less valuable. When farmers sell the entire IGR, if the purchaser may use only 1/4 or 1/2 af/a, the right itself is significantly reduced in value.[102]

If the GMA had made no mention of this newfangled notion called an Assured Water Supply, the lives of DWR administrators and lawyers would have been far happier. Nevertheless, AWS is part of the GMA framework and the rules deserve a fresh look. Thus far, they arguably conflict with achieving safe-yield by authorizing new development that will rely on groundwater and further deplete the state's groundwater supply. The AWS rules ought to encourage reducing or retiring current uses in exchange for permission to drill new groundwater wells.[103] This approach would allow development to occur and move Arizona toward safe-yield.

The GMA permits exactly this option. Section 45-576(L) defines AWS as having three components: that sufficient groundwater will be available to satisfy the proposed uses' water needs for 100 years; that the use is "consistent

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99. *Id.* at 466.

100. The Act generally allows a farmer with an irrigation grandfathered right to retire the land from irrigation and convert the water right into a Type 1 non-irrigation grandfathered right. The water may no longer be used to irrigate and must be used on the appurtenant land. *See* ARIZ. REV. STAT. ANN. §§ 45-463, -469, -470 (1987). The Act recognizes one other type of grandfathered rights — Type 2 non-irrigation grandfathered rights — typically held by mines and utilities. *See* ARIZ. REV. STAT. ANN. §§ 45-464, -471 (1987 & Supp. 1990).

101. *See* DWR Draft Rule R12-15-706B, *reprinted in* Oppenfeld, *supra* note 94, at 533-34.

102. Oppenfeld, *supra* note 94, at 491, suggests that this may be a taking of property.

103. The Clean Air Act contains a similar sort of incentive. The Act establishes quality standards for certain pollutants and monitors regions to assure that the national standards are met. 42 U.S.C. §§ 7407, 7409 (1988). Each state must develop implementation plans designed to bring the area into attainment. 42 U.S.C. § 7410 (1988). In non-attainment areas, no new source of a pollutant may be constructed until the standard is attained. 40 C.F.R. § 51.18 (1973). Because this injunction would halt economic growth, the Environmental Protection Agency developed and Congress ratified an "offset program." 41 Fed. Reg. 55524 (1976); 42 U.S.C. §§ 7502(b)(6), 7503 (1988). This program allows construction of a new emitting facility if an existing pollution source decreases its emissions so that a positive net benefit on air quality occurs. *See* Citizens Against Refinery's Effects v. EPA, 643 F.2d 183 (4th Cir. 1981).

with the management plan and achievement of the management goal for the active management area"; and that the developer has the financial capability to construct the delivery system and any necessary treatment plant. For present purposes, we need to focus on the second part: Is the proposed use consistent with the management plan and achievement of the management goal? In other words, is the proposed use consistent with safe-yield for the Phoenix, Tucson, and Prescott AMAs? Since safe-yield involves moving toward an equilibrium, DWR could reasonably insist that each proposed use be consistent with achieving safe-yield.

DWR has gingerly recognized this policy option in two ways. First, the draft rules created a slight incentive to develop irrigated land. Second, DWR recognized that its decision to grant a certificate ought to be affected if the developer retires IGRs. The same policy objective might be achieved, however, if development occurs on land other than the acres to which IGR are appurtenant. In the Sun Lakes CAWS application, the City of Chandler opposed granting the certificate because the development would withdraw more groundwater than would be recharged to the aquifer and was therefore inconsistent with the management goal of safe-yield for the Phoenix AMA.[104] The City attempted to define safe-yield on a project-by-project basis. The Director of DWR rejected this argument, reasoning that "since the safe-yield goal applies to the Phoenix AMA, not to individual developments, achievement of the goal will not be measured on a development-by-development basis."[105] In addition, the Director concluded that the Legislature did not intend to prohibit, forty years prior to the date for achieving safe-yield, all new residential developments that place an additional demand on groundwater.[106] Yet, at the same time, the Director analyzed how the Sun Lakes development, by retiring agricultural land, would result in a reduction in the consumptive use of water on that land.[107] DWR thus analyzed a CAWS application by considering the extent to which the development would reduce the consumption of water by other users overlying the aquifer.

Rolf von Oppenfeld, a prominent Phoenix water and environmental lawyer, has argued that the Department's AWS rules ought only require consistency with the management *plan* and, by virtue of that consistency, assume that the project moves toward achieving the management goal.[108] However, the Act's definition of an assured water supply provides that the water use must be "consistent with the management plan *and* achievement of the management goal for the active management area."[109] This language is conjunctive, not alternative, and its plain meaning is that the use must be consistent with both. The distinction is critical because, as stated by DWR attorney Howard Kopp, "[t]he management plans alone will not get us to safe-yield."[110] Kathleen Ferris also recently observed, "[i]t is clearly not consistent with safe yield to allow

104. In the Matter of the Application of Sun Lakes Marketing for a Certificate of Assured Water Supply, No. CAWS-86-002 Ariz. Dep't Water Resources (1986), *reprinted in* ARIZONA'S WATER LAW: OVERVIEW AND CURRENT TOPICS, *supra* note 94, at 508.

105. *Id.* at 510.

106. *Id.*

107. *Id.* at 509.

108. *See generally* Oppenfeld, *supra* note 94.

109. ARIZ. REV. STAT. ANN. § 45-576(L)(2) (1987 & Supp. 1990) (emphasis added).

new developments to mine groundwater indefinitely."[111] Section 45-576 requires DWR to consider whether a proposed use is consistent with the achievement of safe-yield. Although it would be inequitable totally to prohibit developments in 1990 based on the idea that safe-yield ought to be achieved by 2025, it is permissible, perhaps necessary, to consider the extent to which new development will further mine groundwater in that aquifer.

I suggest that new AWS rules should be written with several principles in mind. First, no certificate based on groundwater ought to be approved unless the developer retires a currently existing groundwater use or augments the groundwater supply sufficiently to obtain a net reduction in the overdraft of the relevant aquifer. Options for developers are varied but the most likely candidates are to retire grandfathered rights, especially IGRs, or to obtain surface water rights, including entering into CAP contracts. Second, the quantity of the water use retired ought to exceed the anticipated consumption of the proposed use. One might argue that developers ought to receive a drop-for-drop credit. Since DWR, in making AWS determinations, currently does not consider whether other rights have been retired, if new AWS rules require *some* retirement of current use, the developer ought to receive 100 percent credit. The problem with this approach is that it merely substitutes municipal for irrigation use and safe-yield will never be achieved. Given the limited impact of augmentation and conservation under the Management Plans, new development must more than substitute for an existing water use. Otherwise there is no net reduction in groundwater pumping.

Third, the preference should be for retiring rights within the same AMA. Rural Arizona rightly objects that the cities and developers in the urban areas are unnecessarily trammeling their economic and political autonomy by obtaining rural water farms to secure paper water rights for CAWS purposes. Even though the safe-yield goal is an AMA objective, it makes little policy sense to erect legal rules that envision enormous water transfers from the western part of the state to the urban areas, when more reasonable, focused and limited measures are available closer to home. Quite simply, the cities and urban developers must take steps to get their own houses in order.

The new rules could provide a sliding scale of credits. For example, to obtain an AWS by purchasing and retiring agricultural land with IGRs:

(1) If the land is in the same AMA and in the same basin, the credit will be 2.5 acre feet per acre (af/a).

(2) If the land is in the same AMA, but in a different basin, the credit will be 1.75 af/a.

(3) If the land is outside the AMA, the credit will be 1 af/a.

A sliding scale would encourage retiring land in the AMA where the development will occur. The details need to be carefully considered. Otherwise new AWS rules may simply encourage purchasing larger parcels of relatively cheap rural land rather than somewhat smaller parcels of more expensive acreage within an AMA.

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110. Kopp, *supra* note 47, at 564.
111. Ferris, *supra* note 39, at 141.

A spin-off possibility would credit developers who pay for conservation measures for agriculture or other third parties. If it could be determined how much water is saved, for example, by lining a ditch, allow the development community to finance the improvements in irrigation efficiency in exchange for AWS credit.[112]

The number of acres of agricultural land that must be retired to achieve safe-yield depends on the data used to project water use in the year 2025. Bruce Peacock suggests that in the Phoenix AMA if all non-Indian agriculture was retired and converted to Type 1 rights at three af/a, there still would not be sufficient water saved to achieve safe-yield.[113] The conversion must be reduced to 2.64 af/a to achieve the safe-yield goal.[114] In the Tucson AMA, there may not be sufficient irrigated acreage available for retirement to meet safe-yield. DWR has certified 53,300 acres with IGRs in the Tucson AMA.[115] If those rights represent typical acreage that consumes about three af/a when cultivated and irrigated, then a reduction in overdraft of approximately 160,000 af/year is the maximum water savings available by retirement of IGRs even if no new use is initiated. This argues strongly for permitting developers who retire agricultural rights to use only a percentage of those rights.[116]

The AWS-IGR retirement linkage has additional advantages. It would negate the claim that DWR has become a super-zoning agency. It also avoids the anomalous situation of prohibiting a developer who purchased an IGR from using those rights on that same land. It requires newcomers, not established residents, to bear the increased costs. Most importantly, however, the new system will help move toward safe-yield. Re-casting the AWS rules in this fashion fosters opportunities for water marketing, which in turn should increase water use efficiency. Using the market to retire IGRs is preferable to government bureaucracy condemning tracts of private land, which is likely to

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112. *See In re* Alleged Waste and Unreasonable Use of Water by Imperial Irrigation District, Water Rights Decision No. 1600, Calif. Water Resources Control Board (June 21, 1984).

The location of a retired use may be important for the impact on safe-yield. There are six sub-basins in the Phoenix AMA. Depending on where agricultural land is retired, the impact on overdraft may vary enormously. Indeed, Bruce Peacock suggests that one section of the western part of the Phoenix AMA is waterlogged. If water is conserved in this section, more water would flow out of the AMA and, perversely, increase the overdraft. *See* B. Peacock, *supra* note 44.

113. *Id.*

114. *Id.* This calculation assumes that all farm land in the Phoenix AMA is retired. This paper does not advocate that result as desirable. Quite clearly, agricultural communities deserve protection, not only for the importance of their role in Arizona's history, but also for the life style and values they offer as an alternative to those of urban culture.

115. DWR, Draft Tucson AMA Second Management Plan at 21 (April 1988); Ariz. Dep't Water Resources, *supra* note 48, at 2. Tucson faces a problem because the largest percentage of irrigated acreage, in Marana, is not hydrologically connected to the rest of the basin because of bedrock that extends from the Tucson Mountains to the Tortolita Mountains. The Farmers Investment Co. lands near Green Valley, on the other hand, are hydrologically connected.

116. One institution available for implementing these ideas in the Tucson AMA is the Augmentation Agency that recent legislation permits. *See* ARIZ. REV. STAT. ANN. § 45-1902 (Supp. 1990).

occur under the GMA after the year 2006.[117] My proposal is incentive driven and maximizes free-market choices, in contrast to a regulatory system.

From the development community's perspective, this proposal involves some increased costs. These costs may be lower than expected if the proposal creates a market for water rights that, according to the laws of supply and demand, ought to reduce the effective cost of available supplies. Also, this proposal may appear preferable to purchasing Type 1 rights for use off tract because it would eliminate the transportation costs associated with moving Type 1 water. Finally, clearly drafted rules would provide predictability thus far lacking in AWS rules.

The proposal places the costs on developers, a community that has both cost-bearing and cost-spreading ability.[118] Michael McNulty, former DWR head of the Tucson AMA and a prominent water attorney whose clients include developers, recently stated: "New growth should pay its own way, and new growth is willing to pay its own way."[119] How much can the development community equitably pay to retire agricultural rights? A recent Texas A&M University survey found that in 1990, the median price per acre for average-quality irrigated cropland in Arizona was $2,000.[120] Since the sale of irrigation land would carry with it IGR rights of up to 3 af/a, and since a developer needs approximately 1 af/a for two residences per acre, allowing a developer to use 2.5 af would provide enough water for five residences. This

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117. *See* Ackerman & Stewart, *Reforming Environmental Law*, 37 STAN. L. REV. 1333 (1985). *See* ARIZ. REV. STAT. ANN. § 45-566(A)(8) (Supp. 1990).

118. *Cf.* G. CALABRESI, THE COSTS OF ACCIDENTS 39-67 (1970).

119. M. McNulty, If A Super Agency Is The Answer, What Is The Question 2 (1990) (unpublished essay).

120. Beard, *Arizona farmland prices fall faster, but still top 3 states*, Ariz. Daily Star, Apr. 15, 1991, at D7, col. 1. Figures vary considerably. Another recent study of farmland value in seven areas of the State concluded that the market value of farmland ranged from $1,500 to $5,750 per acre. Factors especially influencing the value are urban influence and the cost of irrigation water. *See* R. Dietrich, MAI, Burke Hansen, Inc., Appraisal Report (1990) (unpublished report). Some rural parcels with groundwater rights have sold recently for between $700 and $2,100 per acre. *See* E. CHECCHIO, WATER FARMING: THE PROMISE AND PROBLEMS OF WATER TRANSFERS IN ARIZONA 9 (Arizona Water Resources Research Center, Jan. 1988); G. WOODARD, E. CHECCHIO, G. THACKER & B. COLBY, THE WATER TRANSFER PROCESS IN ARIZONA: ANALYSIS OF IMPACTS AND LEGISLATIVE OPTIONS 39 (University of Arizona College of Business and Public Administration, Division of Economic and Business Research, Apr. 1988).

For several reasons, it is particularly hazardous to predict how much agricultural land will be available for sale and at what price. In one direction, the savings and loan crisis, particularly the Charles Keating indictment, illustrates that Lincoln Savings and American Continental allegedly purchased Arizona water farms at inflated prices. These transactions have artificially raised agricultural land sales prices. In the other direction, the S & L collapse has caused Arizona land prices to plummet. It is thus difficult to obtain reliable figures on current agricultural land values.

Beyond price lies the question of quantity. University of Arizona economics professor Dennis Cory has observed that markets for agricultural land tend to be "thin," with a small number of transactions. In economic terms, this point suggests that the supply curve for agricultural land is relatively inelastic. A trivial number of transactions may significantly increase the price of agricultural land. As a consequence, insisting that developers retire agricultural land may create windfall profits for a few farmers. To offset this scenario — of farmers holding developers hostage — an alternative could allow developers to pay into a fund an amount equivalent to the market price of purchasing and retiring agricultural land. This possibility was proposed by

translates into $1,200 per residence for the cost of purchasing and retiring IGRs. Is this price too high? The City of Mesa currently charges a water and sewer development fee of $1,845 for each new residence; Phoenix charges between $600 and $900; and Scottsdale charges $2,605.[121] Moreover, obtaining a CAWS may greatly increase the value of the land, making it even more reasonable to expect developers to retire other existing water uses.

A potential difficulty with this approach is that the GMA restricts IGRs to use on the overlying land by virtue of the GMA requirement that the rights are appurtenant to the land. Does allowing the use off-tract violate the GMA? No, because two different approaches to obtaining groundwater rights are involved. That is, a developer purchases and retires IGRs and, as a consequence, DWR issues a certificate, which enables the developer to hook up to a city's system or to drill new groundwater wells.

This proposal is not limited to certificates sought by private developers. On the contrary, beginning in the year 2001 when municipalities are no longer deemed to have an AWS, DWR will be reviewing their water use. Over the long haul, the major issue is finding water for developments within cities. In the 1980's, developers outside cities focused attention on the AWS rules. Relatively speaking, these developments use a tiny fraction of the state's water. The leverage will come after 2001 if DWR no longer "deems" a city to have an AWS. Every individual developer will then need his or her own sources of water in order to obtain a CAWS.

Properly structured, AWS rules ought to credit municipalities for water rights that they retire within the AMA. DWR apparently is reluctant to credit either municipalities or developers with retiring land within the AMA because DWR anticipates that the land will ultimately be developed anyway and it fears double dipping: the water rights retired serve as the basis for new water use elsewhere and then a later project on the original parcel needs water for its purposes. It is important to consider what will happen ultimately to land that has been retired from agricultural use. First, provisions must protect against retired land creating problems of noxious weeds and other difficulties to the surrounding areas. Second, if that same land is developed later, the long-term fear of double dipping can be corralled either by an up-front set of rules that sharply reduces the quantity of water that a new development may use below that historically consumed or that places a penalty on the subsequent development of earlier retired lands.

An issue might be raised as to the scope of DWR's rule making authority for AWS. The Department seems to have concluded that its power is broad and flexible. In its Response to the Auditor General's Performance Audit, the Department disagreed with the conclusion that AWS provisions be re-examined by the Legislature.

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former Governor Bruce Babbit in commenting on an earlier draft of this article at a conference on the GMA in September 1990.

121. As of August, 1990, the City of Phoenix Water Department charged an additional $775.00 for a water hook-up. The City of Scottsdale Water Department charges $670.00 for the same service. These fees are for standard residential hook-ups, including a new meter and 5/8" pipe.

> A change in the policy by the Department in how it implements this provision is all that is needed. One interpretation of the statutory language is that all new assured supplies must be consistent with achievement of the management goal, and therefore no volume of mined groundwater component may be included. In other words, the Department could solve this problem administratively by adopting much more restrictive policies and rules for use of groundwater in the demonstration of an assured water supply. The Department is currently in the process of formulating rules to address this issue.[122]

Some authority suggests that the Department has power broadly and comprehensively to frame AWS rules, but there may be reasons to address this proposal through other avenues.[123]

Another management tool for retiring agricultural rights will be available in the future. As of 2006, the Act permits DWR to set up a program for purchasing and retiring agricultural rights.[124] The problem comes with the funding for the program. For administration, enforcement, augmentation, and, beginning in 2006, for purchasing and retiring grandfathered rights, DWR can levy and collect various fees from persons withdrawing groundwater.[125] However, the total fees may not exceed $5 af per year and the fees for purchasing and retiring IGRs may not exceed $2 af per year.[126] The GMA ought to be amended to move up the effective date of this program and to increase sharply the fees DWR may charge all groundwater users in AMAs. DWR may then use these funds to retire IGRs. An increase in withdrawal charges would also encourage actual conservation among farmers (and other users).[127] Increasing the costs of water use may drive marginal users out of business and prompt others to reduce the quantities used.

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122. Ariz. Dep't. Water Resources, *supra* note 48, at 1.

123. The Administrative Procedure Act, ARIZ. REV. STAT. ANN. §§ 41-1001 to -1015 (1985), is applicable to all state agencies. Didlo v. Talley, 21 Ariz. App. 446, 520 P.2d 540 (1974). Powers and duties of an administrative agency are measured by the statute creating it. Fund Manager, Pub. Safety Personnel Retirement Sys. v. Tucson Police Pub. Safety Personnel Retirement Sys. Bd., 137 Ariz. 536, 672 P.2d 201 (App. 1983). The rules adopted by an administrative agency must be in accordance with statutory authority vested in it, must be reasonable, and must be adequately related to the purpose of the act. Grove v. Arizona Criminal Intelligence System Agency (ACISA), 143 Ariz. 166, 692 P.2d 1015 (1984). The rules may not be arbitrary or in contravention of any expressed statutory provision. *Id.*

When I first presented this paper at a conference on the GMA in September 1990, former-Governor Bruce Babbit raised a different concern about proceeding through the rulemaking route. Babbit endorsed this article's proposal but considered the issue too important to expect the Director of DWR to do it. To obtain public input, Babbitt thought that the proposal ought to be enacted into law by the Legislature.

124. ARIZ. REV. STAT. ANN. § 45-566(A)(7) (1987 & Supp. 1990). For reasons identified in the text, *see supra* text accompanying notes 112-21, it is preferable to create a private market for water rights.

125. ARIZ. REV. STAT. ANN. § 45-611 (1987 & Supp. 1990).

126. *Id.* § 45-611(3).

127. The research by Bruce Peacock suggests that pumping costs translate directly into conservation by farmers (apparently in contrast to conservation requirements imposed by DWR). *See* B. Peacock, *supra* note 44. Water use varies with price because of the elasticity of the price/use curve.

VII. CONCLUSION

This article has offered some preliminary and tentative proposals for discussion and debate.[128] Scrutiny and criticism of these ideas hopefully will yield concrete remedies. Solving Arizona's groundwater problems will require the best efforts and creative talents of everyone interested in the state's future. None of the remedies will be painless. All present and future water users must bear some burden. In searching for solutions, the twin principles of efficiency and equity must serve as guides. The idea behind this article is that we must harness growth to address the problems that will accompany growth. Further growth without offsetting reduction in water consumption will further exacerbate the groundwater mining problem in Arizona.

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128. Other ideas for achieving the policy objectives of the Act, and of sound water management generally, merit consideration but are beyond the scope of this article. With respect to environmental issues, perhaps instream flows and riparian habitats ought to have been on the minds of the framers of the GMA, but the historical reality is that these were not important factors. Thus it is not surprising that the Act has had such a problem with environmental questions. It would be appropriate to amend the Act to take into account recent sensitivity to environmental concerns. In this connection, an important recent article has advocated the conjunctive management of ground and surface water. *See* Leshy & Belanger, *Arizona Law Where Ground and Surface Water Meet*, 20 ARIZ. ST. L.J. 657 (1988). Other ideas include reducing agricultural support subsidies and cheap Bureau of Reclamation water. These two federal programs are interfering with Arizona's efforts to protect and conserve its groundwater supplies. Another possibility is to change Arizona surface water law of beneficial use to encourage conservation. It is scandalous that a city such as Scottsdale must irrigate alfalfa fields with thirteen af/a per year on its Planet Ranch land in order to maintain its prior appropriation rights. The use-it-or-lose-it principle may have made sense in an earlier era. However, one ought to be permitted temporarily to suspend water use if one files appropriate papers with DWR and subsequently to resume use when a more efficient use is contemplated. Similarly, prior appropriators ought to have a legal claim to water salvaged by conservation practices, such as improving the conveyance and delivery system or by shifting to crops that consume less water. *But see* Salt River Valley Water Users Ass'n v. Kovacovich, 3 Ariz. App. 28, 411 P.2d 201 (1966). Finally, legislation might empower DWR to require the use of effluent as an alternative to pumping potable groundwater.