BEHIND SCHEDULE AND OVER BUDGET: THE CASE OF MARKETS, WATER, AND ENVIRONMENT

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I. INTRODUCTION

We live in a world in which capitalism and environmentalism are both on the rise. "Green" is attractive; people want healthy pocketbooks *and* environments. Those who have long aspired to the American standard of living now wish to emulate our environmentalism as well. The Russians, Eastern Europeans, Indians, Brazilians, Indonesians, and many others have experienced rapidly growing environmental movements in the midst of efforts to unleash markets to cure their economic ills. A key premise of these changes seems to be that Americans have somehow succeeded in making markets and environmental protection work together. Is this true?

This article looks at markets, water, and the environment in an attempt to answer that question. First, the article provides an overview of markets for environmental resources, and the lack thereof, and then surveys existing water regulatory and price administrative policies. The article next discusses different economic incentives, drawing a sharp distinction between those with prices based on administrative processes and those with prices based on market processes. It examines markets for both water quantity and quality, with a focus on the barriers to their implementation. It then sketches an extensive reform agenda to remove these barriers, arguing that the stalemate in implementing this agenda is due in large part to the political and legal uncertainties concerning ownership and control of water resources. Such ownership uncertainties—often cast in terms of conflicts between "public" and "private" values and uses—violate a critical precondition to the orderly functioning of markets.

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II. Markets for Environmental Resources—the Path Not Taken

In surveying the environmental "policyscape" in America, one observes that markets are typically treated like predators, not protectors. Although the potential for using markets to solve environmental problems is great,[1] there are few examples of the actual successful use of markets for environmental protection. To a great extent, government still allocates air, water, forests, wildlife, fish, land, and minerals. What success stories can pro-market environmentalists cite?

Ecosystem and wildlife habitat protection through private land purchases has been occurring for some time. Hunting and fishing clubs and land trusts, including groups such as The Nature Conservancy, Ducks Unlimited, and Trust for the Public Land, often operate as environmental real estate dealers or even owners.[2] These groups have found it difficult to finance permanent acquisitions through user-pricing and other income-producing means, however; users remain either unable or unwilling to pay for environmental amenities or simply have not been asked to pay in an effective manner. Public funding has been more accessible, frequently leading the trusts to resell or transfer purchased lands to public agencies, which then own and manage the lands.[3]

It is not surprising that most market activity consists of land purchases for environmental protection. The relative certainty of real estate law provides clear deed and title transfer procedures. While such land transactions have often suffered from local monopsony—public agencies being the sole buyer—they remain nevertheless the most common example in the United States, and increasingly elsewhere, of reliance on markets to achieve environmental goals.[4] As one would expect when markets are allowed to operate, some innovative concepts have been developed to facilitate these land acquisitions, such as tradable development rights allowing protection of some lands and development of others with less environmental value.[5]

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1. *See generally* Terry L. Anderson & Donald R. Leal, Free Market Environmentalism (1991).
2. Michael A. Mantell et al., Creating Successful Communities 39-40 (1990).
3. *See id.*
4. A number of international examples are discussed in John A. Dixon & Paul B. Sherman, Economics of Protected Areas (1990).
5. *See* Mantell et al., *supra* note 2, at 12, 25.

Beyond the markets for such land transfers, however, established and sustained markets for environmental resources are rare. There have been several experimental or temporary markets, including air pollution bubbles, inter-refinery lead trading, and water pollution permits.[6] These have not become ongoing markets. With the 1990 enactment of the reauthorized Clean Air Act,[7] America is beginning a new set of experiments that should result in established markets for sulfur dioxide emissions. Regional sulfur dioxide markets, particularly in the Ohio Valley and Northeast, are expected to emerge. The Chicago Board of Trade has even established a counter for sulfur dioxide emissions rights.[8]

Before a sulfur dioxide market can be established, there must be an initial distribution of emissions rights.[9] Permits for historic emission rates under the prior Clean Air Act have formed the basis for a political solution to this problem. Once a permit distribution system is established among several hundred clearly identified emitters, allowing tradability is much less difficult than in the case of many other environmental resources for which definitional and distributional issues are more ambiguous. Another feature favoring markets for sulfur dioxide is that the environmental policy goal, control of acid rain, can be achieved by capping the emissions of a single target pollutant for the several regions that contribute to one emissions pool. Thus, regional trading is possible without insurmountable barriers from local third-party opposition and external effects.

We will see below that these potential problems of the definition and distribution of the property rights embedded in permits, the numbers of potential market participants, and externalities and other local barriers to trading often prove to be serious obstacles to water markets. Without the resolution of these problems, establishing environmental markets in gen-

6. *See* Robert W. Hahn & Robert N. Stavins, *Incentive-Based Environmental Regulations: A New Era from an Old Idea*, 18 ECOLOGY L.Q. 1 (1991).

7. Clean Air Act Amendments of 1990, 42 U.S.C.A. §§ 7401-7671q (Supp. 1991).

8. William B. Crawford, Jr., *CBOT Puts Hedge on Pollution*, CHI. TRIB., Aug. 19, 1991, at C1.

9. *See* Daniel J. Dudek & John Palmisano, *Emissions Trading: Why is this Thoroughbred Hobbled?*, 13 COLUM. J. ENVTL. L. 217, 221 (1988) ("The success of particular emissions trading tools requires the definition of facilities' emission control obligations, creating a system of granting 'credits' for doing better than the control obligation, establishing administrative means for certifying these credits, and establishing uses for these credits.").

eral is much more difficult. The potential benefits of *pareto superior* allocations tend to be clouded by political arguments about *who* holds the right to the resource and by the fact that there may be losers, real and perceived, from market processes. When faced with distributional choices, some people view the gains in efficiency and individual choice associated with markets as secondary and even abstract.

In addition to these barriers to the creation of new markets for environmental resources, other political and social forces continue to seek "re-regulation" of existing markets.[10] Emissions permits are just that—permits issued by government with at best quasi-property right status that can be altered or revoked by legislation, with or without compensation for the resulting economic damages. Courts may or may not uphold such actions, and administrative agencies may or may not see their interests served by regulating to facilitate markets. Even real estate ownership has been subject to shifting legislative actions and judicial opinions. Thus, market participants, extant and potential, must somehow calibrate their decisions according to these risks and the resulting transactions costs.

The case of water illustrates the problems of creating, and even of maintaining, markets for environmental resources. On one hand, there are water markets in some areas; there is a relatively well-established system of legal rights to use water, if not to pollute it. On the other hand, there is growing opposition to the idea that this historic use, even if condoned by legislative and court decisions of the past, constitutes an ongoing right to use the resource. During the past two decades, fledgling water markets have arisen in some western regions, but further development is problematic, and trading within existing frameworks has growing transactions costs.[11] The situation with water quality is extreme. No water emissions markets exist yet; many pollution sources are not even certified by a permit or other emissions rights systems; quantitative and geographic boundaries on markets have not been defined; and

10. Current examples involve the airline and banking industries. *See* Marshall Ingwerson, *Regulation Questions Divide White House*, CHRISTIAN SCI. MONITOR, Dec. 31, 1991, at 7; Louis S. Richman & John Labate, *Report Card on Bushonomics*, FORTUNE, November 4, 1991, at 105.

11. *See generally* LAWRENCE J. MACDONNELL, U.S. GEOLOGICAL SURVEY, THE WATER TRANSFERS PROCESS AS A MANAGEMENT OPTION FOR MEETING CHANGING WATER DEMANDS (1990).

governing statutes have not addressed the market alternative. Thus, water markets, in spite of obvious arbitrage and value-added prospects, have developed haltingly or not at all. A closer look at some pertinent aspects of recent water policies should help to explain how market barriers have evolved.

III. Existing Water Policies: A Potpourri of Regulatory Uncertainties and Administered Pricing

During the 1970s and 1980s, partly in response to drought, the expansion of water marketing appeared to be the logical next step in policy to allow orderly transfers of dry-year and other water rights.[12] Some farmers and irrigation groups favored an expansion of markets because of the economic benefits possible from water sales and leases.[13] Many agricultural interests, however, did not and do not favor water markets; indeed, representatives of agricultural water-users groups have often been the key opponents of water markets in some regions.[14] Opponents voice fears that irrigators will soon be forced to "bid for water," although irrigators would hold most of the water rights in established markets. Opponents also perceive threats to rural lifestyles and cite the loss of potential taxpayer-subsidized water projects as the downside risks of allowing markets to develop.

Where there has been environmental support for water markets, the aim has been to create a businesslike procedure that would halt, and eventually reverse, the degradation of the

12. A number of studies and commissions in the western States have suggested this. *See, e.g.*, National Water Commission, Water Policies for the Future (1973); Governors' Commission to Review California Water Rights Law, Final Report (1978); Charles E. Phelps et al., Efficient Water Use in California (1978); Zach Willey, Economic Development and Environmental Quality in California's Water System (1985); Water Efficiency Working Group of the Western Governors' Ass'n, Water Efficiency: Opportunities for Action (1987).

13. For an overview of water marketing transactions with irrigators as the typical sellers, see *1991 Annual Transaction Review: Water Comes to Town*, Water Strategist, Jan. 1992, at 3. A case study of the economic benefits of water trading for California's Imperial Irrigation District is found in Robert Stavins & Zach Willey, *Trading Conservation Investments for Water*, *in* Regional and State Water Resource Planning and Management 223, 226-229 (Randall J. Charbeneau & Barney P. Popkin eds., 1983).

14. Examples are California's Central Valley Project Contractors Association's and Nevada's Truckee-Carson Irrigation District's opposition to federal water legislation in 1991 and 1990 respectively. The legislation included voluntary sales of water contracts and rights by irrigators. *See* Truckee-Carson-Pyramid Water Rights Settlement Act, Pub. L. No. 101-618, 104 Stat. 3294 (1990); CVP Fish and Wildlife Restoration Act, S. 484 102d Cong., 1st Sess. (1991).

West.[15] Support for water markets has also been based on the prospect that these markets would provide new supplies of water for growing urban areas, and would be a viable alternative to economically and environmentally expensive new water projects. At the same time, some environmentalists have opposed water marketing because they prefer government control and worry that financing environmental acquisitions in private water markets would be difficult.[16] Opponents of water marketing emphasize that past public investments in infrastructure would be arbitraged into private "profiteering," a phenomenon not restricted to public water supply investments. Fundamentally, environmental skepticism, if not opposition, has been based on the same fear that drives the anti-market agriculturalists: Ability or willingness to pay, or both, may be inadequate. This common perspective among some environmentalists and agricultural interests contributes to the stalemate in market development, and government continues to be the default allocator.

A. *Historical Context*

A cursory review of western resource development policies explains how this array of conflicting interests has stagnated the evolution of water markets. In the United States, particularly in the western regions, water resource development and environmental policies during the past century have not been market-oriented.[17] Recent attempts to facilitate markets have tried to splice pro-market provisions onto an anti-market foundation.

Development policies initiated in the late Nineteenth and early Twentieth Centuries placed a low or even zero price on

15. *See, e.g.*, WILLEY, *supra* note 13; Robert Wigington, Update on Market Strategies for the Protection of Western Instream Flows and Wetlands (June 6, 1990) (unpublished manuscript, on file with the Natural Resources Center, School of Law, University of Colorado, Boulder); Zach Willey & Tom Graff, *Federal Water Policy in the United States—An Agenda for Economic and Environmental Reform*, 13 COLUM. J. ENVTL. L. 325 (1988).

16. See Bonnie G. Colby, *The Economic Value of Instream Flows—Can Instream Values Compete in the Market for Water Rights?*, *in* INSTREAM FLOW PROTECTION IN THE WEST 87 (Lawrence J. MacDonnell et al. eds., 1989).

17. For historical chronologies of water, land, and environmental policy, see MICHAEL C. ROBINSON, WATER FOR THE WEST: THE BUREAU OF RECLAMATION, 1902-1977 (1979); ROY M. ROBBINS, OUR LANDED HERITAGE: THE PUBLIC DOMAIN, 1776-1970 (1976); JOSEPH M. PETULLA, ENVIRONMENTAL PROTECTION IN THE UNITED STATES (1987).

environmental resources and invested taxpayer monies in infrastructure to stimulate agricultural diversions, flood control storage, and hydroelectric projects.[18] Prior appropriation doctrine in state laws encouraged early and ongoing water diversions that were tied to particular places and types of uses.[19] Such measures to keep the costs of water low were augmented by policies to boost the profitability of development of other natural resources, including agriculture, mining, forestry, flood control, shipping, and energy.[20]

Environmental policies underwent a shift during the Twentieth Century from the early conservation and resource management ethic to the current protectionist one.[21] Multiple use and management of forests, soil, fish, and wildlife were key aspects of conservationist-era policies. The initiation of the wilderness and national park systems during this era was a harbinger of the protectionist movement. During the 1960s and 1970s, the bulk of environmental protection statutes were enacted, including an array of statutes to regulate toxic chemicals. These statutes made little if any reference to markets as allocators and protectors of water or other natural resources.

Serious thoughts of using such markets were confined mainly to the halls of academe. Some natural resource economists recognized the potential of markets as alternative policy instruments for allocating resources. After World War II, a new generation of economists focused on water resource development projects, particularly those supported with public monies in the western states. Projects in each region were analyzed to determine whether the economic benefits would be outweighed by the costs, the non-market values were being recognized, and the projects could be built without public subsidies. If water market pricing had prevailed and public subsidies were not available, many of these projects would not have been started.

18. *See* OTTO ECKSTEIN, WATER-RESOURCE DEVELOPMENT: THE ECONOMICS OF PROJECT EVALUATION 110-17, 151-59, 192-96, 237-39 (1958); WATER RIGHTS: SCARCE RESOURCE ALLOCATION, BUREAUCRACY, AND THE ENVIRONMENT 20-28, 83-113, 167-88 (Terry L. Anderson ed., 1983) (hereinafter "WATER RIGHTS").

19. *See* MACDONNELL, *supra* note 11.

20. *See* ECKSTEIN, *supra* note 18, at 110-17, 151-59, 192-96, 237-39; WATER RIGHTS, *supra* note 18, at 20-28, 83-13, 167-88; MARION CLAWSON, THE FEDERAL LANDS REVISITED 63-98, 112-22 (1983); RICHARD W. WAHL, MARKETS FOR FEDERAL WATER: SUBSIDIES, PROPERTY RIGHTS, AND THE BUREAU OF RECLAMATION 3-4, 27-46 (1989); GARY D. LIBECAP, LOCKING UP THE RANGE (1981).

21. *See* CLAWSON, *supra* note 20, at 9-14, 170-205, 224-29; PETULLA, *supra* note 17, at 39-68.

Economists in each region presented analyses developing their economic criticisms in spite of animosities from regional politicians and developers. Arizona, California, the Pacific Northwest, and other states and regions had their economic critics of water projects.[22]

Water marketing eventually became recognized as an obvious alternative to the political porkbarrel in which public monies supported bad projects.[23] In 1966, Bain, Caves, and Margolis[24] took an economic look at California's investment in water projects. With not only big federal and state water agencies in place, but also a handful of wholesaling public water districts controlling distribution, California faced a problem of bureaucratic, as opposed to market, allocation:

> [W]e underline the freedom of the monopoly wholesaler in the water industry not just to monopolize, but rather to respond to any of a number of possible whims and motives. The major disadvantage of monopolized wholesaling of irrigation water is probably that most of the power to plan for large-scale development of storage and of interbasin transfers is vested in a single decision-making body, and is subject to influence by such caprice, error, or bureaucratic bias as may influence the decisions of this body. Monopolized wholesaling reverses the safety in numbers secured when numerous independent agencies with separate decision-making bodies are engaged in a common pursuit . . . .[25]

B. *The Environmental Damages of Water Policies*

In the late 1970s, a water policy revolution seemed likely because of the turmoil created by a bizarre potpourri of anti-market policies, pro-market theories, drought, emerging public fiscal conservatism, and environmentalism. The environmental

22. *See* MAURICE M. KELSO ET AL., WATER SUPPLIES AND ECONOMIC GROWTH IN AN ARID ENVIRONMENT: AN ARIZONA CASE STUDY (1973); James C. DeHaven & Jack Hirshleifer, *Feather River Water for Southern California*, 33 LAND ECON. 198 (1957); NORMAN K. WHITTLESEY ET AL., ENERGY TRADEOFFS AND ECONOMIC FEASIBILITY OF IRRIGATION DEVELOPMENT IN THE PACIFIC NORTHWEST (1981).

23. For example, work specifically on water by David Gardner & Herbert H. Fullerton, *Transfer Restrictions and Misallocation of Irrigation Water*, 50 AM. J. AGRIC. ECON. 556-71 (1968); and LOYAL M. HARTMAN & DON SEASTONE, WATER TRANSFERS: ECONOMIC EFFICIENCY AND ALTERNATIVE INSTITUTIONS (1970) was related to the pathbreaking work on property rights and markets of Ronald H. Coase, *The Problem of Social Cost*, 3 J.L. & ECON. 1 (1960), as well as to that of JOHN H. DALES, POLLUTION, PROPERTY, AND PRICES (1968) and JACK HIRSHLEIFER ET AL., WATER SUPPLY (1960).

24. JOE S. BAIN ET AL., NORTHERN CALIFORNIA'S WATER INDUSTRY (1966).

25. *Id.* at 127-128.

damages alone provided tremendous impetus to overhaul existing water policies. The litany of abuse is extensive: Nearly every state had increasingly visible sites of environmental degradation stemming from water diversions, storage, or pollution. A brief survey[26] of the kinds of degradation helps to explain the breadth of the environmental water demands that have arisen.

Appropriation of freshwater supplies devastated a wide variety of environmental resources. Nevada's Pyramid Lake and California's Mono Lake became famous when their depth, surface area, and wildlife habitat were dramatically reduced because of upstream diversions. Deterioration of instream, riparian, and wetland habitats has been significant in most states. Wetlands are extremely productive habitats, supporting about one-third of the nation's endangered and threatened species,[27] but since the time of Anglo-European settlement in the 1700s, the lower forty-eight states have lost over half of their wetlands.[28] Ninety-six percent of California's Central Valley wetlands, which provide critical wintering habitat to 60% of the Pacific flyway's waterfowl population, have been lost since the 1850s.[29] The average annual loss of wetlands has been about 350,000 acres; however, after World War II losses steadily increased and since the 1970s, the losses of wetlands have increased to between 400,000 and 500,000 acres per year.[30] Eighty percent of the wetlands lost between 1955 and 1975 were converted to agricultural production.[31] Many of the remaining wetland habitats are protected through state and federal wildlife refuge systems. In California, approximately twenty percent of the state's remaining wetlands are protected in refuges.[32] However, about 20% of the 435 federal refuges investigated in a United States Department of Interior study are at risk from contamination by agricultural drainage or other

26. The material in this survey is based largely upon Deborah Moore & Zach Willey, *Water in the American West: Institutional Evolution and Environmental Restoration in the 21st Century*, 62 U. COLO. L. REV. 775 (1991).

27. THE CONSERVATION FOUNDATION, PROTECTING AMERICA'S WETLANDS: AN ACTION AGENDA 9 (1988).

28. *Id.*

29. Peter Steinhart, *Empty the Skies*, AUDUBON, Nov. 1987, at 73, 75.

30. THE CONSERVATION FOUNDATION, *supra* note 27, at 12.

31. *Id.* at 12-13.

32. Steinhart, *supra* note 29, at 75.

activities.[33]

Water quality has also declined as a result of urban, industrial, and agricultural development. Large quantities of nutrients have contributed to eutrophication of the nation's lakes, streams, and estuaries.[34] High salinity of water supplies is causing yield reductions in about one-fourth of irrigated lands in the United States.[35] Heavy metals and other toxins are contaminating drinking-water supplies. It has been estimated that non-point (diffuse, non-localized) sources of pollution contributed over 90% of total nitrogen and coliforms, over 60% of phosphorus, and over 40% of the heavy metals lead, chromium, and copper.[36] Other studies have found that non-point sources account for over half of the biological oxygen demand and almost all of the suspended solids.[37] Sources of non-point pollution include urban runoff, mining and logging activities, and atmospheric fallout,[38] and most predominantly, agriculture. Clearly, control of point sources, such as sewage and industrial discharges, alone will not achieve water quality goals.

The effects of such reductions in the quantity and quality of habitats are evident in wildlife populations. The population of the ten most common ducks in North America has declined by over 30% since the 1950s.[39] California duck populations have decreased precipitously from seven million birds in 1980 to two million in 1985.[40]

Numerous other habitats and ecosystems have been affected by water development activities. San Francisco Bay and its estuary have suffered from years of water exports and polluted discharges. Flows through the delta have been reduced by over 50% of the natural, pre-development flows, contributing to the

33. UNITED STATES GENERAL ACCOUNTING OFFICE, WILDLIFE MANAGEMENT: NATIONAL REFUGE CONTAMINATION IS DIFFICULT TO CONFIRM AND CLEAN UP 3 (1987).

34. ASSOCIATION OF STATE AND INTERSTATE WATER POLLUTION ADMINISTRATORS, AMERICA'S CLEAN WATER (1985).

35. SANDRA POSTEL, WATER FOR AGRICULTURE: FACING THE LIMITS 16-17 (Worldwatch Paper No. 93, Dec. 1989).

36. Gordon Chesters & Linda-Jo Schierow, *A Primer on Nonpoint Pollution*, 40 J. SOIL & WATER CONSERVATION 9, 13 (1985).

37. Winston Harrington et al., *Policies for Nonpoint-Source Water Pollution Control*, 40 J. SOIL & WATER CONSERVATION 27 (1985).

38. *See* Chesters & Schierow, *supra* note 36, at 9.

39. *See* FISH & WILDLIFE SERVICE, U.S. DEP'T OF INTERIOR, NORTH AMERICAN WATERFOWL MANAGEMENT PLAN (1986); Philip Shabecoff, *Urgent Effort to Save Ducks Begins in U.S. and Canada*, N.Y. TIMES, Feb. 9, 1988, at C1.

40. *See* Steinhart, *supra* note 29, at 75.

decline of the striped bass fishery.[41] Adult fish mortality rates have increased from 40% in the early 1970s to over 50% in the mid-1980s.[42] The index for striped bass "young of the year," which since 1971 has always been lower than expected (and since the last California drought, from 1976 to 1977, has been much lower), declined to an all-time low in 1985.[43]

Out of the 1,240 miles of the Columbia River, only 44 miles run free without the hindrance of a dam and reservoir. There are 14 dams on the Columbia River and 55 on its tributaries. The Columbia River salmon and steelhead runs have taken the brunt of this abuse. The number of salmon and steelhead returning to spawn is approximately 20% of the historic average of 12 million.[44] The summer and fall chinook salmon runs on Idaho's Snake River tributaries—historically contributing 45% and 35% of total Columbia Basin chinook populations—were down to less than 10% and 5% respectively of historic levels during the 1980s.[45] Of the 2.5 million fish that do return to spawn, only 10-20% are from wild stocks; the remainder are from hatcheries. Efforts are underway to list various runs of Columbia River basin salmon as endangered species, portending economic blood-letting on a much grander scale than any that may result from protections for the spotted owl and old growth forests.

Finally, during the 1970s and 1980s, a number of new water projects on the drawing boards further heightened environmental water demands. The recent destruction of the Stanislaus River's whitewater by the New Melones Dam and portions of the Snake River's wild salmon migratory habitats by federal hydroelectric dams raised public opposition to additional projects such as the Auburn Dam and Peripheral Canal in California, the Orme Dam in Arizona, Animas-LaPlata project in New Mexico and Colorado, the Two Forks Project in Colorado,

41. *See* Philip B. Williams, *Managing Freshwater Inflow to the San Francisco Bay Estuary*, 4 REGULATED RIVERS: RESEARCH AND MANAGEMENT 285, 289, 294 (1989).

42. *See* CALIFORNIA DEPARTMENT OF FISH AND GAME, FACTORS AFFECTING STRIPED BASS ABUNDANCE IN THE SACRAMENTO-SAN JOAQUIN RIVER SYSTEM at v (1987) (Exhibit 25, entered for the State Water Resources Control Board 1987 Water Quality/Water Rights Proceeding on the San Francisco Bay/Sacramento-San Joaquin Delta).

43. *Id.* at v-vi.

44. *See* NORTHWEST POWER PLANNING COUNCIL, COLUMBIA RIVER BASIN FISH AND WILDLIFE PROGRAM 3 (1987).

45. COLUMBIA BASIN FISH & WILDLIFE AUTHORITY, COLUMBIA BASIN SYSTEM PLANNING PRODUCTION PLAN—SALMON AND STEELHEAD: INTEGRATED SYSTEM PLAN 55, 70 (1990).

and most other proposed new water supply dam and reservoir projects.

C. *Water Policy Reform Movement Emerges*

Constituencies to halt such projects, and even to reverse the damage of completed projects, arose to promote politicians who would represent the emerging environmental electorate. Groups opposing water projects coalesced with those proposing water policy reforms. The result was the initiation of a new era of federal and state water policy reforms, the fate of which remains uncertain.

Federal policy headed in new directions. The Carter Administration created a "hit list" of water projects to be removed from the federal budget; the Reagan Administration decreased federal cost shares and increased local funding of water projects; Congress reformed the Reclamation Act to increase recovery of variable costs and limit water subsidies for "large" farms; the federal government began "liability shedding" for obligations, such as toxic clean-up and wildlife habitat destruction, associated with federal water projects; and federal water contractors gave a highly tentative and qualified support to voluntary water transfers.

The reform movement of the 1970s and 1980s encompassed a bewildering array of theories, doctrines, and proposals that were aimed largely at promoting different government, as opposed to market, allocation policies. Key proposals would at least weaken and perhaps invalidate historic usufructuary water rights and would impose strict pollution controls based on rigid technological standards. Spin-offs included the public trust doctrine as a means of restricting or reducing existing appropriative water rights, possibly without compensating owners; mandatory government-approved plans for water use and conservation; ad hoc applications of "beneficial and reasonable use" language in state water codes, which aggravated water rights uncertainties; subsidy-induced cooperation from sewage districts to adhere to technological standards for pollution discharge permits; and other ways to change, yet perpetuate, allocation by government agencies rather than by markets.

At the same time, another slew of reforms ostensibly headed "in the direction" of markets, but could also fit within revamped government allocation policies. In many regions, on-

going adjudications of water rights were a prerequisite to functioning water markets because they clarified property rights. At the same time, adjudications that applied new standards or doctrines to old water rights became a form of government reallocation. Because of the frequent lack of precision in defining existing water rights, the distinction between "new" and "different" standards has often been difficult to identify. Similarly, the establishment of instream flow standards could be viewed as the estimation of instream demands leading to acquisitions of water rights; on the other hand, such flow standards could also be used as a basis for reducing other water rights to "free-up" water for instream flows.

Economic incentive-based reforms, described below, are also two-way streets—one headed for markets, the other headed for government regulation. Administered pricing, while incentive-based, is not market-based, because it leaves government in de facto control of allocation.[46] But it also creates opportunities to implement user pricing according to marginal costs, encouraging conservation and other investments and shedding subsidies. It is, of course, hard to predict whether or not the political processes of administering prices will allow these markets to take hold. Interestingly, water transfer taxes, as opposed to water use taxes, have become fashionable recently because a coalition of rural and environmental interests have sought to extract compensation from the gains in trading in water markets.[47] Using transfer taxes to penalize the subset of water users willing to trade their rights, as opposed to all water users, is counterproductive if one believes that markets should be encouraged to maximize reallocations and efficiency gains. Nevertheless, the transfer tax has the support of important interests, enhancing its political feasibility.

The mixed bag of water policies is characterized well by the following:

> Two principal approaches have emerged [during the 1980s]. . . . [T]here is the regulatory approach, which seeks

46. *See* BUREAUCRACY VS. ENVIRONMENT (John Baden & Richard L. Stroup eds., 1981).

47. These transfer taxes have been based on in-kind assessments that retain a portion of proposed water transfers for other uses by public agencies. *See, e.g.*, OR. REV. STAT. § 537.470 (1989) (authorizing at least 25% of "conserved" water to be allocated to the state before transfer); S. 484, 102d Cong., 1st Sess. § 5 (1991) (providing similar provisions for California's Federal Central Valley Project).

> to achieve efficiency through aggressive enforcement of limits on water use under state constitutional prohibitions against waste and unreasonable use. On the other hand, there is the market approach, which stresses the use of financial incentives. . . . While the first approach is essentially coercive, the latter approach is voluntary.[48]

Of course, judicial interpretations of underlying property rights have been central, as noted in the California context: "Since the California courts show no great reluctance towards judicial redefinition of property interests in water, the only possible limitation on further reallocations by judicial fiat may be the United States Constitution."[49]

IV. Economic Incentives in Water and Environmental Policies

The political and institutional barriers to market-based water policies are severe, as evidenced by the slow progress in their application during the past fifteen years. Even within the group of policies that rely on economic incentives, only some rely on market allocations. The basic distinction is whether prices are derived primarily from administrative or market processes. A closer look at the application of both types of incentive-based policies helps to explain the infrequent substitution of any incentive-based policies, including market-based policies, for those relying on the discretion of administrative agencies.

A. *Government-Administered Pricing*

Most of the water policies that rely on economic incentives are actually government-administered pricing. Water supply and pollution discharge rates, as well as product prices for many commodities that rely heavily on water as an input, are set by government agencies or by state-chartered monopolies such as water districts. Administered prices imply indirect government water allocation. It is unlikely that administered price-setting can simulate market pricing because the informational and methodological problems of doing so are significant. Furthermore, substantial transaction costs accompany the bureau-

48. Kevin M. O'Brien, *Water Marketing in California*, 19 Pac. L.J. 1165, 1166 (1988).

49. Clifford W. Schulz & Gregory S. Weber, *Changing Judicial Attitudes Towards Property Rights in California Water Resources: From Vested Rights to Utilitarian Reallocations*, 19 Pac. L.J. 1031, 1033 (1988).

cratic and political processes required to administer prices.[50]

Water supply prices are most often administered by agencies with monopoly control of water storage and delivery facilities. Agencies such as water districts usually set prices according to average costs: A "cost-plus" ratemaking allows the agency to recover its fixed and variable costs and avoid "excess revenues," which state laws frequently prohibit. The discrepancy between prices derived from these procedures and those that a market would signal is compounded in the case of federally-developed irrigation water supplies. Here, reclamation contract prices omit the interest costs of the debt incurred to construct the water supply facilities.[51] In addition, it is still common for some water supply entities, particularly irrigation districts, to charge users a flat rate or per acre rate, rather than a rate based on the quantity of water consumed. Most pollution-discharge entities—such as sewage treatment plants—bill their customers on a non-quantity basis, usually by a flat service fee set by customer class. In these cases, price-based options to conserve water or reduce pollution are not available.

An array of reforms are necessary before administered water prices can simulate market outcomes. Overcoming the difficult technical and political obstacles to marginal cost-based pricing is imperative. The social debate over ratemaking that now focuses on keeping rates low at significant environmental expense must shift to the disposition of "excess revenues" generated by monopolistic water agencies. Stringent, imperfect, and costly oversight of the ratemaking of such monopolies, mimicking the current practice in electric utility regulation, is necessary. Water-related investments must be evaluated by private sector financial criteria,[52] not by the availability of public subsidies. All pricing must be based on quantity of use, requiring metering and monitoring of both water supplies and effluent discharges.

Some pricing reform and subsidy reductions have occurred

50. For a discussion of public utility ratemaking processes and problems, see ALFRED E. KAHN, THE ECONOMICS OF REGULATION: PRINCIPLES AND INSTITUTIONS 25 (1970). A detailed discussion of water utility ratemaking is contained in AMERICAN WATER WORKS ASSOCIATION, WATER RATES: MANUAL OF WATER SUPPLY PRACTICES (1983).

51. *See* WAHL, *supra* note 20, at 28-29; U.S. GOVERNMENT ACCOUNTING OFFICE, RECLAMATION LAW—CHANGES NEEDED BEFORE WATER SERVICE CONTRACTS ARE RENEWED (1991).

52. *See* RODNEY T. SMITH, TROUBLED WATERS: FINANCING WATER IN THE WEST 159 (1984).

in the United States, but much more remains to be done.[53] Even if all the contemplated reforms were in place, however, significant benefits of market allocation would not be realized. Government-administered pricing—often implemented to regulate monopoly production and distribution—severely limits consumer choice. Because water users usually hold no clear water rights in these government-administered systems, the end-user has little ability or incentive to conserve, trade, switch to alternative supplies, or pursue other market-based options. The absence of clearly-defined, individual water rights and liabilities means that the control of environmental degradation is dependent solely upon the decisions of regulatory agencies and state-chartered water monopolies, subject to legislative and judicial checks.

Government agencies also administer the prices of a number of commodities that depend heavily on water; here again, government-administered pricing leads to further market distortion and political allocations. Government agencies administer agricultural commodity price supports, leases of timber rights on public lands, permits to graze livestock on public lands, and shipping, flood control, and hydroelectric production from facilities constructed and operated in part by public funds. Such programs tend to inflate net profits above those that would occur under market conditions for products and inputs, and therefore encourage overproduction and consequent overuse and depletion of water supplies and quality. Removal of subsidies, together with the establishment of auctions and competitive bidding procedures to establish the appropriate price for these resources, are important steps toward achieving market outcomes. Establishing tradable rights to use these resources would allow the replacement of current administered pricing and allocation systems.

B. *Markets for Water Resources*

Most water and environmental policies in the United States are command-based, and most incentive-based policies rely on administered prices. The small remainder use markets. As noted earlier, land transactions have been the most common

53. *Id.* at 72; WILLEY, *supra* note 12, at 5-10; Charles V. Moore & Richard E. Howitt, *The Central Valley of California*, *in* WATER AND ARID LANDS OF THE WESTERN UNITED STATES 6-7, 85, 96-97 (Mohamed T. El Ashry & Diana C. Gibbons eds., 1988).

use of markets for environmental protection. Markets to allocate water and related environmental resources have only begun to be developed, with uncertain future prospects for expansion.

1. *Water Quantity*

Markets for the quantitative rights to use water have emerged in a number of western states. The prior appropriation doctrine underlying these rights is based on usufructuary principles. The key legal and political barriers confronting water markets have, therefore, concerned the shifting of these rights in place, type, and time of use. Several types of transactions have emerged. One such type, permanent transfer, involves the outright selling of water rights, contracts, or concomitant land in perpetuity. Such sales can be on an intermittent basis, such as in dry years only, or on an 'every-year' basis. An alternative transaction, lease of water rights, provides that after a specified term the right to use the water returns to the lessor. A substantial variety of legal and technical arrangements characterize these water marketing transactions.[54]

Water marketing transactions can benefit the environment in three ways. First, transactions can shift water from existing to new uses, without embarking upon new surface supply and diversion projects that have negative environmental effects. In the western United States, agricultural irrigation accounts for between 80% and 90% of total water consumption, and thus is the prime source of supply for water marketing transactions.[55] The water conserved as a result of less irrigation can be made available for other uses. Where growth in municipal and industrial water uses is the primary source of new demand, as is the case in the western United States, water transfers from agricultural to urban uses are increasingly common.[56]

Second, shifts in water use underwritten by water marketing

54. For discussions on the properties and merits of water markets, see HARTMAN & SEASTONE, *supra* note 23; Charles W. Howe et al., *Innovative Approaches to Water Allocation: The Potential of Water Markets*, 22 WATER RESOURCES RESEARCH 439-445 (1986); Bonnie C. Saliba et al., *Do Water Market Prices Appropriately Measure Water Values?*, 27 NAT. RESOURCES J. 617 (1987). Institutional responses and impediments to creating and operating water markets have been examined in MACDONNELL, *supra* note 11, and in WAHL, *supra* note 20.

55. *See* SMITH, *supra* note 52.

56. For a discussion of municipal and industrial water demand in the western United States, see *id.* at 7-12.

transactions can directly benefit the environment. The direct acquisition of water supplies for environmental purposes is a relatively new aspect of water marketing, and is either under active consideration or is actually being implemented in several areas of the western United States. Irrigation water supplies are the prime source for such acquisitions. The degradation of environmental resources can be mitigated and possibly reversed, while irrigators and other water rights holders are compensated for making adjustments in their water use.

Finally, water marketing can be an important component of an incentive-based effort to control water pollution by encouraging reduced water use, conservation investments, wastewater recycling, and other measures.[57] Such measures become economically attractive to the water user if water marketing options are available to provide financing.[58]

Limited water markets in the western United States have emerged during the past decade both because low-value agricultural users have held most of the water rights and because urban and environmental demands, resulting from the region's demographic and economic growth, have increased. Arbitrage potentials, the difference between prices for irrigation water and those for municipal and industrial uses, are substantial in many regions. Such arbitrage potentials exist for environmental purchasers as well, although typically with lower margins.[59] Interestingly, such potential gains from agriculture-to-municipal and industrial water transfers are frequently diminished by the absence of marginal cost-based water ratemaking.

Water market prices would provide considerable latitude for irrigators to invest in improved irrigation systems and practices. The costs of water freed up by many irrigation water conservation practices and systems exceed the water prices paid by irrigators. While there are frequently yield-related reasons for irrigators to improve their systems and practices, in many cases the value of conserved water in reduced water costs does not

57. For an application to irrigation in California's San Joaquin Valley, see Marca Weinberg & Zach Willey, *Creating Economic Solutions to the Environmental Problems of Irrigation and Drainage, in* THE ECONOMICS AND MANAGEMENT OF WATER AND DRAINAGE IN AGRICULTURE 531 (Ariel Dinar & David Zilberman eds., 1991).

58. *See* SMITH, *supra* note 52, at 4-8.

59. Limited valuations of environmental uses of water have been done using nonmarket valuation techniques in lieu of market pricing. *See, e.g.*, Colby, *supra* note 16; JOHN LOOMIS, AN ECONOMIC EVALUATION OF PUBLIC TRUST RESOURCES OF MONO LAKE (Institute of Ecology Report No. 30, 1987).

cover the costs of water conservation. Income from water sales and leases by irrigators can underwrite many additional improvements in irrigation systems.[60] The ability to sell conserved irrigation water at prices that exceed the water prices paid by irrigators would obviously stimulate reallocations. Regional water markets in the western states would draw on the vast supply of agricultural water rights in low-value uses, which constitute more than 75% of total supplies in many basins. Municipal and industrial demands, while high-valued, tend to account for less than 25% of total supplies. Equilibrium prices under such conditions will be considerably lower than feared by some agricultural and environmental interests.[61]

While water transfers from irrigation to urban uses are increasingly frequent, a few transfers to environmental uses are beginning to take place. In Colorado, where rights to instream flows are allowed under state law, the Nature Conservancy is implementing an acquisition program involving some irrigation water rights.[62] Legislation enacted by Congress in 1990[63] to acquire water rights for Lahontan Valley wetlands as well as to settle the fisheries-based water rights claims of the Pyramid Lake Paiute Tribe is aimed at mitigating the environmental effects of the Newlands Reclamation Irrigation Project in central Nevada. In California, state legislation to acquire water supplies for Mono Lake[64] was enacted, and similar efforts for wetlands in the Central Valley are underway.[65] In the Pacific Northwest, migratory habitats for salmon are being protected through short-term leases of irrigation water rights by the Bonneville Power Administration,[66] and federal legislation was introduced to finance transfers of irrigation water rights to instream flows in the Yakima River.[67]

Such efforts to foster market solutions to water allocation

60. For a case study involving the Metropolitan Water District of Southern California, see Stavins & Willey, *supra* note 13, at 223.

61. *See, e.g.*, DONALD ERLENKOTTER ET AL., *The Economics of Water Development and Use in California*, *in* CALIFORNIA WATER PLANNING AND POLICY: SELECTED ISSUES 169 (E.A. Englebert ed., 1979).

62. *See* Wigington, *supra* note 15.

63. Truckee-Carson-Pyramid Water Rights Settlement Act, Pub. L. No. 101-618, 104 Stat. 3294 (1990).

64. Water Resources—Environmental Water Act of 1989, 1989 Cal. Stat. 715 § 1.

65. The CVP Fish and Wildlife Restoration Act, S. 484 102d Cong., 1st Sess. (1991).

66. *See BPA, Idaho Power Leasing Irrigation Water for Fish*, BONNEVILLE POWER ADMINISTRATION J., Aug. 1991, at 2.

67. H.R. 3097, 102d Cong., 1st Sess. (1991).

problems face formidable legal and political barriers. An array of regulatory uncertainties persists, caused in part by existing statutes that were not intended to facilitate marketing, and in part by new anti-marketing legislation.[68] Regulations generally have not clarified ambiguous definitions of "beneficial and reasonable use" of water in state laws. Basin-wide adjudications are underway in many regions, and trading in the midst of these legal uncertainties is risky. Adjudications take many years to complete, often more than a decade. Further ambiguities about who holds the rights to trade water—are they the end-users such as irrigators, or intermediaries such as water districts?—can make it unclear to potential buyers who the seller would be.[69] Such problems are the result of past allocations administered without consideration of the possibility of water trading.

Another set of barriers concerns possible externalities associated with water markets. Current uncertainties about the amount and terms of existing water rights are augmented by an array of possibly conflicting claims based on the public trust doctrine,[70] Indian water rights,[71] and third party claims, including possible "area-of-origin" environmental, economic, and community effects. Opportunity costs in lost jobs, income, and tax revenues are increasingly cited by those who oppose the transfer of water from their areas.

Groundwater use also often creates conditions under which

68. A variety of water transfer-related bills are introduced each year in the western state legislatures. Some are designed to facilitate water markets, others to constrain or even prohibit them. *See, e.g., Recent Developments in the Practice of Water Marketing: Transactions, Legislation, and Mitigation*, WATER STRATEGIST, Oct. 1991, at 2.

69. An important bill was introduced in the California legislature in 1991 that attempted to clarify this problem for irrigators and their water districts. A.B. 2090, 1991-92 Leg., Reg. Sess. (1991).

70. *See* Joseph L. Sax, *The Constitution, Property Rights, and the Future of Water Law*, 61 U. COLO. L. REV. 257, 269-71 (1991).

71. The *Winters* Doctrine, based on the decision in Winters v. United States, 207 U.S. 564 (1908), established that a water right was reserved with the land set aside for tribal uses. Its application was most recently upheld in Wyoming v. United States, 109 S.Ct. 2994 (1989), which affirmed the ruling of *In re* Rights to Use Water in Big Horn River, 753 P.2d 76 (Wyo. 1988). A number of Congressional Indian water settlement acts have quantified tribal rights as an alternative to *Winters* litigation. In 1990, for example, Congress enacted three such settlement acts for the Fort Hall Shoshone-Bannock Tribes in Idaho, the Pyramid Lake Paiute and Fallon Shoshone and Paiute Tribes in Nevada, and the Fort McDowell Apache Tribe in Arizona. *See* Fort Hall Indian Water Rights Settlement Act of 1990, Pub. L. No. 101-602, 104 Stat. 3059; Truckee-Carson Water Rights Settlement Act of 1990, Pub. L. No. 101-618, 104 Stat. 3294; Fort McDowell Indian Community Water Rights Settlement Act of 1990, Pub. L. No. 101-628, 104 Stat. 4480.

externalities can occur. Like disputes over surface water rights, these externalities would be reduced if ownership ambiguities were reduced. Overpumping by one user can damage other uses, including use by other pumpers as well as groundwater-based surface uses such as springs and stream flows. The common property status of most groundwater often perpetuates external damages because terms of individual uses are unclear and damaged users' avenues for recourse and compensation tend to be limited. Most states have not adjudicated pumpers' quantitative rights to use groundwater. Instead, the right to pump is based on the correlative right associated with owning overlying lands. Transfers of surface water rights can often be replaced by the transferor with groundwater pumped from common pool aquifers, which in turn can damage other aquifer users. Proposals to use aquifers as "water banks"[72] can help to integrate them into markets and to clarify the terms of their use, but do not necessarily solve ownership and externality problems.

Two additional environmental objections to water markets have recently emerged. First, a lack of ability or willingness to pay for water by some environmental entities is leading either to opposition to markets or to proposals to tax transfers to provide water for environmental uses. The principle that environmental users should pay for water is one which, in addition to legitimizing existing appropriative rights, requires new institutional and financial arrangements among public and private environmental entities. Such options are discussed in Section V below. Second, because most water market transactions have been for urban uses, some anti-growth environmental interests have begun to oppose both water marketing and conservation, which they believe cause new urban growth.[73]

A final objection is based on the desire of many water distribution entities to maintain current levels of control. Such enti-

72. Recent activities in California are perhaps the best illustration. A description of a large groundwater bank is described in Stuart T. Pyle & Richard B. Iger, *The Promise of Water Banking: A Quantity and Quality—Issue Update on Kern Water Bank, in* PROCEEDINGS OF THE SEVENTEENTH BIENNIAL CONFERENCE ON GROUND WATER 72 (1990). A statewide water bank, controlled by state agencies with fixed prices, was initiated in 1991. *See* GOVERNOR'S DROUGHT ACTION TEAM, RESOURCES AGENCY, STATE OF CALIFORNIA, REPORT IN ACCORDANCE WITH EXECUTIVE ORDER NO. W-3-91 (1991).

73. HELEN M. INGRAM, DOES ANYONE WIN? THE COMMUNITY CONSEQUENCES OF RURAL TO URBAN WATER TRANSFERS: AN ARIZONA PERSPECTIVE (University of Arizona, Udall Center for Studies in Public Policy Issue Paper No. 2, 1990).

ties suspect, sometimes validly, that their existing control will be diminished if competing buyers, sellers, or both are allowed to operate within a water market. The most common example in the western states is the typical water or irrigation district concerned with how individual selling or buying activity among members adversely affects system operation or finance. Such concerns are legitimate, and the district can incorporate ways to address them into the rules for water marketing transactions. In Nevada, for example, water transfers by individual members must not undermine the district's financial integrity.[74] In California, a legislative initiative in 1991 sought to establish rules to govern districts' powers over individual water transfers.[75] In Colorado, tradable shares in the Northern Colorado Water Conservancy District provide an innovative solution to this problem.[76] Similar concerns exist among state, federal, and other wholesaling water supply entities, whose allocative duties would be preempted to a degree by water markets.[77] After all, a key benefit of water markets is to engage existing end-users in a new array of opportunities and incentives that bureaucratic allocation procedures now stifle.

2. *Water Quality*

Water quality is also an environmental commodity with trad-

74. Nevada state law allows water rights transfers as long as they "do not adversely affect the cost of water for other holders of water rights in the district . . . ." NEV. REV. STAT. § 533.370 (1989). The federal water settlement legislation enacted by Congress in 1990 deferred to this principle in its authorization of water transfers from the federal Newlands Project. *See* Fallon Paiute Shoshone Indian Tribes Water Rights Settlement Act, Pub. L. No. 101-618, § 3084, 104 Stat. 3289 (1990).

75. California Assembly Bill 2090 (Katz), 1991. Transfers by individual irrigators can, under certain circumstances, have external costs for other irrigators or water rights holders. This reaffirms the need for a transfer of water rights procedure in which such problems can be addressed through formal protests. Many states already have such transfer procedures in place.

76. Building on this example, a proposal for irrigation districts to make "tender offers" similar to corporate stock offerings would allow individual sellers of water rights or contracts to participate in market transactions. *See* Rodney T. Smith, *Water Transfers, Irrigation Districts, and the Compensation Problem*, 8 J. POL'Y ANALYSIS & MGMT. 446 (1989).

77. An important example is the creation of state-run "water banks," which can facilitate water transfers while avoiding the loss of state control that accompanies water markets, such as those in Idaho and established in California in 1991. Similarly, an interstate bank operated by the Secretary of the Interior and state representatives has been proposed for the Colorado River Basin. *See* STATE OF CALIFORNIA, CONCEPTUAL APPROACH FOR REACHING BASIN STATES AGREEMENT ON INTERIM OPERATION OF COLORADO RIVER SYSTEM RESERVOIRS, CALIFORNIA'S USE OF COLORADO RIVER WATER ABOVE ITS BASIC APPORTIONMENT, AND IMPLEMENTATION OF AN INTERSTATE WATER BANK (1991).

ing potential.[78] As noted above, trading *water quantity* rights often has incidental implications for *water quality*, given associated changes in place and manner of use. This country has had some experience with tradeable quantitative water rights, but none with tradeable water quality or pollution rights. Water pollution control laws in the United States have relied primarily on a technology-based approach that sets standards for individual pollutant discharge points. Through permits, agents have regulated the discharges of such "point sources" as paper processing plants, steel mills, and municipally-owned wastewater treatment plants. Public regulatory agencies have been responsible for enforcement of the terms of these permits. Various forms of "best available technology" (BAT) for control have determined allowable pollutant levels in discharges.

While an emissions trading system would require an initial issuance of discharge permits, the rigidity of technological standards for these permits is the antithesis of such trading. Other features of existing policies impede progress toward trading. The federal taxpayer has subsidized the construction of many of the legally-required BAT treatment facilities, alleviating cost-minimization pressures on facility managers.[79] Allowable discharge levels for individual points have often not achieved the basin-wide quality objectives of "swimmable and fishable" waters as originally targeted for 1982 in the Clean Water Act of 1972.[80] Monitoring and enforcement by the Environmental Protection Agency and many state agencies are costly and therefore vulnerable to budget cuts. Perhaps most significant is that the dispersed "nonpoint" sources of pollution have yet to be defined by a permit or discharge rights system. In its amendments to the Clean Water Act in 1987, Congress addressed these problems but did not formulate an

78. Reference material in this section is extracted from Weinberg & Willey, *supra* note 61, and from Zach Willey, *Environmental Quality and Agricultural Irrigation—Reconciliation Through Economic Incentives*, *in* AGRICULTURAL SALINITY ASSESSMENT AND MANAGEMENT 575-576 (Kenneth K. Tanji ed., 1990).

79. *See* THOMAS TIETENBERG, EMISSIONS TRADING: AN EXERCISE IN REFORMING POLLUTION POLICY (1985).

80. The Federal Water Pollution Control Act, 33 U.S.C. §§ 1251-1376 (1982 & Supp. III 1985), originally enacted in 1970, has been amended several times. Failures and successes of the Act continue to be documented nationally. *See* Richard A. Smith et al., *Water Quality Trends in the Nation's Rivers*, 235 SCIENCE 1607 (1987); U.S. GENERAL ACCOUNTING OFFICE, GAO/RCED-89-38, WATER POLLUTION: MORE EPA ACTION NEEDED TO IMPROVE THE QUALITY OF HEAVILY POLLUTED WATERS (1989).

effective incentive mechanism for nonpoint source controls.[81]

Tradeable discharge permits (TDPs) offer an incentive-based system with which regulatory agencies can achieve pollutant loading targets. Under a TDP system, regulatory agencies must quantify these targets and issue permits. Pollutant sources must obtain permits based on their discharge levels, but permits may be traded among sources. Because permits are valuable, they create an incentive to reduce emissions. Each source is free to reduce emissions in a least-cost manner and will do so to the extent that the cost of reducing emissions is less than the cost of buying discharge permits. Thus, unlike the BAT approach, TDPs allow polluters a degree of economic flexibility within the limits of the loading targets, ensuring that discharges are reduced at the lowest overall cost.[82]

Before TDPs can be issued, regulatory agencies must establish loading ceilings that are specific to individual pollutants and basin segments. Agencies must use performance standards when setting these ceilings or "caps" to protect beneficial uses. Congress had performance standards in mind when it designated "fishable and swimmable" goals to be achieved under the provisions of the Clean Water Act.[83] Technical understanding of aquatic ecosystems has progressed considerably since then, and the need to set ecosystem performance-based and environmental quality-based standards to guide the establishment of pollution loading ceilings is becoming apparent.[84] Existing procedures to set "total maximum daily loads" (TMDLs) for watercourses that are in violation of water quality standards are an important step in this direction. Unfortunately, however,

81. Bruce A. Ackerman & Richard B. Stewart, *Reforming Environmental Law: The Democratic Case for Market Incentives*, 13 COLUM. J. ENVTL. L. 2 (1988).

82. Discussions of the properties and types of tradeable permit systems are presented in WILLIAM J. BAUMOL & WALLACE M. OATES, THE THEORY OF ENVIRONMENTAL POLICY (1988). TDP implementation concerns are addressed in TIETENBERG, *supra* note 79. Illustrative analyses of TDP programs for Oregon's Willamette River Basin, and Wisconsin's Fox River Basin are presented in Barbara J. Lence et al., *Cost Efficiency of Transferable Discharge Permit Markets for Control of Multiple Pollutants*, 24 WATER RESOURCES RES. 897 (1988), and in William B. O'Neil, *Transferable Discharge Permit Trading Under Varying Stream Conditions: A Simulation of Multiperiod Permit Market Performance on the Fox River*, 19 WATER RESOURCES RES. 608 (1983).

83. Federal Water Pollution Control Act Amendments of 1972, § 101, Pub. L. No. 92-500, 86 Stat. 816 (1972) (codified in scattered titles and sections of U.S.C.).

84. The necessity of measurable environmental quality as a overarching guide for the EPA's implementation of pollution control programs, including water pollution, is increasingly recognized. *See* U.S. GENERAL ACCOUNTING OFFICE, GAO/RCED-88-101, ENVIRONMENTAL PROTECTION AGENCY: PROTECTING HUMAN HEALTH AND THE ENVIRONMENT THROUGH IMPROVED MANAGEMENT 83 (1988).

TMDLs have rarely been set.[85] Before trading potentials can be realized, such loading ceilings must be established on a broad basis. For highly toxic pollutants, load ceilings would be low, allowing only a limited number of discharge permits and trading possibilities.

The Clean Water Act grants agencies the authority to prevent impairment of other water uses by using pollutant loading targets and the concomitant use of TDPs to achieve such targets. Section 319(b)(4) of the 1987 amendments to the Clean Water Act states that nonpoint source pollutant managers should "to the maximum extent practicable develop programs on a watershed-by-watershed basis."[86] The Act does not specify what type of implementation program is appropriate; this is the states' responsibility. The language 'watershed basis' engenders the option of pollutant trading programs. Congressional leaders have proposed TDPs,[87] and European countries have adopted water quality control programs based on economic incentives and some trading.[88] Extensive pilot studies involving potential trading between point and nonpoint sources of water pollution have been implemented in the Great Lakes Basin, Tennessee, and Colorado.[89]

Most river basins absorb substantial pollution from vast tracts of land containing dispersed nonpoint sources in agriculture, livestock, forestry, mining, septic tanks, atmospheric deposition, and urban storm runoff. But these discharges have yet to be regulated by permitting or other systems that codify the terms under which polluters may discharge. Nutrients, trace elements, salinity, pesticides, hydrocarbons, acidity, and heavy metals are significant pollutants. Discharge permits would

85. *See* U.S. GENERAL ACCOUNTING OFFICE, GAO/RCED-89-38, WATER POLLUTION: MORE EPA ACTION NEEDED TO IMPROVE THE QUALITY OF HEAVILY POLLUTED WATERS (1989).

86. Water Quality Act of 1987, § 319(b)(4), 33 U.S.C. § 1329(b)(4) (1988).

87. *See* ROBERT N. STAVINS ET AL., PROJECT 88: HARNESSING MARKET FORCES TO PROTECT OUR ENVIRONMENT: INITIATIVES FOR THE NEW PRESIDENT: A PUBLIC POLICY STUDY (1988).

88. Gordon M. Brown & Ralph B. Johnson, *Pollution Control by Effluent Charges: It Works in the Federal Republic of Germany, Why Not in the U.S.?*, 24 NAT. RESOURCES J. 929 (1984); Peter Harrison & W.R. Derrick Sewell, *Water Pollution By Agreement: The French System of Contracts*, 20 NAT. RESOURCES J. 765 (1980).

89. *See* John Jaksch & Diane Niedzialkowski, *Speeding Water Cleanup While Saving Money*, 11 EPA J. 8 (1985); Stuart Sessions & Lauren Fillmore, Evaluation of Measures to Control Point and Nonpoint Sources of Pollution to Boone Reservoir, Tennessee, (Feb. 9, 1989) (final report to the U.S. Environmental Protection Agency, Contract No. 68-01-7288).

specify permissible pollutant loads at points of discharge into public waters. Regulatory agencies must establish formulas, based on local plume dispersion and hydrologic conditions, linking discharges at other points in the basin, and between some individual polluters.[90] The lack of a credible system of certified and enforceable permits prevents the financial power of TDPs from being applied toward major new gains in reductions in pollutant loading.

It has long been recognized that issuing individual discharge permits to non-point sources is not feasible given their large numbers and diffusivity. Nevertheless, to control the nonpoint sources in a way that is compatible with the existing National Pollution Discharge Elimination System for point sources, *some* system is required. Larger geographical units, such as irrigation or drainage districts, watersheds within timber or range lands, or urban storm districts, must be the recipients of individual permits.[91] Internal allocation of discharge rights within these units could then proceed in a variety of ways. The charters of these units and the preferences of landowners and other discharging entities would determine how the terms of the permits will be implemented.

While nonpoint source (NPS) permitting is not required under the existing provisions of the Clean Water Act, several states have begun to experiment with programs that permit discharges from nonpoint sources. Florida, Pennsylvania, Nebraska, and Maryland have programs that have used the "back door" to NPS permitting. For example, the South Florida Water Management District was authorized by the state's legislature to control agricultural runoff through permit systems for consumptive use and for surface storage of water.[92] Because of the water quality implications of the program, the District has incorporated water quality concerns into the terms and conditions of those permits.

Such programs are experiments in NPS permitting. Other states and regions are struggling with the same problem—the

90. For a proposed formula to establish weighting of multiple pollutants, see Barbara J. Lence, *Weighted Sum Transferable Discharge Permit Programs for Control of Multiple Pollutants, Water Resources Research*, 27 WATER RESOURCES RES. 3019 (Dec. 1991).

91. For a discussion of the need for entities representing "consortia" of non-point sources within a region, see Jeffrey A. Foran et al., *Regulating Nonpoint Source Pollution in Surface Waters: A Proposal*, 27 WATER RESOURCES BULL. 481-82 (1991).

92. *Id.* at 7.

need to develop accountability among nonpoint sources. Without such accountability, any serious policy of control of NPS pollution is difficult to envision. Certainly obtaining the contractual assurances needed to implement voluntary trading of pollutant loading rights among dischargers will continue to be practically impossible. Indeed, loading discharge compliances, reduction credits, or offsets—whether for regulatory or market-based uses—must be defined, monitored, and enforced if *any* system of NPS control is to produce real results.

Systems for trading among nonpoint sources require careful monitoring and accountability. For example, in California's San Joaquin River Basin, selenium loading from irrigation drainage poses bioaccumulation risks to fish and wildlife. In 1985, waterfowl populations at Kesterson Wildlife Refuge, which received irrigation drainage, had reduced reproduction rates and a greater incidence of birth deformities.[93] To implement a loading ceiling on selenium in the San Joaquin River, associated wetlands, and downstream estuarine systems, NPS selenium loading units must be identified and accountability assigned. While there are some potentials for point sources, particularly downstream refineries, to participate in selenium discharge trades, most of the opportunities may be among the nonpoint sources themselves. Variations in soils and in farming and irrigation practices within the San Joaquin River Basin allow some irrigated areas to invest in others to develop lower cost selenium reduction credits. But such transactions would not be possible unless water quality regulators establish loading rights and allocate them among the entities, such as irrigation or drainage districts, which represent non-point source areas or watersheds.

An important opportunity for the trading of loading rights exists among discharges into Publicly-Owned Treatment Works (POTW). Non-domestic wastes from industrial sources often contain toxins that can interrupt POTW operations, which are typically not designed to treat many toxins that can kill biological agents used in municipal sludge treatment. In addition, toxic discharges can contaminate sludge as well as receiving waters. To address these problems, nearly 1500 POTWs have pre-treatment programs that regulate about

93. *See* NATIONAL RESEARCH COUNCIL, IRRIGATION-INDUCED WATER QUALITY PROBLEMS 11-36 (1989).

30,000 significant industrial users.[94] Each program issues loading rights to these users, usually in the form of a permit, and monitors, inspects, and enforces these rights. TDPs are possible where a number of users are linked to a POTW. Of particular interest here is the potential to increase funding for toxic source reduction programs and facilities among the users.

The setting of loadings caps and distribution of discharge permits is a tough political decision due in part to the economic benefits of permits and the costs of caps. A combination of historic use and auctions may be the most feasible approach to the allocation of both rights to use water and to discharge pollutants. Historic use can be applied to certify existing uses, and auctions can be applied where additional rights are not allocated by historic use. Auctions of water rights have been used elsewhere[95] and are scheduled to be held for a portion of allowable sulfur dioxide emissions rights under the recently reauthorized Clean Air Act.[96] Such auctions have the potential to attract the most economic users as well as alleviate the political problem of agency issuance.

Unlike water marketing, using TDPs as a market-based means to achieve environmental goals is a nascent policy. Yet TDPs have the best potential to control pollution effects without massive and costly regulatory intrusion and constraint on economic activities. There is no policy alternative on the horizon that has the potential to achieve both of these environmental and economic goals. Nevertheless, it appears that the congressional reauthorization of the Clean Water Act initiated in 1991 will neither encourage nor prohibit the development of TDPs.[97] But opposition to TDPs is multi-faceted, and the lack of an existing permit system for the vast nonpoint sector of pollution sources means that the issue of permit distribution is far from settled. Most agricultural and other nonpoint sources of

94. *See* U.S. Environmental Protection Agency, *Clean Water Act Reauthorization: Potential Market Mechanisms—Pretreatment Market Incentives, in* POTENTIAL MARKET FORCE MECHANISMS TO HELP ACHIEVE CLEAN WATER 1 (1991).

95. For a description of actual water rights auctioning systems, see Benjamin Simon & David Anderson, *Water Auctions as an Allocation Mechanism in Victoria, Australia*, 26 WATER RESOURCES BULL. 387 (1990).

96. Clean Air Act Amendments of 1990, 42 U.S.C.A. §§ 7651-7661f (Supp. 1991).

97. For example, a bill introduced into the Senate in 1991 contained a limited use of effluent fees to cover administrative costs and additional authorizations, as in the previous Clean Water Act, for grants to States to develop nonpoint source programs. S. 1081, 102d Cong., 1st Sess. (1991).

water pollution oppose any permitting system at all, and some environmentalists either do not support permitting, which violates a "zero discharge" platform, or support permitting but not tradability of permits. The key economic interest group that should support trading consists of the existing holders of point source permits who need to expand their capacities and could do so more cheaply if trading were allowed.[98] The problem in activating their support is that the incentive to achieve least-cost pollution controls through trading is often not sufficient, particularly among public monopolies, such as sewage districts, with powers to adjust rates according to revenue requirements.

V. Financing Acquisitions of Water Rights and Pollution Discharge Permits for Environmental Uses

Reform of water use and pollution discharge pricing, along with implementation of markets for water rights and TDPs, would provide powerful incentives for conservation and pollution discharge reduction in both the public and private sectors. Arbitrage opportunities among holders of water rights and discharge permits would ensure that substantial financial resources would be unlocked to implement environmental protections. Nevertheless, there would continue to be cases in which further environmental improvement and restoration would be productive. Acquisitions of both water quantity rights as well as further reductions in pollution loads will be necessary to achieve these additional gains.

With public funding for all programs on the decline, substantial legislative appropriations for such acquisitions will probably not be accessible. For example, the 1987 Clean Water Act Amendments[99] substantially increased water quality-related responsibilities for state and federal agencies, but corresponding funding has not materialized. Because a political barrier to markets for both water rights and TDPs is the concern that environmental "buyers" may not have adequate purchasing power, other as yet undeveloped funding sources will be

98. Zach Willey, *At the Crossroads of Control*, Agricultural Engineering, May 1991, at 12.

99. Water Quality Act of 1987, Pub. L. No. 100-4, 100 Stat. 7 (1987) (codified as amended in scattered sections of 33 U.S.C.).

needed to supplement the financing generated by water rights and TDP markets.[100]

As noted earlier, an opposing set of proposals focuses on defining, or redefining, underlying property rights to water resources. By doing so, the problem of financing environmental acquisitions would become moot because wealth transfer issues would be resolved directly by such property right designations. One set of proposals suggests that environmental water rights be held as public trust rights,[101] with the implication that protections be achieved by re-allocating existing private use rights, frequently without compensation. Another proposes clarification of rights and responsibilities by replacing public with private ownership of water rights, including those dedicated to environmental uses, as much as possible.[102] The complexity and controversy involved in the public versus private ownership debate will probably keep the issue in the courts and the legislatures for the foreseeable future. Other approaches to solving the problem of funding environmental acquisitions are needed. None are without problems.

One such approach, noted earlier, is the imposition of taxes on water market transactions. Because this approach appears to have emerging political appeal, it is particularly important to note that both economically and environmentally counterproductive effects are possible. Taxes on water trading will increase the cost to purchasers, making water transfers less economically attractive including possible new source developments that may have environmental costs. At the same time, prices received by sellers will decline, reducing the economic feasibility of financing water conservation and other measures from the income from sales of resulting free-up water. Taxes on markets for water pollution reduction credits, if such markets were allowed to function, would have the same effect.

From a revenue generation perspective, the environmental transfer tax can be counterproductive as well. First, because it increases the price of transfers, less environmental water can be acquired with a given amount of revenue. Second, in many regions of the country, particularly in the western regions, the

100. For a discussion of alternative institutional arrangements to implement such funding, see Moore & Willey, *supra* note 26.

101. *See* Sax, *supra*, note 70.

102. *See* WATER RIGHTS, *supra* note 18.

number of environmental water rights needed for protection and restoration requires substantial revenue-funding requirements. But increasing the transfer tax rate to increase revenues will not produce additional tax revenues unless purchasers' demand is "inelastic"—that is, percentage decreases in amounts of water rights purchased are less than percentage increases in the price that result from the transfer tax.[103] Thus, while transfer taxes to finance environmental acquisitions may be attractive from one perspective on equity—tax those who benefit from water marketing opportunities—they can undermine achieving the goals of encouraging and financing water trades for environmental protections.

An alternative means of generating revenues for environmental acquisitions that does not punish market-based transactions is a system of water user-based surcharges. The financial burdens of environmental protection and restoration would be spread among *all* water users, not just among those interested in trades and transfers. There are two general groups of users—those who use water at the expense of the environment, and those who use water as an environmental resource.

The first group is relatively easy to identify—it includes all water-using and polluting industries, including municipal utilities serving residences. These users divert, consume, and pollute water resources, and an environmental surcharge or fee for their use would generate revenues. State governments would play a pivotal role in authorizing such surcharges for water rights governed by state laws. Federal reclamation contracts could be subject to such user surcharges by Congressional action, as could other federally-supported "indirect" uses such as inland shipping, hydroelectric, grazing, timber, mining, and agricultural commodities. In addition, section 204(b)(1) of the Clean Water Act requires the development of user charge systems with the option of recovering operation and maintenance costs at wastewater treatment facilities. Further amendments to the Act could expand user charge systems to recover costs of water quality degradation and of environmental protection and restoration. In the never-ending federal-state sparring over funding of federal water quality and other

103. The empirical evidence on price elasticity of water demand varies considerably according to type and place of use. For a sampling of elasticities for municipal uses, see SMITH, *supra* note 52, at 92.

environmental programs, federal demands for state cost-sharing could be answered at least in part by revenues generated from such water diversion, consumption, and pollution discharge fees.

The actual specification of fee characteristics would depend upon several factors. Fees would be determined by instream depletions, water quality degradation, and other environmental costs associated with the use. For water quantity, amount, timing, and location of diversion and consumption, along with the water quality and other environmental consequences of that use, would be the key factors. For water quality, these same considerations would need to be applied to types and concentrations of pollutant discharges. There are substantial measurement requirements to incorporate these kinds of factors into fee design. As noted above, many consumption uses as well as pollution discharges are not now measured either for volumes or quality. This shortage of use-related information may require that fee schedules be based on more general use classes that serve as proxies for use and environmental damage. Fee levels would be sized to a basin-wide or regional environmental revenue target.

The other group of water users are those associated with environmental and recreational values. These uses require water quantity and quality to maintain aquatic ecosystems and associated beneficial uses. Establishment of fees for these groups is a very different matter from that for the consumptive use and polluting users. Instead of damages to the resource, benefits from its protection are the key. This is a more difficult undertaking because environmental and recreational users tend to be harder to identify and measure. Some recreational users such as boaters, fishers, and campers are already charged through day-use fees, licenses, and other instruments. An environmental use fee could be included. But many users do not access water resources through organized charge systems, allowing the so-called "free rider" problem to continue. "Non-market" valuation studies and surveys are increasingly being undertaken to estimate benefits to such users, including those who do not directly use the resource but value its existence anyway. This type of research might be useful in helping to design a user fee system for these "non-captured" environmental and recreational users.

The imposition of such fees on these user groups is predictably an unpopular proposal among both. But this is a core issue in environmental politics—the arguments as to why others should pay for environmental quality are as diverse as the environment itself. Further, the disposition of funds generated by such fees would also be controversial, with different interests within the water quality and environmental communities competing along with local, state, and federal agencies. Regardless of how the pie gets sliced, environmental trust funds can be created to manage and disperse these revenues for water quality and environmental improvement projects.

Because these trust funds could be created as new accounts, there would be opportunities to introduce businesslike procedures into resulting environmental acquisitions. Either private or public management of these funds would be possible. There are, however, compelling arguments for using private management, not only for efficiency reasons but also to help avoid the notorious "raids" on such special funds that result from government budgetary and spending battles. Priority systems will be needed, and trade-offs among potential projects will need to be addressed—private management may have a better chance of implementing technically-sound and economically-rational criteria to guide such decisions. Competitive bidding procedures should be a basic tool in the disposition of these funds. In addition, a portion of fee revenues could be applied to the endowment of revolving loan funds, which can leverage additional water quality and environmental investments.

VI. Ending Thoughts

The market-based water policy instruments discussed here are generally not *directly* prohibited under existing state and federal laws. We have seen, however, that there is an extensive and convoluted set of barriers to trading of water rights and pollution discharge permits that will not likely be overcome without explicit legal authorities. State water laws must be clarified if these barriers are to be reduced. Federal laws, including the Reclamation Act, individual reclamation project acts, the Clean Water Act, and other related statutes involving flood control, inland shipping, agriculture, forestry, and hydropower contribute in many cases to the stalemate in market emergence.

Congressional action will be necessary to remove barriers in these laws.

To overcome this stalemate, the underlying political entrenchments must change. The problem is that, on the one hand, while the water-using and polluting industries may like the economic flexibility and opportunities presented by markets, the setting of real and enforceable limits on pollutant loadings would mark the end of the era of free disposal. The targeting of water rights acquisitions for the environment continues to be viewed by many existing water rights holders, as well as would-be water consumers, as a threat rather than an opportunity. On the other hand, environmental interests would welcome the introduction of real and enforceable goals to limit pollution and provide environmental water rights. But implementing these goals with market-based policy instruments is frequently viewed with suspicion. At the same time, government regulators, an important interest group, would face changes in their authorities and responsibilities with the introduction of markets, although some kinds of duties would actually become of higher priority. Elected officials would be less able to deliver water-related benefits to particular constituencies under a market-based system. And third-party claims to water rights and to damages from market transactions can be significant in some cases.

While markets deliver "win-win" outcomes for buyers and sellers, the experience of the past fifteen years indicates the importance of other interests that are threatened by or perceive themselves to be losers from markets. Although significant policy initiatives have been launched, they have generally not been implemented, and many projected curtailments in government control and mismanagement of water resources have not occurred. During this time span, the complexity and magnitude of the "institutional reforms" necessary to simultaneously substitute markets for regulatory price controls and implement specific environmental performance targets have become much clearer.

Markets provide opportunities, not guarantees. Real or not, guarantees, not opportunities, are the currency of the political allocations that have characterized American water policy. But over time, the environmental and economic costs of these political allocations are becoming increasingly unacceptable to

a large enough portion of the body politic that changes seem inevitable. Whether these changes will occur in a timely, equitable, and market-based manner remains to be seen. The overall gains from trading systems are apparent, and the emergence of diverse regional water markets is the sensible result. But overcoming the layers of political, legal, and regulatory complexity is a daunting challenge. The removal of these barriers is a large "water project" that is clearly behind schedule and over budget.