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Water That Is Not Water

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The increased interest in the development of geothermal resources has given rise to the need for the formulation of a legal framework in which this development can be carried out. In this article, Mr. Olpin and Professor Tarlock analyze the proper relationship between western water law and geothermal resources development. They present an argument against the blanket application of western water law and propose a means of accommodating geothermal resources development with the protection of conventional water users.

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I. INTRODUCTION

Anyone desiring to write about western water law soon encounters a problem analogous to one facing all new water users. Just as many western streams are over-appropriated, water law scholarship has been over-appropriated by Frank Trelease. Fortunately, senior scholars cannot make calls on junior scholars and preempt the supply of ideas. But a problem of scholarly preemption remains. There is scarcely an area of western water law on which Dean Trelease has not written comprehensively and with great insight into the problems of this harsh and wonderful region. In the same manner that appropriators seek constantly to develop water not within a system of prior vested rights, we offer the following analysis of a new and potentially complex problem—the proper relationship between western water law and geothermal resources development—to honor Dean Trelease and to circum-

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vent the constraints of scholarly prior appropriation. This article is drawn from a forthcoming larger study and is designed only to outline the major issues that must be faced in establishing a functional relationship between water law and geothermal resources development.

II. THE NATURE OF THE RESOURCE AND ITS RELATION TO CONVENTIONAL WATER RESOURCES

Geothermal energy is energy derived from heat beneath the earth's surface. Sub-surface temperatures are primarily controlled by the conductive flow of heat through solid rocks, the convective flow in circulating fluids, and by mass transfer in magma. "Where conduction is dominant, temperatures increase continuously with depth, but not at a constant gradient. The important interrelations are those between thermal gradient, heat flow, and thermal conductivity. . . ."[1] At the present time we are unable to exploit commercially the heat produced by the thermal gradient. Instead, commercial interest centers on the exploitation of hydrothermal convective systems,[2] geothermal anomalies. The Far West is an area of recent volcanism, high regional conductive heat flow and a relatively shallow mantle. As a result there are a number of "hot spots" where high silica varieties of volcanic rock at shallow levels below the crust can sustain high-temperature

1. White, *Characteristics of Geothermal Resources*, in GEOTHERMAL ENERGY: RESOURCES, PRODUCTION, STIMULATION 69, 72 (Kruger & Otte eds. 1973). The best comprehensive technical introduction to geothermal resources is PROCEEDINGS, SECOND UNITED NATIONS SYMPOSIUM ON THE DEVELOPMENT AND USE OF GEOTHERMAL RESOURCES, Vol. I-III (1976) [hereinafter cited as UNITED NATIONS SYMPOSIUM].
2. In 1975 the installed global geothermal electrical generating capacity was only 1,400 megawatts. ENERGY: GLOBAL PROSPECTS 1985-2000 39 (Wilson 1977). At the present time only one geothermal field in the United States, The Geysers, north of San Francisco, produces electricity commercially. The present total output of the Geysers is about 500 megawatts. Commercial production is also anticipated in California's Imperial Valley and the Roosevelt Hot Springs area in Utah. In the early 1960's and 1970's projections for geothermal production were very optimistic, but these projections have now been revised downward, in response to a more realistic understanding of the limits of current technology to exploit the resource at rates competitive with conventional power sources. The leading assessment of geothermal reserves in the United States, ASSESSMENT OF GEOTHERMAL RESOURCES OF THE UNITED STATES-1975 argues that known high temperature convection systems alone could supply 30,000 megawatts for 100 years or 100,000 megawatts for 30 years at prices between one and two times current power costs. The history of reserve estimates is summarized in SCARTO, STATE POLICIES FOR GEOTHERMAL DEVELOPMENT (National Conference for State Legislatures 1976). In 1976, fifty-two geothermal wells were drilled in the states of California, Idaho, Nevada, Oregon and Utah. Of these "39 (75%) are now considered to have found at least potentially commercial quantities of steam or hot water . . ." Smith, Isselhardt & Matlick, *Summary of 1976 Geothermal Drilling—Western United States*, 5 GEOTHERMAL ENERGY 8 (May 1977).

convection systems for a prolonged period of time.[3] These geothermal reservoirs can be tapped and heat extracted from the transfer medium for the production of electricity and other uses such as space heating. There are two types of hydrothermal systems with commercial potential: vapor and liquid dominated systems. A vapor-dominated system is thought to be caused by a very high-temperature hot-water system with a low recharge rate so that more water is boiled off than is being replaced by recharge. The result is high-temperature steam which transfers the heat to the surface. In a liquid-dominated system, the heat transfer medium is water trapped by a relatively impermeable formation with few fractures or inter-connected pores. This water may contain brines of a high salinity and can be "flashed" to produce steam or converted by other technologies such as the binary cycle.[4]

According to the United States Geological Survey, there are three known vapor-dominated fields with commercial potential in the United States, but there are many potential liquid-dominated fields.[5] The Geysers in Northern California is already in commercial production and is thought to have a potential of 1000-2000 megawatts. The other two potential steam fields are located in Yellowstone and Mount Lassen Volcanic National Parks. Geothermal leasing is prohibited in national parks[6] so liquid-dominated systems will be the source of commercial geothermal production in the foreseeable future.

Conflicts with conventional water users may result from the exploitation of a liquid-dominated system. Development

3. A geothermal reservoir with appreciable commercial potential has four characteristics identified by the United States Geological Survey. They are: (1) a temperature between 150-400° Fahrenheit, (2) a depth of less than 10,000 feet to permit drilling, (3) sufficient permeability of the rocks to allow the heat transfer agent—water or steam—to flow continuously at a high rate, and (4) sufficient water recharge to maintain production for a number of years. Goodwin, *et al.*, *Classification of Public Lands Valuable for Geothermal Steam and Associated Geothermal Resources*, GEOLOGICAL SURVEY CIRCULAR 647 (1971).
4. "Flashing" converts a hot liquid into steam by lowering the pressure of heat transfer medium as the liquid is injected into a flash separator which separates the vapor from the remaining liquid fraction. A binary cycle concept uses a heat exchange system to transfer a fraction of the brine enthalpy to vaporize a secondary working fluid. "Expansion through a turbine to a lower pressure, fixed by the heat rejection temperature, provides the means for power generation." Austin, *Prospects for Advances in Energy Conversion Technology for Geothermal Development*, in UNITED NATIONS SYMPOSIUM, at 1925, 1927 (1976).
5. ASSESSMENT OF GEOTHERMAL RESOURCES OF THE UNITED STATES—1975, *supra* note 2.
6. 30 U.S.C. § 1014(c) (1970).

of the field may interfere with the quantity and quality of water available to conventional water users, primarily high capacity pumpers. A geothermal field may tap liquids which are part of a developed ground aquifer causing a diminution in the pressure and quantity of "sweet water" available to a conventional user. Both for conservation reasons and to comply with the no-discharge policy of the 1972 Federal Water Pollution Control Act Amendments, liquid wastes must be reinjected into the reservoir after the conversion of the liquid to steam, and thus there is a risk of groundwater contamination.[7]

Whether or not these conflicts will actually occur depends upon the physical relationship between a geothermal reservoir and an aquifer dedicated to conventional uses. The law structuring the relationship between geothermal and conventional water uses should flow from physical relationships between the two resources. Unfortunately, there is a critical lack of scientific information concerning the physical nature of geothermal resources and their relation to conventional groundwater resources.

There is general agreement among scientists that the ultimate source of heat in a geothermal reservoir is the natural radioactivity of the earth.[8] Beyond this it is difficult to generalize about the origins of the heat and heat transfer medium in a particular reservoir. This scientific uncertainty poses a complex problem for lawyers concerned with developing an allocative regime for geothermal resources. There is a high level of consensus that goethermal energy is a relatively clean resource, and it should be developed as an alternative to fossil fuel and nuclear energy;[9] however, when one tries to fit geothermal energy into an existing property rights scheme or to

7. *See* STANFORD ENVIRONMENTAL LAW SOCIETY, GEOTHERMAL ENERGY: LEGAL PROBLEMS OF RESOURCE DEVELOPMENT 25-27 (1976); Swanberg, *Physical Aspects of Pollution Related to Geothermal Energy Development*, in UNITED NATIONS SYMPOSIUM, at 1435 (1976).
8. Muffler, *Summary of Section II, Geology, Hydrology, and Geothermal Systems*, in UNITED NATIONS SYMPOSIUM, at xlv (1976).
9. The leading scientific critic of the blanket proposition that geothermal energy poses no significant environmental risks has nonetheless concluded with respect to the adverse environmental impacts which may occur from field development: "every field presents a unique mix of environmental problems, and most of the worst impacts are avoidable. In short, each geothermal installation presents abundant opportunities for creative environmental engineering." Axtmann & Peck, Geothermal Chemical Engineering, 22 AM. INST. CHEM. ENJ. J. 817, 823 (1976). *See generally* Tarlock & Waller, *An Environmental Overview of Geothermal Resources Development*, 13 LAND & WATER L. REV. 289 (1977).

create a new one, one must confront the problem that there may be rival claimants to the heat transfer medium. The purpose of this article is to describe briefly what is known about the relationship between geothermal resources and conventional sources of water in order to analyze the proper relationship between the law of geothermal development and western water law.

In a liquid or vapor dominated system, heat is transferred in a medium containing water. However, the presence of water alone should not determine whether geothermal resources should be allocated as water. A conventional groundwater user draws from circulating systems which are relatively shallow compared to geothermal systems. Use of these recharging or non-recharging systems is the limit of the pumper's historic expectations. Geothermal resources should be allocated as water only when a geothermal developer is drawing from the same source of water as a conventional groundwater user. Science provides no blanket answer to this question for every reservoir is different. In some cases shallow groundwaters will be heated by a geothermal system. In other cases geothermal fluids will be formed by processes unrelated to the initial supply and recharge of conventional groundwater basins. But, considerable evidence has accumulated from different systems throughout the world to suggest that in order to have a viable geothermal system the heat source must be sealed from a conventional groundwater source and whatever mixing between the sources that does occur, occurs late in the fluid formation cycle.[10] In short, there is a scientific basis to presume non-interference between geothermal developers and conventional groundwater users.

The scientific basis behind the presumption is a distinction between sources of water based on the length of time the water has been in the ground. Controversies over the nature of geothermal resources go back to the seventeenth century, but recently it became necessary to resolve the controversy at the Big Geysers in Northern California. Rival geothermal developers held conflicting leases from the surface

10. *E.g.*, Stefansson & Arnorsson, *A Comparative Study of Hot-Water Chemistry and Bedrock Resistivity in Southern Lowlands of Iceland*, in UNITED NATIONS SYMPOSIUM, at 1207; Tezcan, *Geophysical Studies in Saraykoy-Kizildere Geothermal Field Turkey*, in UNITED NATIONS SYMPOSIUM, at 1231.

and mineral owners. A very sophisticated trial court opinion held for the mineral lessee on the basis of expert testimony that the fluids were formed from connate as opposed to juvenile waters.[11] Connate waters are waters trapped within a host formation for millions of years. When the intrusive system expels volatiles, the connate waters are absorbed from the host rock and, after a complex process, are boiled several times before they reach the surface as a heat transfer medium. One cannot generalize from the Geysers to every geothermal reservoir, but the experience in Northern California indicates the scientific potential exists for segregating geothermal fluids from conventional sources of water.

We argue that a geothermal reservoir is simply a natural resource to be exploited efficiently for commercial uses. Exploitation should be regulated for environmental and conservation reasons so the developer is forced to bear all the costs of exploitation. Subject to these constraints, geothermal energy should be allocated, as have other resources in the past, through the recognition of private rights subject to well-defined police power regulations.[12] However, the nature of the likely heat transfer medium—water— poses a problem for geothermal developers and regulators attempting to integrate the resource into existing property rights and regulatory regimes. Two analogies have been suggested to accomplish this result.

11. We have drawn on the deposition of Dr. Carl Austin, Naval Weapons Center, China Lake, California in Geothermal Kinetics v. Union Oil Co., Inc., No. 75314 (Superior Court for Sonoma County, California). The decision was filed June 1, 1976, and affirmed by the Court of Appeal of the State of California, First Appellate District, Division Three, Nov. 15, 1977, ___ Cal. App. 3d ___, 141 Cal. Rptr. 879 (1977). For a more general statement of Dr. Austin's testimony written for the lawyer *see* Austin, *Technical Overview of Geothermal Resources*, 13 LAND & WATER L. REV. 9 (1977).

12. Sato & Crocker, *Property Rights to Geothermal Resources: Part I*, 6 ECOLOGY L.Q. 250 (1977) make a contrary argument. They assert that the state has the power to declare all geothermal resources underlying privately held lands to be public resources subject to lease by the state. Three analogies are put forward in support of the thesis. The first is the elimination of unused riparian rights when a state shifts from the common law to prior appropriation; the second is the limitation of landowner trespass claims for overflights; and the third is the long standing recognition of the navigation servitude. These analogies are said to support the theory that all property rights are based on reasonable expectations and because "[u]ntil the recent activity concerning geothermal resources, most land owners had no expectation of capturing the resources value. Therefore, if incidents of landownership should be held to include property rights in these resources, the landowner would receive a windfall." *Id.* at 316. Part II of the study recommends that geothermal rights be allocated by an administrative agency applying a prior appropriation system similar to that used to allocate western groundwater. Sato & Crocker, *Property Rights to Geothermal Resources: Part II*, 6 ECOLOGY L.Q. 481 (1977).

We disagree with both of the principal conclusions of the Sato-Crocker study. The argument for state ownership is unconvincing for two reasons. First, the analogies relied upon by Sato and Crocker do not support their conclusion. The first

Federal and much state legislation proceeds on the assumption that geothermal reservoirs are analagous to oil and gas reservoirs, and thus the resource should be regulated as a mineral. Other state legislation and scholarly commentary proceed on the assumption that because the heat transfer medium is water, the resource is water.

III. EXISTING CLASSIFICATIONS OF GEOTHERMAL RESOURCES

A. *Federal and State Geothermal Legislation*

The federal government and thirteen Western states have some form of regulation of geothermal resources to promote their development. Prior to the passage of federal and state legislation there was great uncertainty as to the proper legal classification of geothermal resources, and it was argued that this uncertainty impeded their development.[13] When the federal government and the states turned to the problem of encouraging and regulating geothermal development, most legislation followed either the mineral or water model, although some states classified geothermal resources as *sui generis* to no particular end. Most federal and state geothermal legislation was enacted between 1967 and 1975. Because the

two analogies provide scant support for an assertion of the state's power to shift resources from private to public uses for they involve only the recognition of correlative rights among competing resource users. The third analogy provides mild support for such a shift, but the navigation servitude doctrine should not be extended to the recognition of state ownership of geothermal resources. Normally, expectations that private ownership rights will be recognized by the government are valid unless the state puts affected property owners on notice that the claims will not be recognized. Michelman, *Property, Utility, Fairness: Comments on the Ethical Foundations of "Just Compensation" Law*, 80 HARV. L. REV. 1165 (1967). The understanding is not, as Sato and Crocker suggest, that expectations need not be recognized if the property owner has only recently come to rely on exploiting a new and now valuable use of his property. The burden is on the state to put the property owner on notice of non-recognition, as it has allegedly historically done with respect to the navigation servitude; the state should not be able to invoke a non-expectation rules simply because the value of a resource has only been recently recognized. Our second ground of disagreement flows from this analysis. Adoption of the Sato-Crocker rule might lead to the inefficient allocation of resources because it creates a disincentive for property owners to respond to societal demands for new uses of their property.

An administrative prior appropriation system is recommended because the permit granting agency can manage the reservoir, by timing the issuance of and conditioning permits, to maintain optimum reservoir levels over time. Unitization, based on the oil and gas model, is rejected, in part, because the transaction costs are high. Sato & Crocker, *Property Rights to Geothermal Resources: Part II*, 6 ECOLOGY L.Q. 527-38 (1977). In light of the high cost to a public agency of acquiring adequate information to implement their proposed administrative management system, we conclude that unitization is the most efficient method of conserving geothermal resources. *See* Goldstein, *Unitization for Geothermal Resources: United We Save*, 13 LAND & WATER L. REV. 159 (1977).

13. Olpin, *The Law of Geothermal Resources*, 14 ROCKY MTN. MIN. L. INST. 123 (1968).

resource was considered a clean one environmentally at this time, the primary objective of most legislation was to provide a legal structure which would induce development of the resource. The federal government and most states authorized leasing on lands they owned. Most states undertook to provide a definition of a leaseable private resource and to regulate drilling on privately owned lands to prevent blowouts and pollution. Some states enacted compulsory unitization statutes to increase the efficiency of resource recovery.

The federal government and most of the states define geothermal resources but not in a manner designed to integrate them into the property rights regimes of other resources.[14] Rather, geothermal resources have been defined almost exclusively for the purposes of assigning them to an existing regulatory regime to provide a definition of a leaseable resource. Integration problems, for the most part, have been postponed. For this reason, to solve the problems we are addressing, no great weight can be assigned to the existing definitions. This is unfortunate because it affects where geothermal resources are placed in the scheme of previously recognized property rights systems, although it is simplistic to assume that classification will resolve all conflict problems. Constitutional protection of vested property rights prevents legislatures from solving all conflicts by the simple expedient of classification, but a definition can avoid some conflicts and provide a framework for the solution of others.

Scientifically, geothermal resources are simply useable heat energy from beneath the earth's surface, and thus they are neither conventional mineral or water resources. However, the medium by which the heat is transferred is important to the lawyer because other resource users may assert competing claims to the medium. In the West, the medium will initially either be steam or heated waters consisting of low to high saline brines if the reservoir is a hydrothermal convec-

14. A useful discussion of the purpose of classification, emphasizing the need to separate geothermal from water resources, is SCARTO, STATE POLICIES FOR GEOTHERMAL DEVELOPMENT: UNCOVERING A MAJOR RESOURCE 43-46 (National Conference of State Legislatures 1976). *See also* Elmer & Rogers, *Legal Issues in the Development of Geothermal Resources of Texas and Louisiana Gulf Coast*, in V SECOND GEOPRESSURED-GEOTHERMAL ENERGY CONFERENCE (Center for Energy Studies, University of Texas 1976), which contains a useful discussion of existing statutes. The authors emphasize the need to define more precisely the different sources of geothermal energy.

tion system. Also, proposals exist to exploit hot dry rocks by injecting water into the formation and taking it out as steam.[15] If the exploitation of hot dry rocks proves commercially feasible, the medium will, of course, be conventional water. Thus, the heat transfer medium links geothermal resources to water, but the use to which they are put does not. Heat will be generally used to produce electricity so functionally geothermal resources are linked to hydrocarbon minerals, although the mechanics of an oil and gas reservoir and a geothermal reservoir are quite different. In short, neither analogy provides an adequate characterization of the resource.

Because the object of state legislation has been to promote geothermal resource development, it is not surprising that many states elected, directly or indirectly, to treat geothermal resources as minerals. Mineral resources are generally owned by the state, the discoverer, or the overlying landowner, and the classification of geothermal resources as minerals has the advantage of assigning them to a regime where exclusive property rights are recognized. Water, on the other hand, is said to be the property of the state in the sense that the state, in its sovereign capacity, is trustee for the public. Private rights can be obtained but usually by a valid appropriation. If geothermal resources are classified as water, the overlying landowner would have no right to lease them if he had not perfected an appropriation. State "ownership" could be used by the state to assert an exclusive right to lease all non-federally-owned geothermal resources and to collect royalties from state lessees. There have been vigorous constituencies within each state to treat geothermal as water, so states sometimes have dual classifications embedded within their statutes even when the resource is formally defined as a mineral or at least not water.

California and New Mexico were the first states to regulate geothermal development, and other states have either followed their lead or that of the Geothermal Steam Act of 1970. California defines geothermal resources as:

> [T]he natural heat of the earth, the energy, in whatever form, below the surface of the earth present in,

15. Ewing, *Stimulation of Geothermal Systems*, in GEOTHERMAL ENERGY: RESOURCES, PRODUCTION, STIMULATION 217 (Kruger & Otte eds. 1973).

> resulting from, or created by, or which may be extracted from, such natural heat, and all minerals in solution or other products obtained from naturally heated fluids, brines, associated gases, and steam, in whatever form, found below the surface of the earth, but excluding oil, hydrocarbon gas or other hydrocarbon substances.[16]

New Mexico[17] and Hawaii[18] follow the California model. Regulatory jurisdiction is assigned to the state oil and gas commission in California and New Mexico and the state lands department in Hawaii.

An immediate problem presented by the California definition is the characterization of the heat transfer medium. The definition does not clearly include water as a geothermal resource. The energy and extracted solution materials clearly are; oil, hydrocarbon gas and other hydrocarbon substances are not. It could be argued that water is part of the resource by virtue of the provision including energy "in whatever form" since the energy is usually in fluids that are the transporting media for geothermal energy. But, a contrary argument can be made from the definition's inclusion of minerals and other products derived from natural fluids, brines and associated gases, and steam suggesting that only the extracted substances are part of the resource and substances from which the extraction is made are not.

Oregon[19] and Idaho[20] have adopted the California definition but go further and take a position on the heat transfer medium. Oregon excludes hot waters of less than 250° Fahrenheit bottom hole temperature at depths less than 2000 feet from its definition of geothermal resources, and thus the state has a dual mineral-water regime for geothermal resources. The 250° or under limitation was selected to exclude the hot-water wells around Klamath Falls and other areas of the state which have long been used for space heating. These wells are treated as water wells and to date the state has not restricted hot-water pumping.[21] Idaho adds the following to

16. CAL. PUB. RES. CODE § 6903 (West 1977).
17. N.M. STAT. ANN. § 65-11-3 (Supp. 1975).
18. HAWAII REV. STAT. § 182-1(1) (Supp. 1975).
19. ORE. REV. STAT. § 522.005(7) (1975).
20. IDAHO CODE § 42-4002(c) (1977).
21. Interview with Mr. Chris Wheeler, Deputy Director, Oregon State Department of Water Resources, Salem, Oregon (Aug. 15, 1977).

the California definition: "Geothermal resources are found and hereby declared to be *sui generis*, being neither mineral resource nor a water resource, but they are also found to be closely related to and possibly affecting and affected by water and mineral resources in many instances." Geothermal resources in Idaho might be more aptly characterized as *quasi sui generis* resources, and the Idaho solution teaches that just as assignment to a traditional natural resource category does not solve hard conflicts among resource users, the creation of a meaningless new classification is equally ineffective for it creates no new protection for either the water user or geothermal developer. Geothermal development is regulated by the Idaho Department of Water Administration so, in effect, the resource is water. Idaho has a leasing statute, and an appropriation is required for a geothermal well that involves the use of water. Montana has adopted the Idaho definition in its statute authorizing geothermal leasing on state lands, but recognizing the difficulties of the *sui generis* classification, adds "unless the context requires otherwise."[22]

The other competing definition of the resource is the federal definition. Section One of the Geothermal Steam Act of 1970 provides:

> Geothermal steam and associated geothermal resources means (i) all products of geothermal processes, embracing indigenous steam, hot water and hot brines; (ii) steam and other gases, hot water and hot brines resulting from water, gas, or other fluids artifically introduced into geothermal formations; (iii) heat or other associated energy found in geothermal formations; and (iv) any byproduct derived from them:
> . . .
> "Byproduct" means any minerals (exclusive of oil, hydrocarbon gas, and helium) which are found in solution or in association with geothermal steam and which have a value of less than 75 per centum of the value of the geothermal steam or are not, because of quantity, quality, or technical difficulties in extraction and production, of sufficient value to warrant extraction and production by themselves.[23]

The major difference between the federal and California definitions is that the federal definition explicitly includes the

22. MONT. REV. CODES ANN. § 81-2602 (Supp. 1975).
23. 30 U.S.C. § 1001 (1970).

heat transfer medium within the definition of the resources. Otherwise both the California and mineral definition treat geothermal heat as essentially a mineral resource. Arizona[24] and Colorado[25] have adopted the federal definition, but Arizona goes further by including "any artificial stimulation or induction thereof" of the geothermal reservoirs within the definition and it has a slightly different byproduct definition than the federal definition. Arizona has apparently anticipated the possibility that steam may be produced by injecting water into hot rocks. Washington's statute is similar to the federal model in that the heat transfer medium is included in the definition of the resource, but geothermal resources are limited to those "from which it is technologically possible to produce electric energy commercially. . . ."[26]

A final group of states have not adopted either of these definitions but treat the resource as water. Wyoming amended the definition of underground water in 1973 to include "geothermal steam and hot water,"[27] and an appropriation permit is required. Utah apparently reached the same result. The resource is not yet defined in Utah law, but in 1973 the division of water rights was given jurisdiction over "all wells for the discovery and production of water to be used for geothermal energy production in the State of Utah. . . ."[28] Similarly, Montana includes geothermal resources on privately owned lands within the definition of groundwater in the water code.[29] Nevada, which has many potential geothermal sites, classified the resource as water by a 1965 opinion of the Deputy Attorney General and required all drillers to obtain a permit to appropriate. In 1975 the situation became somewhat more confused when the legislature defined the resource simply as "heat or other associated geothermal energy found beneath the surface of the earth."[30] Regulation is still in the State Engineer's Office, but the 1975 legislation allows him to adopt special regulations for geothermal development.

24. ARIZ. REV. STAT. ANN. § 27-651(5) (1976).
25. COLO. REV. STAT. § 34-70-103 (Supp. 1976).
26. WASH. REV. CODE ANN. § 79.76.030 (Supp. 1976).
27. WYO. STAT. § 41-121 (Supp. 1975). However, the State Board of Land Commissioners uses the California definitions in lease forms for state lands. SCARTO, STATE POLICIES FOR GEOTHERMAL DEVELOPMENT, *supra* note 14, at 44.
28. UTAH CODE ANN. § 73-1-20 (Supp. 1977).
29. MONT. REV. CODES ANN. § 89-867(1) (Supp. 1975).
30. NEV. REV. STAT. § 322.005 (1975). *See* SCARTO, STATE POLICIES FOR DEVELOPMENT OF GEOTHERMAL ENERGY, *supra* note 14, at 44.

These statutory definitions are not the only place where the relationship between geothermal and water resource development is addressed. States have references to water used in geothermal development, water recovered from steam and liquid brines, and waste disposal. However, these additional references add little to the resolution of the conflicts with which we are concerned.

B. Relation Between Geothermal and Water Rights

Some states recognize the possibility that a geothermal well may interfere with a conventional water use. The statutes solve the problem by treating the geothermal developer as an appropriator in those cases where the state water agency or an existing water user contests a geothermal well permit. For example, the statutes in Colorado and Washington seem to cast the burden of proving non-interference on the geothermal developer.[31] In discharging the burden, however, the statutes give the geothermal operator the same rights as a conventional groundwater pumper. Washington's statute provides that a permit shall not be granted if the Department of Natural Resources "finds that the operation of any well will unreasonably decrease ground water available for prior rights in any aquifer . . . unless such rights are acquired by condemnation, purchase, or other means."[32] Under Washington law, a pumper has a right only to the maintenance of the water table at the safe annual yield so an assertion of a right to lift above that level could not be used to defeat a geothermal claim.[33] Only California has tried to avoid water geothermal conflicts by a statutory procedure which allows the geothermal developer to make a preliminary showing of non-interference. This statute is discussed in detail in Section VI.

Another water problem addressed by some geothermal statutes is the well that produces water for conventional uses rather than energy. These wells are treated as water wells, and an appropriation permit must be obtained. For example,

31. COLO. REV. STAT. § 34-70-107(4) (Supp. 1976); WASH. REV. CODE ANN. § 79.76.080 (Supp. 1976). In Colorado the State Engineer must determine whether or not inappropriated water is available except where the "permit clearly does not contemplate the appropriation or use of groundwater." *See* Vranesh & Musick, *Geothermal Resources: Water and Other Conflicts Encountered by the Developer*, 13 LAND & WATER L. REV. 109 (1977).
32. WASH. REV. CODE ANN. § 79.76.080 (Supp. 1976).
33. WASH. REV. CODE ANN. § 90.44.070 (Supp. 1976); *see* A SUMMARY DIGEST OF STATE WATER LAWS 779 (Dewsnup & Jensen eds. 1973).

in Washington a geothermal well that produces only water suitable for beneficial uses is converted to a water well.

C. *Judicial Classifications of the Resource*

Courts have addressed the classification of geothermal resources in two contexts: title disputes where the surface and mineral estates were severed prior to the recognition of the commercial worth of geothermal resources and tax deduction allowance claims. In both contexts the courts have unanimously held that geothermal resources are minerals.[34] Unfortunately, the resolution of the mineral versus surface conflict does not answer the important question which principally concerns us here. It is useful to have the question of proprietorship answered, whoever the ultimate victor might be, since the elimination of doubt will remove a potential deterrent to development. Once proprietorship is settled, prospective geothermal developers know whom to approach to secure development rights. But, proprietorship does not determine whether or how state water laws might apply to geothermal development. Surprisingly, on this there seems to be some unwarranted confusion. One state water agency has expressed concern that a victory for the mineral owner would strip that agency of power to regulate water extraction through geothermal wells, but this need not follow. It is logical to assign proprietorship to the mineral owner and at the same time regulate geothermal wells pursuant to water laws. This would multiply the number of steps for the would-be developer. The developer would have to secure both a geothermal lease or other property right from the mineral owner (or the surface owner if the cases should go the other way) and an appropriative right from the state for any water to be produced. This two-step process has been routinely followed in both Utah and Nevada.

The mineral-surface owners title dispute cases, however, have important implication for regulatory choices. For the

34. United States v. Union Oil Co., 369 F. Supp. 1289 (N.D. Cal. 1973), *rev'd*, 549 F.2d 1271 (9th Cir. 1977), *cert. denied*, 46 U.S.L.W. 3287 (No. 76-1796). State of California v. Pariani, No. 657-291 (Superior Court for County of San Francisco, California 1977); and Geothermal Kinetics, Inc. v. Union Oil Co., No. 75314 (Superior Court for Sonoma County, California 1976), *aff'd*, ___ Cal. App. 3d ___, 141 Cal. Rptr. 879 (1977). *See generally* Bjorge, *The Development of Geothermal Resources and the 1970 Geothermal Steam Act—A Law in Search of a Definition*, 46 COLO. L. REV. 1 (1974). The leading case upholding a depletion allowance for a geothermal resources is Reich v. Commissioner 454 F.2d 1157 (9th Cir. 1972).

most part, the courts in these cases have exhibited a willingness to look behind labels and to inquire into what kind of water is involved in geothermal phenomena. The Court of Appeals for the Ninth Circuit was satisfied the congressional action with respect to water for livestock raising did not establish the legal order that should be applied to "underground sources of energy for use in generating electricity."[35] A California trial court has rejected the argument that surface owners should have geothermal rights because they have rights to freshwater when, for the surface owners' purposes, "there is no realistic basis to find that the water condensed from the steam is or could be beneficial."[36] This same willingness to discriminate should allow regulatory choices to be made on more substantial grounds than labels such as water and mineral. It may make sense to apply some of the laws and regulations dealing with water resources or with mineral resources. On the other hand, it may make sense to create new laws and regulations tailored specifically for geothermal resources.

IV. DEVELOPMENT ON FEDERAL LANDS

The Geothermal Steam Act of 1970[37] removed considerable doubt as to whether geothermal development rights could be obtained in federal lands. Prior to the passage of the Act, would-be developers had sought to secure development rights under the Mining Law of 1872[38] and the Mineral Leasing Act of 1920,[39] but the Department of the Interior took the position that neither statute was apt and, indeed, that no legal authority existed under which development rights could be obtained.

In opening federal lands for development, the 1970 Act followed the pattern of the Mineral Leasing Act in providing a system of competitive and noncompetitive leasing.[40] The question of the availability of development rights under prior law was addressed by granting limited privileges to convert mining claims and mineral lease rights to geothermal leases

35. United States v. Union Oil Co., *supra* note 34, at 1279.
36. Geothermal Kinetics, Inc. v. Union Oil Co., No. 75134 at 17 (Superior Court for Sonoma County, California 1976), *aff'd*, ___ Cal. App. 3d 141 Cal. Rptr. 879 (1977).
37. 30 U.S.C. §§ 1001-25 (1970).
38. 30 U.S.C. §§ 22 *et seq.* (1970).
39. 30 U.S.C. §§ 181 *et seq.* (1970).
40. 30 U.S.C. § 1003 (1970).

under the new Act.[41] The issue of state water rights, though discussed during congressional deliberations, was essentially left unresolved. After some thrashing about on water rights, Congress ducked the issue:

> Nothing in this chapter shall constitute an express or implied claim or denial on the part of the Federal Government as to its exemption from State water laws.[42]

Some state water agencies contend the result of this language is that state water laws apply, and in states requiring permits or other authorizations to drill water wells, those same permits and authorizations are required to drill geothermal wells on federal lands.[43] Neither the Department of the Interior nor any federal lessee has challenged this assertion of state regulatory power. In this section, we will consider whether a successful challenge might be made.

A. Provisions in the Geothermal Steam Act Dealing With Water

The words Congress used in defining geothermal resources are broad enough to include water.

> (c) "geothermal steam and associated geothermal resources" means (i) all products of geothermal processes, embracing indigenous steam, hot water and hot brines; (ii) steam and other gases, hot water and hot brines resulting from water, gas, or other fluids artificially introduced into geothermal formations; (iii) heat or other associated energy found in geothermal formations; and (iv) any byproduct derived from them;[44]

This definition differs from definitions adopted in some states (including California), where there is considerable doubt as to whether the water content is part of the defined resource.

Byproducts of geothermal resources are also defined in the Act.

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41. 30 U.S.C. § 1003(a)-(f) (1970).
42. 30 U.S.C. § 1021 (1970).
43. *See, e.g.*, U.S. DEP'T OF THE INTERIOR, FINAL ENVIRONMENTAL STATEMENT FOR THE GEOTHERMAL LEASING PROGRAM, Vol. III, at C-D 23 (the Colorado position) and C-D 25 (the Nevada positions). The Department of the Interior responded that the proposed federal regulations were adequate "to put the public on notice that states' rights are not in any way enlarged, diminished, or modified" by the regulations. *Id.* Vol. III, at C-74.
44. 30 U.S.C. § 1001(c) (1970).

> (d) "byproduct" means any mineral or minerals (exclusive of oil, hydrocarbon gas, and helium) which are found in solution or in association with geothermal steam and which have a value of less than 75 per centum of the value of the geothermal steam or are not, because of quantity, quality, or technical difficulties in extraction and production, of sufficient value to warrant extraction and production by themselves;[45]

The byproducts definition appears to be aimed at minerals in solution that might profitably be extracted; it does not seem to include the geothermal fluids that contain those solution minerals. A subsequent provision of the Act, however, injects some uncertainty.

> If the production, use, or conversion of geothermal steam is susceptible of producing a valuable byproduct or byproducts, including commercially demineralized water for beneficial uses in accordance with applicable State water laws, the Secretary shall require substantial beneficial production or use thereof unless, in individual circumstances he modifies or waives this requirement in the interest of conservation of natural resources or for other reasons satisfactory to him.[46]

The structure of this last sentence suggests that commercially demineralized water is a byproduct and requires that beneficial use of such water be in accordance with state water laws. The Act is entirely silent on whether there is also state authority to regulate the production of noncommercial water. The question is posed whether state law applies to water which evaporates or which is reinjected or which must be treated as waste because it is unfit for beneficial uses. The most that can be said is that the provision by inference seems to negate state regulatory power. If it was necessary to provide explicitly that state laws apply to the use of commercially demineralized water, it must be that state laws would not otherwise apply. Although this analysis has a plausible ring, it is certainly not dispositive.

45. 30 U.S.C. § 1001(d) (1970).

46. 30 U.S.C. § 1008 (1970). If state water laws were fully applicable to commercially demineralized water, no by-product royalty would appear to be payable to the United States since the appropriation of water rights under state laws does not result in any royalty obligations when water is taken from federal lands. The Secretary of the Interior's regulations take the position, however, that royalty payments must be made on such water. 43 C.F.R. § 3205.3-6 (1976). A persuasive argument might be made that the royalty payment on water called for in the regulations is contrary to the 1970 Act.

In the final analysis, Congress enacted but a single section directly addressing the federal-state water issue and that is the sentence stating that the 1970 Act is neither a "claim or denial" as to federal exemption from state water laws. State agencies grounding their claimed regulatory powers on that sentence rely on a precarious statutory structure. The best argument they can make is that Congress intended to leave the question to resolution under existing legal principles and those principles (the Desert Land Act of 1877,[47] in particular) repose regulatory power in the states. This argument will be explored in greater depth in the following section.

B. State Authority Over Water in Federal Lands and the Federal Reserved Water Rights Doctrine

A logical beginning assumption might have been that the Unites States would be regarded as the owner of water in federal lands. If that were so, it would appear to follow that the United States would own and control geothermal fluids whether they be classified as water or something else. If the slate were clean, such a simple analysis would be almost indisputable; however, the slate is not clean. What Congress and the federal courts have written on the slate presents some difficulty in delineating federal-state relationships with respect to waters on and under public lands.

In the course of the early westward migration during the nineteenth century, settlers helped themselves to both minerals and waters on public lands.[48] Both were there for the taking, and no government objection was interposed. The first rules were made by the settlers themselves in an attempt to define "property" rights and avoid bloodshed. The United States gave no signal that this situation was unacceptable and in due course approved the settlers' practices by explicit legislation, both as to minerals[49] and waters.

47. 43 U.S.C. § § 321 *et seq.* (1970).
48. The problems of settlement in the arid lands west of the 100th meridian were many. Major John Wesley Powell explored much of this country and wrote a report recommending national programs and policies to improve the chances of the settlers. Unfortunately, his recommendations were largely ignored, and more settlers failed than succeeded. *See* POWELL, REPORT ON THE LANDS OF THE ARID REGION OF THE UNITED STATES (1879).
49. The history of mineral resources laws affecting public lands is told in a highly readable treatment in Swenson, *Legal Aspects of Mineral Resources Exploitation*, in GATES, HISTORY OF PUBLIC LAND LAW DEVELOPMENT (1968).

By a statute passed in 1866 and amended in 1870,[50] Congress recognized and sanctioned possessory water rights on federal lands asserted under local laws and customs. By the Desert Land Act of 1877,[51] Congress went further and severed, for purposes of future acquisition, the soil and water rights. The key provision reads:

> *Provided, however,* That the right to the use of water by the person so conducting the same, on or to any tract of desert land of three hundred and twenty acres shall depend upon bona fide prior appropriation; and such right shall not exceed the amount of water actually appropriated, and necessarily used for the purpose of irrigation and reclamation; and all surplus water over and above such actual appropriation and use, together with the water of all lakes, rivers, and other sources of water supply upon the public lands and not navigable, shall remain and be held free for the appropriation and use of the public for irrigation, mining, and manufacturing purposes subject to existing rights.[52]

In a 1935 opinion the Supreme Court wrote as though the statutory severance were complete and the resulting state power were plenary. Specifically,

> The purpose of the Acts of 1866 and 1870 was governmental recognition and sanction of possessory rights *on public lands* asserted under local laws and customs. . . . The Desert Land Act severed, for purposes of private acquisition, soil and water rights *on public lands,* and provided that such water rights were to be acquired in the manner provided by the law of the State of location.[53]

But, even before 1935 a landmark case had already articulated the doctrine that would substantially impinge on state powers. In *Winters v. United States,*[54] the Supreme Court held that the establishment of the Fort Belknap Indian Reservation in 1888 resulted in the retention of such water rights as might be needed to irrigate reservation lands and sustain the Indian settlement.

50. 43 U.S.C. § 661 (1970).
51. 43 U.S.C. §§ 321 *et seq.* (1970).
52. 43 U.S.C. § 321 (1970).
53. Federal Power Comm'n v. Oregon, 349 U.S. 435, 447-48 (1955).
54. 207 U.S. 564 (1908).

For a time it was widely believed the *Winters* doctrine applied only to Indian reservations, but subsequent Supreme Court decisions have made clear that it applies in numerous other settings. The *Pelton Dam* case, decided in 1955,[55] held that the withdrawal or reservation of land for power purposes resulted in the reservation of water rights necessary to fulfill the purposes of the withdrawal or reservation. The State of Oregon's contention that the Desert Land Act required the United States to perfect water rights in accordance with state law was rejected on the ground that the Desert Land Act did not apply to "reservations":

> [T]hese Acts are not applicable to the reserved lands and waters here involved. The Desert Land Act covers "sources of water supply upon the public lands. . . ." The lands before us in this case are not "public lands" but "reservations." Even without that express restriction of the Desert Land Act to sources of water supply on public lands, these Acts would not apply to reserved lands. "It is a familiar principle of public land law that statutes providing generally for disposal of the public domain are inapplicable to lands which are not unqualifiedly subject to sale and disposition because they have been appropriated to some other purpose." . . . The instant lands certainly "are not unqualifiedly subject to sale and disposition. . . ." Accordingly, it is enough, for the instant case, to recognize that these Acts do not apply to this license, which relates only to the use of waters on reservations of the United States.[56]

The broad scope of the possible reserved federal rights was briefly sketched with yet more completeness in the second *Arizona v. California* case decided by the Supreme Court in 1962:

> The Master ruled that the principle underlying the reservation of water rights for Indian Reservations was equally applicable to other federal establishments such as National Recreation Areas and National Forests. We agree with the conclusions of the Master that the United States intended to reserve water sufficient for the future requirements of the Lake Mead National Recreation Area, the Havasu Lake National Wild-

55. Federal Power Comm'n v. Oregon, *supra* note 53.
56. *Id.* at 448.

life Refuge, the Imperial National Wildlife Refuge and the Gila National Forest.[57]

After *Arizona v. California*, the nature of federal reserved water rights became much clearer; however, many problems remained. When the federal government withdraws or reserves public lands for specific purposes, by necessary implication it reserves from appropriation under state laws such water as may be required to serve those purposes. The power to make withdrawals and reservations may be grounded upon several possible constitutional provisions, with the commerce and property clauses being the most frequently invoked. Reserved water rights are not dependent on actual appropriation and application to beneficial use. Such rights are senior to the water rights of subsequent appropriators under state laws, and subsequent state appropriators take the risk that their water investments may be impaired if there is increased use under reserved federal rights. Appropriators under state laws whose rights antedate the federal withdrawal or reservation, however, remain senior to the federal reserved rights.

The most recent Supreme Court opinion concerning the reserved water rights doctrine dealt with groundwater pumping, and for that reason it provides a closer analogy to geothermal development. In *Cappaert v. United States*[58] the United States brought an action to enjoin levels of groundwater pumping that threatened the habitat of the Devil's Hole Pupfish. Devil's Hole is a deep limestone cavern in Nevada that is a remnant of a prehistoric Death Valley system of lakes. The pupfish that live in the cavern are found nowhere else in the world. In 1957 President Truman issued a proclamation withdrawing the forty-acre parcel of public domain land surrounding Devil's Hole and adding it to Death Valley National Monument. The expressed purpose of the withdrawal was to preserve the pool's "unusual features of scenic, scientific and educational interest" and specifically the "peculiar race of desert fish." In 1968 the Cappaerts began pumping groundwater on their nearby ranch within two and one-half miles of Devil's Hole and in time their pumping began to lower the water level in Devil's Hole. The United States brought

57. Arizona v. California, 373 U.S. 546, 601 (1962).
58. 426 U.S. 128 (1976). *See generally* Meyers, *Federal Groundwater Rights: A Note on Cappaert v. United States*, 13 LAND & WATER L. REV. 377 (1978).

the action to limit pumping from locations near Devil's Hole except for domestic purposes, grounding its claim on the federal reserved water rights doctrine. The District Court and the Court of Appeals ruled in favor of the United States and ordered limits on the Cappaerts' pumping.

The Supreme Court held that President Truman's action had the effect of reserving unappropriated and available water necessary to accomplish the purposes of the reservation of Devil's Hole. The purpose was to protect the pupfish habitat, and water necessary to maintain the pool at a level required for that purpose was accordingly reserved. The water required for the federal purpose is the measure of the right, and no balancing of the equities with subsequent appropriators is necessary. The Court did specify, however, that the amount of the reservation is "only the amount of water necessary to fulfill the reservation, no more."[59]

Without accepting Nevada's argument that the doctrine should only apply to surface water, the Court noted the physical interrelationship of the surface water in the pool and the groundwater being pumped by the Cappaerts and noted Nevada itself acknowledged this physical fact by its appropriation laws which apply to both surface water and groundwater. The Court's strict holding could be narrowly stated to apply only to situations where federal surface waters require protection from subsequent diversions through groundwater pumping. The thrust and reasoning of the opinion suggest, however, that federal reserved rights can attach to groundwater as well as surface water. It should follow that if geothermal fluids are classified as groundwater, it is possible in appropriate circumstances that such fluids could be reserved.[60]

For geothermal fluids in federal lands to be the subject of a federal reserved water rights, some event competent to serve as a withdrawal or reservation of water must be found. The only events that singularly or in combination are arguably competent to that end are:

59. *Id.* at 141.
60. Indeed, federal groundwater pumping was sustained as a proper exercise of a federally-reserved water right in Nevada *ex rel.* Shamberger v. United States, 165 F. Supp. 600 (D. Nev. 1958), *aff'd on other grounds*, 279 F.2d 699 (9th Cir. 1960) (sovereign immunity).

(1) an Executive Order issued by President Hoover in 1930[61] withdrawing vacant, unappropriated public lands containing hot springs or springs possessing curative properties;

(2) a withdrawal by the Secretary of the Interior in 1967 of public lands valuable or prospectively valuable for geothermal steam from all appropriation under public land laws, "including, without limitation, the mining laws and mineral leasing laws;" and

(3) the Geothermal Steam Act of 1970 and leases issued by the United States pursuant to that Act.

On its face, President Hoover's executive order hardly seems competent to reserve geothermal fluids. It was expressly concerned with hot springs and springs with "curative properties" so that such resources could be made available under a 1925 Act of Congress authorizing permits "for the erection of bathhouses, hotels or other improvements." Despite the difficulty of fitting geothermal fluids into this language, the Acting Solicitor of the Interior Department issued an opinion in 1961 suggesting that the executive order is broad enough to do so. The opinion concluded there was nothing in the executive order restricting its application to hot springs valuable primarily for curative properties or to hot springs "created solely by the forces of nature." Thus, in the view of the Acting Solicitor, the executive order could apply to wells drilled to create hot springs for public use and benefit and geothermal wells drilled to produce electricity.[62]

Despite the Acting Solicitor's opinion, the executive order does not seem competent. The bathhouse purpose of 1930 hardly seems apt to encompass geothermal steam used to produce electric energy, especially when there is no intimation that the fluids possess or will ever be used for curative properties. Further, the term "hot springs" does not seem broad enough to include drilled geothermal wells.

In another setting, a federal court has rejected Interior opinions oversimplistically treating geothermal fluids as water. The Court of Appeals for the Ninth Circuit found totally

61. Exec. Order No. 5389 (July 7, 1930).
62. Solicitor's Opinion M-36625 (August 28, 1961).

unpersuasive the Solicitor's opinions ruling that geothermal resources passed to patentees under the 1916 Stock Raising Homestead Act because they were essentially water and, therefore, not within United States mineral reservations.[63] The opinion on the executive order might suffer a similar fate for its simplistic assumption that geothermal wells are merely hot springs within the meaning of the order.

The second event that affords a possible basis for a federal reserved water right in geothermal fluids is the 1967 withdrawal by the Secretary of the Interior,[64] which created a minor congressional furor over the claimed "implied authority" upon which the Secretary relied. The existence of that authority was implied, in view of the Secretary, from long-continued congressional practice of acquiescing in or ratifying former withdrawals by the Executive Branch. The contrary view held Congress had in the Pickett Act[65] specifically spelled out the statutory basis for making withdrawals and the 1967 withdrawal could not be squared with the statute. The validity of the 1967 withdrawal has never been determined, and the rules for future executive withdrawals have been entirely rewritten by the Federal Land Policy and Management Act of 1976.[66] The new rules in the 1976 Act do not, however, invalidate previous withdrawals.

If the 1967 withdrawal was valid when it was made, there can be no question that the Secretary thereby withdrew geothermal resources in the lands described in the withdrawal. It presents none of the constructional difficulties associated with President Hoover's 1930 executive order. A question remains, however, as to whether a consequence of the withdrawal was the creation of federal reserved water rights and, if so, the nature and extent of those rights. It was intended that the withdrawal at least have the effect of barring the acquisition of geothermal resources under then existing laws until federal administration could be "attained through the

63. Union Oil Co. v. United States, *supra* note 34.
64. 32 Fed. Reg. 2588 (Feb. 3, 1967), *as amended*, 32 Fed. Reg. 4506-4508 (March 21, 1967). The March amendment confined the withdrawal to certain designated land which partially quieted the furor when the Secretary initially withdrew simply "all public lands which are valuable for geothermal steam."
65. 43 U.S.C. § 141 (1970).
66. Pub. L. No. 94-579, § 204, 90 Stat. 2743 (1976) (to be codified as 43 U.S.C. § 1714).

enactment of geothermal legislation."[67] But, was it intended that the withdrawal reserve federal "water" rights? If the answer is yes, do such rights attach to geothermal fluids produced from geothermal wells, to conventional surface and subsurface waters needed in geothermal operations (such as cooling water for geothermal power plants), or to both such categories of "water"?

If geothermal fluids *are* water for these purposes, then the classic federal reserved water rights analysis can be utilized and a federal priority established for geothermal fluids as of 1967. This would mean federal geothermal lessees of lands having such rights may have no need to concern themselves with state water rights perfected after the 1967 withdrawal.

The Congressional enactment of the Geothermal Steam Act of 1970 is the third event that could be the basis for federal reserved water rights. The 1967 withdrawal anticipated this Act and was calculated to preserve federal geothermal resources until Congress could legislate an appropriate federal regulatory scheme. Ultimately, it is necessary to consider the possible cumulative effects of the 1967 withdrawal, the 1970 Act, and the issuance of federal geothermal leases under the Act. First, however, it will be useful to focus on the ways in which the factual setting of geothermal development will differ from the factual settings in which federal reserved water rights have previously been recognized.

In all of the Supreme Court's cases, the recognized reserved water rights were associated with specified parcels of land—an Indian reservation, a power site, a national forest. Moreover, the reserved water related to the needs of the specified parcel in order to serve the purposes of the withdrawal for reservation. The focus as to Indian lands has been on irrigable acreage, but reserved rights have also been recognized for other purposes, such as preservation of fisheries, and consideration is being given to industrial and other uses on Indian lands. The *Cappaert* decision provides an example where the use of the specified land required preservation of the water level in a surface pool to protect a rare fish. A lower fed-

67. Letter of Interior Secretary Udall to Congressman Wayne Aspinall (May 19, 1967), reprinted in *Hearings Before the Subcomm. on Mines and Mining of the Comm. on Interior and Insular Affairs*, 90th Cong., 1st Sess., 52 (1967).

eral court has recognized federal reserved rights in groundwater for the needs of a military reservation.[68] In each instance specified land was identified, and the water use contemplated had to do with the utilization of that land to accomplish the purposes for which it was withdrawn or reserved. The limitation this analysis places on federal reserved rights is illustrated by a recent New Mexico Supreme Court opinion. *Mimbers Valley Irrigation Co. v. Salopek*[69] refused to recognize Forest Service claims to reserved rights to support minimum stream flows for environmental and aesthetic reasons on the grounds the purposes for which the Gila National Forest was withdrawn were limited to watershed protection for downstream users and the maintenance of timber as a renewal resource.

Federal geothermal development will differ markedly from the usual reserved rights fact patterns. Apart from the specifications of geothermal prospect areas in the amended 1967 withdrawal, it is not immediately possible to ascertain the lands to which federal reserved rights might attach. Is there, for example, an inchoate federal reserved right in all federal public lands awaiting future geothermal development in order to flower into maturity? If so, will that reserved right have a priority dating from the enactment of the 1970 Act or from the date of the issuance of a geothermal lease? (Or, perhaps, from the date of the 1967 withdrawal if the leased lands were described in the amended withdrawal notice?) The greatest complaint water users and state officials have leveled at federal reserved rights is the difficulty in planning and building water projects in the face of unquantified federal rights that do not depend on actual use. The difficulties would be compounded if it were not possible even to ascertain which federal lands might enjoy federal reserved rights.

The manner of use of geothermal fluids is also different from usual patterns. Conventional water resources have been held subject to federal reserved rights when the water was needed on the land to serve the purposes of the withdrawal or reservation, to make the land serve values that were explicitly or implicitly sought to be served. In the case of geo-

68. Nevada *ex rel.* Shamberger v. United States, *supra* note 60.
69. 564 P.2d 615 (N.M. 1977), *cert. granted*, 46 U.S.L.W. 3426 (No. 77-510).

thermal development, the purpose would presumably be to extract geothermal resources primarily to serve values away from the lands on which the extraction occurs. The geothermal fluids would simply not be used with relation to the lands in the same manner that conventional waters have been used with relation to withdrawn or reserved federal lands. A more apt analogy might exist if federal reserved rights had been recognized as entitling the United States to develop water on federal lands and market it for offsite uses. This, however, has not been the case.

For reasons that may be implicit in the foregoing, federal reserved rights have not been recognized as attending permits or licenses to extract resources from federal lands. Neither the holder of a timber contract with the United States nor the lessee of a mineral permit or lease under the Mineral Leasing Act of 1920 is thought to obtain the right to take water for his operations pursuant to federal reserved rights. By parity of reasoning, the geothermal lessee would not be thought to enjoy federal reserved rights to conventional waters. In these situations, the conventional water needs will probably be regarded as problems of the federal contractors, permitees and licensees; the solutions would seem to lie in perfecting state water rights or acquiring water from the holders of existing rights.[70]

This brings us to the attribute of geothermal resources that argues most convincingly for the recognition of federal reserved rights even though such rights have not been recognized for the benefit of the holders of timber contracts or federal mineral lessees.

A meaningful line can be drawn between conventional waters required in the course of extracting various resources

70. In dictum, however, the Supreme Court has alluded to the possibility of reserved rights for the development of oil shale on Naval Petroleum and Oil Reserves "which, if ever developed, would require water to accomplish the purpose for which the reservation was made." United States v. District Court in and for Water Division No. 5, 401 U.S. 527 (1971). Even taking this dictum at full face value, it speaks to specifically identified petroleum and oil shale reserves, which is quite a different thing than reserved water rights to develop federal resources whenever they might in the future be found on federal lands. *See also* Comment, *The Federal Reserved Water Doctrine—Application to the Problem of Water for Oil Shale Development*, 3 LAND & WATER L. REV. 75 (1968); Holland, *Mixing Oil and Water: The Effect of Prevailing Water Law Doctrines on Oil Shale Development*, 52 DEN. L.J. 657, 682-688 (1975). *See generally* Ranquist, *The Winters Doctrine and How It Grew: Federal Reservation of Rights to the Use of Water*, 1975 B.Y.U.L. REV. 639.

from federal land and geothermal fluids produced from geothermal wells. The former represent but one of numerous needs attending various resource extraction operations and are indistinguishable from many of man's activities that require water consumption. Geothermal fluids, on the other hand, must of necessity be produced in the very course of utilizing the resource. All geothermal resources that man has thus far tapped have utilized the geothermal fluids to transport the heat energy and other values to places where it can be utilized. If the fluids are not produced, the resource is of no use. This physical fact supports an argument for recognition of reserved federal rights. Since fluid production is essential to realizing the purpose of the 1967 withdrawal, the 1970 Act, and the leases under the 1970 Act, federal reserved rights to produce can reasonably be implied. It could then follow that federal geothermal lessees could be regarded as having production rights senior to the holders of subsequent water rights acquired pursuant to state laws. Under the standard reserved water rights analysis, the federal lessees would not be required to follow state water procedures.

The recognition of federal reserved water rights in federal geothermal lessees would, however, leave some bothersome issues. First, the priority date of the federal right would have to be chosen from among the uncertain options of 1967, 1970, the date of the geothermal lease issuance, or some other date. State rights antedating whatever date is ultimately selected would remain senior under federal reserve rights theory, and it would be necessary to determine when such rights are impaired by geothermal operations. Remedies would have to be fashioned to protect these senior state rights. In states applying prior appropriation principles, remedies could well result in cessation of geothermal operations.

In sum, a case can be made for recognizing a federal reserved right to produce geothermal fluids under the rubric of the Supreme Court's opinions on the reserved water rights doctrine. The mere recognition of such rights, however, would create considerable problems in integrating geothermal operations into the fabric of federal-state water jurisprudence. This jurisprudence is cumbersome in dealing with conventional

water resources and is totally unsuited to the vastly different situation of geothermal development.

In the next section, consideration will be given to an analysis that is better adapted to dealing with the development of federal geothermal resources.

C. Federal Supremacy and Federal Geothermal Development

It is basic to American federalism that federal laws control over contrary state and local laws. The supremacy clause of the Constitution provides that in such conflicts state and local laws must give way.[71] A straightforward supremacy analysis of the Geothermal Steam Act of 1970 can yield a convincing case for overriding any state laws, including state water laws, that would prevent or hinder orderly development of federal geothermal sources.

A graphic example of federal supremacy in a water setting was presented in the Supreme Court's opinion in *First Iowa Hydro-Electric Cooperative v. Federal Power Commission*.[72] An Iowa cooperative had applied to the Federal Power Commission for a license to construct and operate a dam, reservoir, and hydro-electric power plant on an Iowa river. Among other things, the project was designed to divert water from one river basin to another within Iowa. Iowa law provided that no dam could be constructed in the state unless a prescribed state license was first obtained. Further, state law prohibited diversion of streams outside their watersheds. Iowa petitioned to intervene in the FPC proceedings and actively opposed the granting of the license relying largely on the requirement of the Federal Power Act that an applicant must submit satisfactory evidence "that the applicant has complied with the requirements of the laws of the State," and the Commission dismissed the application for failure to present the required evidence of compliance.

The Supreme Court reversed, holding the Iowa requirements had no application to those activities affecting navigable rivers which Congress had given to the Commission.

71. U.S. CONST. art. 6, § 2. Dean Trelease has made a prior appropriation here also as he has preceded us in suggesting that constitutional supremacy analysis better explains the Supreme Court's decisions in the federal-state water rights area. TRELEASE, FEDERAL-STATE RELATIONS IN WATER LAW (1971).
72. 328 U.S. 152 (1946).

> To require the petitioner to secure the actual grant to it of a State permit . . . as a condition precedent to securing a federal license for the same project under the Federal Power Act would vest in the Executive Council of Iowa a veto power over the federal project. Such a veto power easily could destroy the effectiveness of the federal act. It would subordinate to the control of the State the 'comprehensive' planning which the Act provides shall depend upon the judgment of the Federal Power Commission or other representatives of the Federal Government.[73]

In a surprisingly cavalier manner, the Supreme Court brushed aside the Federal Power Act language requiring the applicant to submit satisfactory evidence of compliance with state laws. This language, in the Court's view, "did not itself require compliance with any state laws," but was only "by way of suggestion" to the Commission on subjects as to which it "may wish some proof submitted to it of the applicant's progress."[74] While some state laws would remain applicable and effective, the Court said that could not be so as to state laws amounting to a dual system of control of power project permits.

Other Supreme Court opinions are consistent with *First Iowa* in striking down state laws that would impede federal water projects. In *Oklahoma v. Guy F. Atkinson Co.*,[75] the Court turned aside Oklahoma's strenuous objections to what the state regarded as a seriously detrimental water project.

> [S]ince the construction of this dam and reservoir is a valid exercise by Congress of its commerce power, there is no interference with the sovereignty of the State. . . . And the suggestion that this project interferes with the State's own program for water development and conservation is likewise of no avail. That program must bow before the 'superior power' of Congress.[76]

In the *Pelton Dam* case,[77] which has been previously discussed, Oregon's objections to another federal project were unavailing as the Court followed its *First Iowa* ruling.

73. *Id.* at 164.
74. *Id.* at 177-78.
75. 313 U.S. 508 (1941).
76. *Id.* at 534-35.
77. Federal Power Comm'n v. Oregon, *supra* note 53.

Like the Federal Power Act, the Geothermal Steam Act of 1970 provides a federal plan of regulation that does not leave room for conflicting state controls. It is true that application of state water laws is expressly countenanced for utilization of commercially demineralized water, but this cuts against rather than argues for a state role amounting to dual licensing or permitting of geothermal operations. The more logical inference is that deference to state law in this instance also marks the outer boundaries of the role to be played by state water laws.

For the same reasons, the disclaimer in the 1970 Act covering federal exemption from state water laws should not be read to sustain dual licensing. Congress provided that the Act is neither a "claim or denial" of federal exemption from state water laws; it would be a giant leap from there to reason that a state may adopt expansive measures undercutting the federal plan for geothermal development on federal lands. Under no other banner could a state erect a state veto, and the disclaimer should not be construed to authorize a veto simply because the state law erecting the barrier happens to be labeled a water law.

V. THE CASE AGAINST APPLICATION OF WESTERN WATER LAW DOCTRINES TO GEOTHERMAL DEVELOPMENT

If geothermal resources are characterized as water, they will be further classified as groundwater resources, but the experience of the western states in applying prior appropriation to groundwater is not a promising model for the development of geothermal resources. The consequence of this classification is that, in all western states except Arizona and California, rights to geothermal resources will have to be acquired by perfecting a valid appropriation. Prior appropriation was originally applied only to surface waters and it is only within the past two or three decades that most western states have required that groundwater rights be appropriated. States which attempt to conserve groundwater resources do so in ways that are detrimental to geothermal development. The states with extensive experience in applying appropriation to groundwater in declining basins, such as New Mexico, Colorado and Idaho, have found it easier to cut-off access to

a basin at some point and let all the previous pumpers draw equally than to try and adjudicate priorities among pumpers. Other states with geothermal potential such as Montana, Oregon and Washington have elaborate prior appropriation laws giving state agencies the power to adjust rights among pumpers, but they have had little experience applying them, so it is impossible to predict the restrictions to which a groundwater appropriator might be subject. The Arizona doctrine of reasonable use and the California doctrine of correlative rights also constrain geothermal development for they provide no clear standards for apportionment of the resource. Further production may be limited to uneconomic levels in California, and in both states there are substantial restraints on the use of the resource on nonoverlying lands, which is the use to which most geothermal energy will be put. The net result is that in all states the law of groundwater either provides unnecessary constraints or, at a minimum, uncertainties to the geothermal developer. This section surveys the general disadvantages of applying groundwater doctrines to geothermal development. Specific state statutes and cases are used for purposes of illustration, as this article is not intended to be an exhaustive discussion of the law of each state.

A geothermal developer may face two basic types of water-related conflicts. He may be in competition with conventional agricultural, industrial and municipal water users for a share of a common supply, or these users and others may argue that the disposal of geothermal wastes, especially saline brines, will contaminate a common source of supply. Supply conflicts may arise when existing pumpers sue to enjoin the drilling of a geothermal well on the grounds the resulting production will interfere with prior vested rights, when a producing well has been drilled and existing pumpers bring an action for damages based on interference with vested rights, or when the state attempts to block a well on the grounds that the development will involve a use of water that is not in the public interest. Pollution conflicts will generally arise when the geothermal developer proposes to reinject wastes for conservation and environmental reasons, and either existing ground and surface water users or the state claim that the reinjection program will cause pollution.

To restate our basic thesis, in the case of supply conflicts, geothermal development should be presumed *not* to interfere with conventional water users. This presumption must be a rebuttable one, for its purpose is not to allow a geothermal developer to injure prior vested water right holders, unless the state makes an explicit choice that some injury is in the public interest. Rather, the purpose is to provide a means to minimize the needlessly constraining role of water law and regulation on geothermal development by eliminating conflicts based on hypothetical interferences with conventional water sources. No such presumption is warranted when the alleged injury is water pollution, for geothermal development is simply another form of waste-generating activity and should, therefore, be subjected to applicable federal and state pollution laws.

An appreciation of the proper resolution of geothermal-water supply conflicts must start with an understanding of the differences between the law of mineral exploitation and western water use. Although our mineral and western water laws share certain basic principles, there are subtle but fundamental differences between them which could hinder the development of geothermal resources if water laws and state regulatory systems are applied across the board to the geothermal development.

Our argument that there should be no blanket application of state and federal water laws to exploitation proposals is developed as follows: (1) an examination of the different assumptions underlying mineral and water exploitation, (2) an examination of the groundwater law of the fourteen western states with potential for geothermal development in the immediate future, (3) an examination of means of implementing the presumption of noninterference, and (4) an examination of the situations in which the presumption might be overcome and our suggestions for resolving the conflicts. The last two topics are discussed in Section VI of this article.

A. Assumptions Underlying Mineral and Water Exploitation

This section compares and contrasts the assumptions underlying the exploitation of oil and gas, the mineral most closely analogous to geothermal resources, and water.

The law governing the exploitation of oil and gas proceeds on the assumption that these resources are finite, exhaustible, and should be exploited according to market demand. The law implements this by giving overlying landowners, public and private, the right to capture oil and gas beneath their lands.[78] The right to capture is subject to the equal right of adjacent landowners to do likewise so long as each surface owner confines his drilling to vertical planes extending downward from the surface.[79] There are three major exceptions to the law of capture, each based on the premise that these resources are finite and should be exploited according to market demand. First, federal and state governments as landowners can either withdraw land from leasing to meet future needs, for example, to assure adequate supplies in time of war, or reserve resources from exploitation to serve higher public purposes.[80] For example, some potentially valuable geothermal lands are unavailable for development because they are reserved as national parks. Also, state governments can in effect withdraw resources from production by establishing, as done before the Arab oil embargo, production quotas to maintain price.[81] A second exception is judicial and statutory recognition of correlative rights. In *Ohio Oil Co. v.*

78. Due to the early scientific uncertainty about oil and gas reservoir mechanics, different theories to describe the surface owner's interest were advanced. Some states adopted the non-ownership theory of oil and gas which holds that no person owns the oil and gas until it is produced. Most major producing states now follow the ownership in place theory which equates ownership of oil and gas with ownership of solid subsurface minerals. However, after a survey of the impact of these theories on the landowner's right to produce and the state's power to regulate, Williams and Meyers conclude: "The theory held by the state is of little importance apart from its influence on the classification of mineral, royalty, and leasehold interests as corporeal or incorporeal." 1 WILLIAMS & MEYERS, OIL AND GAS LAW § 204.9 (1959). For this reason we speak of the rule of capture without any further effort to distinguish between those states which follow the non-ownership theory and those which follow the ownership in place theory. The states are classified at *Id.* at § 203.1-3.

79. *Id.* at § 227.

80. 1 AMERICAN LAW OF MINING § 2.1 (Martz ed. 1960). Increasingly, the terms withdrawal and reservation are used interchangeably to describe legislative or executive action which segregates a designated area of federally owned land from access under the federal laws relating to entry, location or lease. Courts, however, occasionally refer to reservations as permanent withdrawals and withdrawals as temporary withdrawals. United States v. Consol. Mines & Smelting Co., Ltd., 455 F.2d 432 (9th Cir. 1971). We maintain the distinction between reservation and withdrawal to differentiate between actions which require Congressional action to reverse *and* where such action is unlikely to occur and interim executive or legislative classifications which may change in response to new conditions. 1 AMERICAN LAW OF MINING § 2.46-2.63 (Martz ed. 1960) for a discussion of the various reservations and withdrawals of federally owned land and of the status of the mineral claimant on them.

81. Proration was instituted to insure the maximum possible reservoir recovery and to restrict statewide production to the estimated demand for the next ensuing period. *See* LOVEJOY & HOMAN, ECONOMIC ASPECTS OF OIL CONSERVATION REGULATION 127-184 (1967) for a discussion of pre-1973 market-demand proration.

Indiana,[82] the Supreme Court defined correlative rights for the purpose of sustaining a state law requiring that gas wells be capped as follows:

> Hence it is that the legislative power from the peculiar nature of the right and objects upon which it is exerted, can be manifested for the purpose of protecting all the collective owners, by securing a just distribution to arise from the enjoyment, by them of their privilege to reduce to possession, and reach a like end by preventing waste.[83]

As enunciated by subsequent courts, correlative rights in oil and gas are not recognized to allocate a common supply on some principle of fairness, but only to assure each pumper the right of fair access to the common supply.[84] The doctrine prevents the deliberate waste of a resource to deplete a common source of supply,[85] negligent drilling operations which waste the common supply,[86] and actions such as the negligent failure to plug an abandoned well which result in the spoilage of a common supply.[87] Third, to encourage the maximum physical recovery of the resource, conservation measures may be imposed. These measures are generally designed to conserve reservoir pressure, thus extending the useful life of the reservoir by limiting the number of wells which can be drilled in the field. Pooling and unitization are state regulatory schemes of recognizing and protecting correlative rights.[88] Subject to these limitations on the right to capture, the pumper obtains title to all oil and gas brought to the surface.

Western water law is also based on the principle of capture, but the similarity between oil and gas and water breaks

82. 177 U.S. 190 (1900).
83. *Id.* at 210.
84. The leading discussion of correlative rights is Kuntz, *Correlative Rights of Parties Owning Interests in a Common Source of Supply of Oil and Gas*, SEVENTEENTH ANNUAL INSTITUTE ON OIL AND GAS LAW TAXATION 217 (1963).
85. Louisville Gas Co. v. Kentucky Heating Co., 117 Ky. 71, 77 S.W. 368 (1903).
86. Elliff v. Texon Drilling Co., 146 Tex. 575, 210 S.W.2d 558 (1948).
87. *Cf.* Higgins Oil Fuel Co. v. Guaranty Oil Co., 145 La. 233, 82 So. 206 (1919).
88. Pooling refers to the bringing together of small tracts to create a drilling unit to qualify for a well permit under applicable well spacing laws. Unitization means the joint operation of all or part of a reservoir. The reason for pooling and unitization is the same: the prevention of physical waste, the prevention of economic waste, and the protection of correlative rights. The amount of oil and gas recoverable from a reservoir is a function of the degree of natural or artificial pressure maintained. Pooling and unitization allow production to be maintained for a longer period of time than would be the case if the rule of capture were allowed to run its natural course because fewer wells are drilled in a field. The correlative rights of each overlying landowner are changed from the right to pump as rapidly as possible to avoid

down quickly. As is the case with oil and gas, the first person to divert water to a beneficial use obtains a prior right against all subsequent appropriators, but capture and appropriation are not the same thing. Under the law of oil and gas, absent a state-imposed allowable, or pooling or unitization scheme, a subsequent pumper can capture oil and gas being pumped by a prior pumper so long as there is no trespass or violation of correlative rights. A subsequent appropriator cannot displace a prior one when the supply is not adequate, for a prior right to call available water is vested.[89] Thus, unlike a prior oil or gas pumper, a prior appropriator may be able to block any subsequent use if he can prove that available supplies are necessary to protect vested rights. This result stems from two crucial differences between water and oil and gas. First, there is no substitute for water as there are substitutes for oil and gas; second, water is generally treated as a flow rather than a stock resource, as a replenishable rather than a wasting resource. For example, groundwater withdrawals can be limited to some level of safe yield[90] and surface streams are increasingly subject to minimum flow requirements.[91] Geothermal resources are generally stock rather than flow resources and any effort to limit the amount which can be produced, other than to prevent waste, may be inefficient, yet the purpose of much recent groundwater legislation is to limit production.

An important exception to the principle that water resources should be managed to balance withdrawals against safe yields relevant to geothermal development occurs with respect to groundwater basins which are not located in alluvial fields. Such basins replenish very slowly. In some instances they have been adjudicated as wasting assets for purposes of the federal Internal Revenue Code's allowance of depletion deductions.[92] Some of these basins are managed on the assumption that they should be mined, but ironically this may present greater problems for the geothermal developer

drainage to the right to a share of the production of the "conserved" reservoir. *See generally* 6 WILLIAMS & MEYERS, OIL AND GAS LAW (1975).

89. *See* Holland, *supra* note 70, at 670-72.
90. *E.g.*, Baker v. Ore-Ida Foods, Inc., 95 Idaho 575, 513 P.2d 627 (1973).
91. *See generally* Tarlock, *Recent Developments in the Recognition of Instream Uses in Western Water Law*, 1975 UTAH L. REV. 871, 888-95.
92. United States v. Shurbet, 347 F.2d 103 (5th Cir. 1965). *See* Sato, *Tax Problems Relating to Water Rights and Water Works*, in WATERS AND WATER RIGHTS, § 87.4 (Clark ed. 1967).

than if the basin were not mined since access may be severely restricted.[93]

Further, there is a "public interest" qualification to water withdrawals which is less defined than the "public interest" restrictions on the right to capture oil and gas. Compared to mineral usage,[94] the state has always asserted a substantial interest in the uses to which water is put.[95] This is because water is a scarce resource in the Far West and there are a variety of competing uses of widely disparate economic value. Grossly inefficient uses are curtailed by the doctrine that an appropriation is valid only if the water is applied to a beneficial use, and the state's interest in the use to which water is put is asserted through statutory preferences. Further, it has long been the rule in the Far West that the state owns the water within its boundaries in trust for the public. Declarations of state ownership, as Dean Trelease demonstrated in his famous article "Government Ownership and Trusteeship of Water" written in 1957, are simply assertions of the state's police power over natural resources.[96] The ownership concept, however, serves to underscore the extent of the state's power to deny access to water in order to allocate it to a perceived higher use. Historically, prior appropriations were occasionally subordinated to subsequent ones under this standard. Today, however, there is increasing pressure to supplant the doctrine of prior appropriation by using the public interest standard as a means of allocating scarce supplies. The contours of the public interest standard are not clearly defined. However, for our purposes it is sufficient to state that the public interest limitations which can be asserted on water uses are potentially greater than those imposed on oil and gas where the doctrine of correlative rights has taken on a relatively precise meaning,[97] and serve to limit the amount of wa-

93. *See* Trelease, *The Use of Fresh Water For Secondary Recovery of Oil and Gas in the Rocky Mountain States*, 16 ROCKY MTN. MIN. L. INST. 605 (1971).

94. This may be changing in the Far West as the mineral-rich states begin to appraise the consequences of rapid coal and oil shale development. States have considered legislation, for example, which would discourage energy conversion in the state of origin by inducing or requiring minerals to be exported before they could be converted to energy. *See* Van Baalen, *Mineral Export Legislation—Can It Withstand Federal Preemption and Commerce Clause Challenges?*, 12 LAND & WATER L. REV. 131 (1977).

95. *See* Trelease, *New Water Legislation: Drafting For Development: Efficient Allocation, and Environmental Protection*, 12 LAND & WATER L. REV. 385, 404-16 (1977).

96. Trelease, *Government Ownership and Trusteeship of Water*, 45 CALIF. L. REV. 638, 648 (1957).

97. *E.g.*, Environmental Defense Fund, Inc. v. East Bay Mun. Util. Dist., 125 Cal. Rptr.

ter which may be available for geothermal use in ways which may impede development of this resource. The differences between the law on oil and gas and water are nicely summed up in the legal doctrine that a water right is a usufructory one entitling the holder only to the right to use a certain quantity of water under certain conditions rather than giving him title to the source of supply itself.

B. Western Water Law Doctrines Inapplicable to Geothermal Development

These differences between oil and gas exploitation and water use manifest themselves more concretely in various water law doctrines and state regulatory systems. We have identified the following nine features of western water law and administration which may operate to constrain geothermal development.

1. *Inappropriate Forms and Procedures.* The forms and procedures of water administration are not suited to geothermal development.[98] Required data on the rate of diversion, point of diversion and expected return flow may not be applicable to geothermal development. This is ultimately a minor problem as forms can be adapted to the geothermal developer if the state chooses to regulate the resource primarily through the state engineer. However, this problem underscores the differences between the two resources and the inappropriateness of a blanket analogy to water.

2. *Necessity to Prove an Adequate Available Supply.* An appropriator must establish that an adequate supply is

601 (1975), hearing granted by California Supreme Court No. 23, 422, Feb. 26, 1976. *East Bay* held that an allegation that a utility must reclaim waste water before seeking supplemental fresh water supplies states a cause of action under Art. XIV, Section 3 of the State Constitution which provides, *inter alia*, "The waste or unreasonable use or unreasonable method of waste be prevented . . ." *See generally* LEE, LEGAL ASPECTS OF WATER CONSERVATION IN CALIFORNIA, (Governor's Commission to Review California Water Rights 1977). North Dakota also recently expanded the public interest discretion available to the state engineer. United Plainsmen Ass'n v. North Dakota Water Conservation Comm'n, 247 N.W.2d 457 (N.D. 1976). *United Plainsmen* holds that the state's waters are subject to a public trust and citing, Sax, *The Public Trust Doctrine in Natural Resource Law: Effective Judicial Intervention*, 68 MICH. L. REV. 471 (1969), reasoned that, at a minimum, the state engineer must determine the potential impact of an allocation sought in an appropriation permit on the present water supply and future needs of the state. The suit challenged the issuance of all water permits for coal-related energy production, and plaintiffs obtained a trial on the merits of whether or not existing state water allocation planning was sufficient to meet the public trust requirements.

98. *See* Aidlin, *Representing the Geothermal Resources Client*, 19 ROCKY MTN. MIN. L. INST. 27, 38 (1974): "It is not possible to know in advance how many gallons of geothermal water or how many pounds of steam will be required to produce one kilowatt hour of electricity. . . ."

available for his use by proving that unappropriated water is available. Because the connection between a geothermal reservoir and an aquifer devoted to conventional water uses will probably not be well understood prior to geothermal development, placement of such a burden of proof on the geothermal developer is a possible means by which existing pumpers can block a geothermal development where no actual conflict would result.

3. *Denial of Entry to Groundwater Basin in Overdraft.* The problem of proof of available supply is especially important in states where access to groundwater basins in overdraft is blocked by legislation which closes certain basins to new pumpers by designating them as critical groundwater areas. Once a pumper is in the basin it may be a free-for-all, but getting in may be a substantial problem since designation closes the basin to new pumpers. All western states, except California and Utah, have a procedure by which an administrative agency can designate a groundwater basin as critical.[99] This action generally closes the basin to new pumpers, but existing pumpers are generally allowed to keep pumping at pre-existing rates. Thus, should a geothermal reservoir overlap a critical groundwater area a geothermal developer might be denied entry. For example, in Idaho groundwater management is taking a more aggressive stance unfavorable to geothermal development. State law specifies "reasonably anticipated average rate of future natural recharge" as the standard for basin management, and this has resulted in junior pumpers being shut down on the ground that there is not enough recharge to satisfy senior rights.[100]

4. *Protection of Prior Surface Users' Rights.* A geothermal developer is not only in competition with other groundwater pumpers but with surface users as well. States are moving to close the artificial distinction between ground and surface waters by administering all water rights together. In practice, this means prior surface users now have senior rights against junior groundwater pumpers. Thus, the geothermal developer has another set of potential claimants arguing that his development interferes with prior rights.

99. *See* Harnsberger, Oeltje & Fisher, *Groundwater: From Windmills To Comprehensive Public Management*, 52 NEB. L. REV. 179, 270-79 (1973); Clark, *Western Groundwater*, in WATER AND WATER RIGHTS, § 442 (Clark ed. 1972).
100. Baker v. Ore-Ida Foods, Inc., *supra* note 90.

Colorado adopted legislation in 1965 and 1969 to extend the doctrine of prior appropriation to "designated" non-tributary groundwater, which had been held not subject to appropriation,[101] and to coordinate surface and prior rights. The legislation declared that it was policy of the state that "while the doctrine of prior appropriation is recognized, such doctrine should be modified to permit the full economic development of groundwater resources."[102] Because coordination of ground and surface rights will often mean greater protection of surface rights because they are generally prior in time to pumpers, the legislature attempted to implement the "full development" policy by codifying the futile call doctrine.

Viewed from the perspective of geothermal development, however, the Colorado experience suggests that groundwater legislation modeled after that state might constrain geothermal development because protection of prior rights emerges as the primary objective of the statute. Courts and administrators will opt for protection of prior rights rather than balancing the costs and benefits of new entrants as against existing pumpers in a basin. All things considered, this is a simpler and perhaps fairer solution. In the leading case of *Hall v. Kuiper*,[103] for example, the court approved the state engineer's decision to prohibit two new wells in a designated groundwater basin to protect surface rights in a stream fed in part by groundwater which moved at the rate of three-tenths of a mile per year. The state engineer conceded it would be difficult to show a casual connection between the new wells and any particular surface right, but the futile call doctrine could not be invoked simply by showing that there was no casual connection between particular wells and surface rights.[104] However, the futile call policy has been recognized in cases holding that groundwater which will take 178 and 356 years, respectively, to reach a surface stream is nontributary,[105] and

101. COLO. REV. STAT. § § 37-90-102 *et seq.* (1973). Designated groundwater is defined as "groundwater which in its natural course would not be available to and required for the fulfillment of decreed surface rights, or groundwater in areas not adjacent to continuously flowing natural stream wherein groundwater withdrawals have constituted the principal water usage for at least fifteen years preceeding the date of the first hearing on the proposed designation of the basin . . ." COLO. REV. STAT. § 37-90-103(6) (1973).
102. COLO. REV. STAT. § 37-90-102 (1973).
103. 181 Colo. 130, 510 P.2d 329 (1973).
104. *Id.* at 331, *following*, Fellhauer v. People, 167 Colo. 328, 447 P.2d 986 (1968).
105. Kuiper v. Lundvall, 187 Colo. 40, 529 P.2d 1328 (1974), *cert. denied*, 421 U.S. 996 (1975).

junior pumpers have been able to continue pumping through participation in plans of augmentation.[106]

5. *Groundwater Mining.* One aspect of recent groundwater legislation is potentially more favorable to geothermal development. Colorado and New Mexico have consciously made the decision to mine groundwater in some basins.[107] Formulas have been developed which space the amount of extraction over a definite period. Limits over the amount which can be withdrawn and the number of new pumpers are established in order to keep the basin productive for the mining period. If a geothermal developer could secure a right, the groundwater mining precedents could be adapted to geothermal development. The experience from Colorado suggests the contrary, however, because mining works to the disadvantage of junior appropriators. For example, Colorado developed a scheme to tie depletion of a designated basin to the time necessary to amortize the investment in irrigation equipment. To protect existing pumpers a zone of influence concept was developed, and a new pumper was denied a permit on the grounds that it would cause a forty per cent depletion of existing wells within a three mile radius.[108] Colorado allows a form of mining in nondesignated groundwater areas[109] but the amount which may be mined may not be sufficient for a geothermal developer. To construct a well outside the boundaries of a designated groundwater basin, a permit from the state engineer is required. If the state engineer finds that there is unappropriated water available and the well will not interfere with the vested rights of others, the permit may be issued. In considering whether the permit should be issued, only the

106. In cases where junior wells interfere with prior surface rights, Colorado law provides a procedure which allows junior wells to keep pumping. A junior well owner may participate in a plan of augmentation, COLO. REV. STAT. § 37-92-103(9) (1976 Cumm. Supp.), which allows the burden of replacement water to be shared among pumpers. The standards the courts have established in reviewing plans are favorable to geothermal development. A plan of augmentation need not introduce any new water into the system to be valid. Kelly Ranch v. Southeastern Colo. Water Conservancy Dist.,___Colo.___, 550 P.2d 297 (1976). The participants in the plan must prove that existing right holders are not injured. However, existing right holders are not entitled to require the participants in the plan to replace total diversions when they cannot otherwise prove injury. Cache LaPoudre Water Users Ass'n v. Glacier Meadows,___Colo.___, 550 P.2d 288 (1976).

107. Fundingsland v. Colorado Groundwater Comm'n, 171 Colo. 487, 468 P.2d 835 (1970); Mathers v. Texaco, Inc., 77 N.M. 239, 421 P.2d 771 (1966). *See* Trelease, *Developments in Groundwater Law* (September, 1976) (unpublished paper delivered at American Water Resources Association Symposium on Advances in Groundwater Hydrology).

108. Fundingsland v. Colorado Ground Water Comm'n, *supra* note 106.

109. COLO. REV. STAT. § 37-90-137 (1975 Supp.).

quantity of water underlying the land owned by the applicant is considered to be unappropriated and the minimum useful life of the aquifer is one hundred years, assuming there is no substantial artificial recharge within such period. "The net effect is to limit pumping from these deep aquifers in any given year to nineteen per cent of the water stored in the applicable area. Any water derived from geothermal sources would probably fall into this category and production of geothermal resources which were classified as groundwater by the State Engineer would be limited by the Colorado Groundwater Management Act."[110]

6. *Assertion of a Right to Lift.* A geothermal developer's status will be further complicated if the state recognizes a senior appropriator's right to a fixed hydrostatic pressure. Originally, it appeared states would recognize a right to lift as incident to a senior groundwater right. However, due to the practical problem of proving cause and effect relationships in a basin where there are multiple pumpers and the argument that some decline in the water level is necessary to promote efficient use of the basin, courts and legislatures have backed away from giving senior pumpers an absolute right to lift.[111] The issue is very much open, however, in each state because courts and legislatures have broad discretion to define the appropriator's method of diversion. Thus, it is difficult to predict what duties a geothermal developer might owe to senior pumpers, assuming there was in fact interference between a geothermal and a water well.

7. *Restrictions on Use of Groundwater in California and Arizona.* Groundwater is not allocated exclusively by appropriation in all western states. In California and Arizona groundwater is allocated under common law regimes which define rights by virtue of ownership of the soil. Waters defused in "vagrant wandering drops moving by gravity in any and every direction along a line of least resistance" are governed by the *ad coleum* doctrine, and the right to use them does not depend on a diversion and application to a beneficial use. The doctrine that percolating groundwater may not be subject to appropriation might seem to benefit the geo-

110. Schlauch & Worchester, *Geothermal Resources: A Primer for the Practitioner*, 9 LAND & WATER L. REV. 327, 353 (1977).
111. *E.g.*, Wayman v. Murray City Corp., 23 Utah 2d 97, 458 P.2d 861 (1969).

thermal developer, but he may have the burden of segregating it from the appropriate regime. This problem is important in Arizona and California, which alone among the western states do not apply prior appropriation to all groundwaters. In Arizona, groundwater is presumed nontributary and is the property of the overlying owner. The right to capture is restricted by the rule of reason, which, as developed by the courts, prohibits the use of the water on nonoverlying land by nonmunicipal appropriators.[112] California, which has a mixed system of riparian rights and prior appropriation, applies a rule of correlative rights in groundwater controversies which carries forward the surface law of riparian and appropriative rights to groundwater controversies. Basically, the California court distinguishes between overlying and nonoverlying pumpers. All overlying owners are entitled to a fair allocation of the safe annual yield in times of shortage, but the water must be used on the overlying land. Only if there is a surplus of unused water not in excess of safe annual yield, can the water be appropriated for use on nonoverlying land.[113] The correlative rights rule is not therefore suitable for a stock resource such as a geothermal reservoir. The safe annual yield standard doe not permit mining, and it is economically efficient to encourage geothermal reservoirs to be mined.

8. *Application of Public Interest Restrictions on Right to Appropriate.* In most western states an appropriator must meet the three requirements of intent, diversion and application to a beneficial use and, in addition, in all states but Colorado, he must convince the permit-granting agency that the appropriation is in the public interest. Historically, state engineers have found appropriations to be in the public interest when there was no interference with prior vested rights. Occasionally, smaller projects have been subordinated to larger diversion projects on the grounds that there was a public interest in providing a right for a project that would yield greater economic benefits.[114] Today, state agencies may use the public interest standard to subject appropriation applications to a crude benefit-cost analysis, and they may be able to use

112. Farmers Inv. Co. v. Bettwy, 113 Ariz. 520, 558 P.2d 14 (1976).
113. *See* City of Los Angeles v. City of San Fernando, 14 Cal.3d 199, 537 P.2d 1250 (1975). *See generally* Hanks & Hanks, *The Law of Water in New Jersey: Groundwater*, 24 RUTGERS L. REV. 630-50 (1970).
114. *See* Trelease, *Policies for Water Law: Property Rights, Economic Forces, and Public Regulation*, 5 NAT. RESOURCES J. 1 (1965).

the standard to take diffuse environmental considerations into account. Washington and California have held their state environmental quality acts to apply to appropriation applications, so at a minimum many applications require an environmental impact statement.[115] At the present time the purpose of an EIS has been defined as procedural and confined to data assembly and display. However, if environmental impact statements are found to have a substantive content, the public interest limitation may take on major but unknown new dimensions. Geothermal developers are, of course, already subject to an impact statement requirement in these states, so application of the public interest standard in water law would only introduce more uncertainty into what is already a confusing process.

9. *Application of the Relation Back Doctrine.* The first major public interest limitation asserted in water use was the idea that speculation in water rights should be discouraged. One anti-speculative doctrine which is firmly entrenched in water law is the doctrine that a water right must be perfected with due diligence after an intent to appropriate has been manifested. Intent to appropriate is manifested generally by filing an application with the state engineer. If the diversion is completed with due diligence, the right relates back to the time of the original intent, but if the diversion is unduly delayed the right is lost in favor of more enterprising junior appropriators. Due to the uncertainties concerning the potential of geothermal reservoirs for actual production, there is no assurance that the first well drilled will result in production. Thus, a geothermal developer forced to abandon a well and drill another may find himself faced with a lack of due diligence challenge from other claimants.

Colorado has long allowed an extended relation-back period for large publically financed, multi-purpose projects, so long as a timely first step is taken, by means of a statutory conditional decree procedure. However, this statutory precedent may not be applied to geothermal development because, unlike the case of a public entity such as a water supply district trying to finance a project, the ability to finance a geothermal development often lies in the hands of the geother-

115. Stempel v. Dep't of Water Resources, 82 Wash.2d 109, 508 P.2d 166 (1973).

mal lessee, rather than with Congress, state legislators or voters. Such lessees are more vulnerable, therefore, to the charge that resources are being held for speculative purposes when there is a long delay between the claim of right and institution of a project. Montana recently considered a challenge to an appropriation for an energy development which the state considered speculative.[116] The State Supreme Court rejected the state's challenge to an appropriation for one per cent of the flow of Yellowstone River which had numerous legal and financial hurdles:

> The direct answer to this issue is that there is nothing illegal, inequitable, or contrary to public policy so as to preclude Intake from claiming a right to appropriate 80,650 acre feet of water per year of the waters of the Yellowstone River. Intake has an existing right for the reasons and under the authorities previously cited. While this existing right does not constitute a valid and completed appropriation, it entitles Intake to pursue its project with reasonable diligence to that end for the reasons and under the statutes and case law heretofore discussed. The fact that final determination of the validity of Intake's appropriation may be years away does not place the rights of the people of Montana or subsequent appropriators in limbo for an indefinite and open ended term to any greater extent here than in any other case involving a multimillion dollar project of great magnitude and complexity which is clearly not prohibited. Intake, as well as any other person or business organization, has the right to litigate the constitutionality of any law including Art. X of the Yellowstone River Compact, section 89-846, R.C.M.1947, and the applicability of the Major Facility Siting Act. Considerations of equity and public policy in no way preclude this. The Montana Declaratory Judgment Act authorizes the instant action.[117]

Montana law now allows the state to condition appropriation applications by fixing a timetable for development of the project.[118] However, *Intake* is a strong precedent for the proposition that energy development requires long lead times, and thus the relation-back doctrine should be liberally interpreted to facilitate such development.

116. Montana Dep't of Natural Resources and Conservation v. Intake Water Co., ___ Mont. ___, 558 P.2d 1110 (1976).
117. *Id.* at 1122.
118. MONT. REV. CODES ANN. § 89-886 (Supp. 1975).

This brief discussion of nine areas of contemporary water law development which impact on geothermal development indicates the unsuitability of a blanket application of western water law as a model for geothermal development. The doctrines emerging in the law of groundwater are symptomatic of the fact that most important contemporary water disputes no long involve a single A against a single B. Rather, classes of A's sue classes of B's, often with C's and D's joining the suit, and water rights litigation looks to future as much as past damage. The impact of one class's use pattern on another class's is difficult to prove, but it is even more difficult to translate general casual relations into justifiable prohibitions on one use in favor of another. Courts and administrators, therefore, seek formulas which allocate scarce water resources in the aggregate between classes of users and conserve the resource. This is all to the good as scarce resources such as groundwater must be conserved. However, mineral development needs a more certain property rights regime which emphasizes reduction of the resource to individual ownership rather than sharing among classes of users. The techniques of pooling and unitization developed in oil and gas seem the best way to prevent the waste of geothermal resources. At some point, the geothermal developer may have to confront surrounding water users, but the time to put him in the system is when the presumption of noninterference is overcome. There is no reason to put the geothermal developer into the system in the abstract.

VI. A POSSIBLE PHYSICAL SOLUTION

Efficiency may be served and resource values enhanced by an institutional mechanism which identifies geothermal resource deposits that are sufficiently separated from freshwater sources to merit a legal order that treats them as separate and unconnected. Where physical interconnection exists to a significant degree, the same ends might nonetheless be served by allowing separate treatment if geothermal development is undertaken subject to conditions and requirements that give reasonable assurance of noninterference with freshwater sources. An example of this latter situation might be where reinjection of geothermal fluids, limitations to binary production systems, or other expedients can be employed to protect

fresh groundwater. These institutional mechanisms address only the possible conflicts over rights to produce geothermal fluids, and it is not expected that they would perform the functions of or supplant water pollution laws and regulations.

California has taken a step in this direction through certificates of primary purpose, but our proposals are considerably broader than this concept. Any geothermal driller in California may apply to the Geothermal Resources Board for a certificate of primary purpose. The Board must issue a certificate if it determines that "such well or wells are primarily for the purpose of producing geothermal resources and not for the purpose of producing water useable for domestic and irrigation purposes." A certificate creates a rebuttable presumption that the driller "has absolute title to the geothermal resources reduced to his possession by such well or wells."[119] A person may rebut the presumption only if he establishes that the water content of the geothermal resource is useable for domestic or irrigation purposes without further treatment.

We propose a system which would assign an appropriate state agency the responsibility to make findings concerning the relevant physical facts early in the development of a geothermal area. This agency's charge would be to gather information on subsurface geology and hydrology, and it would be given authority to compel disclosure of drilling and production information on existing water and geothermal wells. In some instances, petroleum drilling and mining activities in the area might provide supplemental information. In extreme cases, it may even be appropriate to drill additional wells for information gathering or for monitoring freshwater pumping and geothermal production impacts and interrelationships. The proposed inquiry would extend beyond the narrow scope of the certificate of primary purpose device available by statute in California which deals only with geothermal wells and inquires only whether the water content of those wells is fit for domestic and irrigation uses without further treatment. Rather, the proposed inquiry by the state agency would deal with all matters that bear on the possible relationship between freshwater pumping and geothermal development.

119. CAL. PUB. RES. CODE § 3742.2 (West 1972).

In geothermal areas where the physical separation is almost total, such as appears to be the case at the Geysers, the agency may well be able to issue findings supporting totally separate treatment. In that event, entirely separate property rights systems could be recognized in the freshwater and geothermal formations, and the only problems other than pollution concerns would be the common pool problems that the multiple owners would have inter se within each formation.

In geothermal areas that are not adequately separated from freshwater sources, the agency's task would be more difficult. The agency would be charged not only to make findings concerning the degree of interconnection but would also have the responsibility to impose conditions and limitations on geothermal development designed to prevent substantial harm to freshwater sources. In effect, the agency would be formulating field production rules. If it is determined that harm to the freshwater sources can be prevented by reasonable physical solutions, the agency would order that production go forward implementing those solutions. Thus, production in particular areas might require one or more measures such as fluid reinjection, utilization of binary production methods, shutting in or cutting back particular wells that pose undue risks of harm to freshwater sources, and others. Any geothermal operator who complies with the prescribed conditions would have the benefit of a presumption that his operations cause no injury to or interference with freshwater sources in the absence of convincing evidence to the contrary. Until such convincing evidence is forthcoming, the two regimes would be treated as though they were totally separate and distinct from one another.

An additional problem is posed by the possibility of production of usable water as a by-product of geothermal development. This water should be treated as part of the separate geothermal regime and should go to the geothermal developers who produce it. Some existing state laws suggest a convenient answer as to that part of the water reinjected into the geothermal formation or used for cooling or electric energy generation or otherwise in connection with geothermal operations. Such fluids should not be regarded as any kind of "water" with which the separate freshwater regime is concerned

regardless of the quality of the water so used. Normally, no royalty should be owing on such water to geothermal lessors, and no steps should be required under water laws to protect the title to this water. Excess water transported away for use or sale apart from geothermal operations should be treated under the developed water doctrine or should otherwise be deemed non-tributary to the freshwater formations. Where state laws require, that water could be appropriated by the geothermal developers whose efforts bring it into being.

Finally, there is a threshold problem that has thus far been ignored. What is a geothermal resource area? A starting point for thinking is that suggested by the California and Oregon statutes providing for certificates of primary purpose. An area could be classified as geothermal if it is valuable primarily for the production of geothermal resources rather than for the production of water for domestic and irrigation uses. This raises the interesting problem of what to do if an area is primarily valuable for water production but has secondary values for geothermal resources.[120]

The proposed solution could be tied to a voluntary or compulsory unitization of geothermal areas. At the time the unitization is accomplished, appropriate field rules could be promulgated under which unit operations could take place, and operations in accordance with those rules would give the benefit of the presumption of noninterference with freshwater sources absent clear and convincing contrary evidence. The incentive to unitization in the presumed noninterference with freshwater sources has parallels in other incentives offered for unitization such as exemption from acreage holding limitations and from anti-monopoly laws.

120. Another problem which must be addressed in developing a physical solution to geothermal-groundwater conflicts is the coordination of federal and state procedures. If, as we have suggested, federal lessees are not subject to state water laws, the federal government may still wish to consider a procedure by which state water rights information could be taken into account in federal decisionmaking. The National Water Commission's recommendations on the coordination of federal reserved right claims with state water adjudication procedures provides a useful starting point of analysis. NATIONAL WATER COMM'N, WATER POLICIES FOR THE FUTURE 459-467 (1973). Dean Trelease wrote the background study from which the final recommendations were taken. TRELEASE, FEDERAL-STATE RELATIONS IN WATER LAW (1971). Our proposed state procedure could be the basis of the state's ability to influence federal decisions.

VII. CONCLUSION

Geothermal energy has a valuable role to play as a supplemental source of energy in the Far West. To date many institutional and technological constraints have impeded its development. One institutional constraint is the possibility that geothermal resources will be subjected to the blanket application of western water laws. Western water law has done an admirable job of promoting western development, but it has a more limited role to play in the development of the geothermal resources industry. This article has briefly presented the case against the blanket application of western water law and sketched a means of accommodating geothermal resource development with protection of conventional water users in situations where a potential interrelationship between the two resources is alleged.