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**COALBED METHANE DEVELOPMENT
IN THE INTERMOUNTAIN WEST:
PRODUCING ENERGY AND
PROTECTING WATER**

*Gary Bryner*¹

Coalbed methane (CBM) is a source of natural gas that is of growing importance as a domestic source of energy at a time when demand is rapidly increasing and output from some conventional sources of natural gas has peaked. Since natural gas is the cleanest burning fossil fuel, producing only about one-half the carbon dioxide emissions of coal, there is great interest in switching from coal to natural gas in order to reduce the threat of disruptive climate change. Since virtually all of the gas used in the United States is supplied either domestically or from Canada, it contributes to national energy security. Natural gas provides twenty-four percent of the energy used in the United States and twenty-seven percent of total domestic production.² Natural gas is used to produce sixteen percent of the electricity generated in the United States, and the fastest growing use of natural gas is to produce electricity.³

CBM accounts for seven percent of total natural gas production and

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2. NATIONAL ENERGY POLICY DEVELOPMENT GROUP, NATIONAL ENERGY POLICY: RELIABLE, AFFORDABLE, AND ENVIRONMENTALLY SOUND ENERGY FOR AMERICA'S FUTURE 1:7 (May 2001).

3. *The Orderly Development of Coalbed Methane Resources from Public Lands: Oversight Hearing before the House Subcomm. on Energy and Mineral Res., Comm. on Res., 107th Cong. 7* (2001) (statement of Dr. Gene Whitney, Supervisory Geologist, U.S. Geological Survey).

eight percent of gas reserves in the United States.⁴ CBM from the intermountain states has played a significant role in meeting United States demand for natural gas, particularly from the states of Colorado, New Mexico, Utah, and Wyoming, and that role is expected to grow in importance. Some eighty percent of the total CBM production in the United States has come from the Rocky Mountains.⁵ The San Juan basin in southern Colorado/northern New Mexico has been the major regional source of CBM. The Powder River Basin in northwest Wyoming is the area of CBM production that is growing the most rapidly. CBM resources are also being developed in the Uinta Basin in eastern Utah, the Raton Basin in south-central Colorado, and the Piceance Basin in northwest Colorado, and major expansions of coalbed development are expected in Montana, the Green River basin in Wyoming, and perhaps other areas in the West. There is little agreement over the size of the natural gas resources remaining in the interior West, but given the exploding demand for natural gas, there will be pressure to find and develop as much of the region's gas as possible.⁶

While CBM development has produced important energy and other economic benefits to many communities in the West, it has nevertheless been quite controversial. In many areas, lawsuits over the adequacy of the analyses of expected environmental impacts, the regulation of development by local governments, and conflicts between surface owners and gas companies have resulted in conflict, delays, uncertainty, and acrimony. Counties have sued state oil and gas regulatory bodies over who has responsibility for regulating the impacts of CBM development, companies have sued counties over zoning and land use plans that restrict their ability to develop resources, community groups have sued federal and state agencies for inadequately assessing environmental impacts, land owners regularly voice concern about impacts on water quality, and these conflicts show no signs of dissipating. Much of the conflict is rooted in widely discussed changes in the population of the West as recreational and preservationist interests increasingly clash with traditional extractive industries.⁷

Environmental impacts associated with CBM development include the construction of roads, drill pads, water disposal sites and related facilities; noise from pumps, compressors, and traffic that disturb residents and wildlife; air pollution; disruption of areas that were previously isolated from

4. Matthew R. Silverman, *Coalbed Methane in the Rocky Mountain Region: Yesterday, Today, and Tomorrow*, in COALBED METHANE DEVELOPMENT IN THE INTERMOUNTAIN WEST 125 (Natural Resources Law Center, University of Colorado School of Law CD-ROM [hereinafter NRLC CD-ROM], July 2002).

5. *Id.* at 128.

6. Walter B. Ayers, Jr., *Coalbed gas systems, resources, and production, and a review of contrasting cases from the San Juan and Powder River Basins*, 86 AAPG BULLETIN 1855 (2002).

7. See Gary C. Bryner, *Coalbed Methane Development: The Costs and Benefits of an Emerging Energy Resource*, 43 NAT. RESOURCES. J. 519 (2003).

development or valued for undisturbed vistas and solitude; and impacts on water quality and supplies. Given the importance of clean water in the arid West, no environmental issue has been more contentious or critical to the future of CBM development than that of the impacts on local water. There is great disagreement among community groups, state agencies, and energy companies over how much water is produced through CBM development, what happens to the produced water and what impacts it has on water quality, local ecosystems, and water supplies, and what are the best uses for the produced water. As valuable as CBM is in the local economies of the West and in the production of domestic energy supplies, even more critical is the protection of the West's water supplies. A number of problems with the impacts of CBM development on water must be worked out before its considerable benefits can be realized.

COALBED METHANE DEVELOPMENT AND PRODUCED WATER

Coal bed methane (CBM) is a form of natural gas that is trapped within coal seams. Methane attaches to the surface areas of coal and is held in place by water pressure. Coalbed methane is produced either through chemical reactions or bacterial action. Chemical action occurs over time as heat and pressure are applied to coal in a sedimentary basin. Bacteria that obtain nutrition from coal produce methane as a by-product.⁸ The cleats and fractures in the coal are typically saturated with water, and the coal must be dewatered (usually pumped out) before the gas will flow.⁹ Methane attaches to the surface areas of coal and is held in place by water pressure. Methane remains in a coalbed as long as the water table is higher than the coal. When the water is released, the gas flows through the fractures into a well bore or migrates to the surface. Drilling initially produces primarily water; gas production eventually increases and water production declines.

When the CBM is extracted, the water must be separated, the gas is sent to pipes, and the water is dumped into ponds or injected back into the ground. In order to develop the resource, companies must first pump large quantities of water from the ground, about 12,000 gallons a day on average for each well, to release the methane.¹⁰ The development transforms the landscape with pipes, roads, compressor stations, and power lines, and discharged water that is often not useable for irrigation and, in some places, is reinjected into underground regions.¹¹ The development of CBM has sometimes pitted energy developers against other users of the affected water. Issues surrounding CBM development and water include:

8. Whitney, *supra* note 3.

9. D. Keith Murray, *Coalbed Methane Reservoir Evaluation and Completion Technology*, in *New Mexico Bureau of Mines and Mineral Resources*, in *ATLAS OF MAJOR ROCKY MOUNTAIN GAS RESERVOIRS* 188 (1993).

10. *Id.* at 188.

11. *Id.*

- underground water quantity and the possibility that drilling for CBM contaminates aquifers with water of lower quality;
- water rights and underground water supplies that may be diminished as dewatering occurs;
- groundwater that may be contaminated by discharged water that is polluted; and
- aquatic areas, stream beds, and local ecosystems that are unaccustomed to receiving such large volumes of water.

When the CBM is extracted, the water must be separated, the gas is sent to pipes, and the water is disposed of. The options for dealing with the large quantities of water released include the following (costs generally increase as one moves down the list):¹²

- Traditional surface discharge: water is allowed to travel downstream and be absorbed or evaporate as it moves;
- Irrigation: water released to agricultural areas;
- Treatment: water is treated to improve quality;
- Containment with reservoirs: water is piped to a surface impoundment where it is absorbed or evaporates, or may be used to water cattle;
- Atomization: water evaporates more quickly than normal through the use of misters placed in surface impoundments;
- Shallow injection or aquifer recharge: water is pumped into freshwater aquifers;
- Deep injection: salty water is typically reinjected deep into the ground.¹³

Water quality indicators vary across and even within basins, depending on the depth of the methane, geology, and environment of the deposition. In general, the deeper the coalbed, the less the volume of water in the fractures, but the more saline it becomes.¹⁴ The major elements of CBM water quality include: total dissolved solids (salts); pH and temperature; sodium, potassium, magnesium, calcium, and chlorine, and trace elements of iron, manganese, barium, chromium, arsenic, selenium, mercury, and hydrocar-

12. C.A. Rice & T.T. Bartos, *Nature and Characteristics of Water Co-Produced with Coalbed Methane with emphasis on the Powder River Basin*, Presentation at the U.S. Geological Survey Coalbed Methane Field Conference (May 9-10, 2001).

13. Peggy Williams, *Western Coalbed Methane*, OIL & GAS INVESTOR, Nov. 2001, at 34.

14. Vito Nuccio, *Geological Overview of Coalbed Methane*, Presentation at the U.S. Geological Survey Coalbed Methane Field Conference (May 9-10, 2001).

bons.¹⁵ Because of differences in water quality, CBM-produced water is dealt with differently across the major basins:¹⁶

San Juan:	99.9% of produced water is injected
Uinta:	97% injected, 3% evaporation
Powder River:	99.9% surface discharge
Black Warrior:	100% surface discharge
Raton Basin:	70% surface, 28% injected

In contrast to the San Juan basin, where produced water is typically reinjected because of poor quality, much of the produced water in Wyoming's Powder River Basin is useable for a variety of purposes. A major challenge has been managing in a semiarid landscape the tremendous increase in produced water. Even if water quality is high, salts may concentrate during evaporation or may overwhelm the semi-arid environment, inundating vegetation and causing erosion. In 2001, there were 5,446 wells producing 642 mcf of gas/day and 61,141,720 gallons of water/day; and CBM wells in Wyoming produce on average 150 barrels of water a day over a seven and one-half year life time.¹⁷ Another estimate concluded that more than 1.28 million barrels of water were produced each day from CBM extraction in 2000.¹⁸ The rate of water production during initial stages of development range from 400-800 barrels/day to 1,000-1,500 barrels/day in deeper wells.¹⁹

Controversy over what happens to produced water has been particularly acute in the Powder River Basin. The water quality varies considerably across the basin: in some areas, water quality is as good as or better than bottled water sold in stores.²⁰ In general, water quality is highest in the southeast, and diminishes to the West and North, where total dissolved solids increase.²¹ Discharges into the Tongue and Powder Rivers have been

15. Rice & Bartos, *supra* note 12.

16. Steve de Albuquerque, *An Overview of CBM Exploration and Production*, in COALBED METHANE DEVELOPMENT IN THE INTERMOUNTAIN WEST 124 (NRLC CD-ROM), *supra* note 4.

17. Lance Cook, *Geology of CBM in Wyoming*, in COALBED METHANE DEVELOPMENT IN THE INTERMOUNTAIN WEST 13 (NRLC CD-ROM), *supra* note 4.

18. C.A. Rice, M.S. Ellis, & J.H. Bullock, Jr., *Water Co-produced with Coalbed Methane in the Powder River Basin, Wyoming: Preliminary Compositional Data*, 2000 USGS OPEN FILE REP. 00-372, at 1.

19. Don Likwarz, *A Review of CBM Development in the Powder River and other Wyoming Basins*, in COALBED METHANE DEVELOPMENT IN THE INTERMOUNTAIN WEST 252 (NRLC CD-ROM), *supra* note 4.

20. Lance Cook, *The Geology and Production Characteristics of the Powder River and other CBM Basins in Wyoming*, in COALBED METHANE DEVELOPMENT IN THE INTERMOUNTAIN WEST 250 (NRLC CD-ROM), *supra* note 4.

21. Mike Day, *CBM Water Management: Challenges, Solutions, and Opportunities*, in COALBED METHANE DEVELOPMENT IN THE INTERMOUNTAIN WEST 263 (NRLC CD-ROM), *supra* note 4.

particularly contentious. Discharged water there is generally of sufficiently high quality for drinking water and watering stock, but the produced water is not as high a quality as in the Tongue River, so no discharge permits are given.²² In other areas, the water can be discharged into the Belle Fouché and Cheyenne Rivers and Caballo Creek.²³ The water is suitable for cattle, but there are insufficient cattle to use the produced water. Surface disposal is a challenge as it may result in erosion when discharged into drainages or inundate vegetation. Even though water quality is good, salts may concentrate during evaporation and harm soils. Stock reservoirs have been created, and while some ranchers have wanted the water source, others do not because the reservoirs take land out of production.²⁴ Ranchers are faced with soils damaged by the salts and metals remaining after evaporation, less grass is available for cattle, clay soils become hard pan, and dead cottonwood trees, dead grass, and weeds result from CBM development.²⁵

Critics of CBM development also argue that the amount of water withdrawn from CBM production will greatly lower the aquifer levels in Wyoming. They warn that by 2010, surface discharge of produced water will reach 1 billion gallons a day. Data from coal mine permits and plans suggest that it will take 800-1500 years following reclamation to recharge the coal aquifer and argue that, despite the differences between coal mining and CBM extraction, CBM development poses the same kind of threat to the region's long-term water supply.²⁶ The Final Environmental Impact Statement (EIS) for the next round of development in the Powder River Basin paints a more optimistic picture, concluding that by the year 2060, aquifer water levels would recover to within 10-50 feet of pre-development levels, and to within 20 feet or less within a hundred years.²⁷

Throughout the arid West, one of the most important challenges surrounding CBM development is finding beneficial uses for the produced water. Given the aridity of the West, however, the region's water is at least as valuable as its natural gas. Water law is tremendously important in shaping water use, but the legal framework surrounding the use of CBM-produced water is not well developed.

22. *Id.*

23. Williams, *supra* note 13, at 43.

24. Hal Clifford, *Drilling method pumps up floods of conflict*, THE CHRISTIAN SCIENCE MONITOR, Jan. 3, 2002, available at <http://csmonitor.com/2002/0103/p3s1-usgn.html> (last visited May 2, 2004).

25. Jill Morrison, *CBM Development, Ranching, and Agriculture*, in COALBED METHANE DEVELOPMENT IN THE INTERMOUNTAIN WEST 286 (NRLC CD-ROM), *supra* note 4.

26. Thomas F. Darin & Amy W. Beattie, *Debunking the Natural Gas "Clean Energy" Myth: Coalbed Methane in Wyoming's Powder River Basin*, 31 ENVTL. L. REP. 10,566, 10,575-76 (2001).

27. U.S. DEPARTMENT OF THE INTERIOR, FINAL ENVIRONMENTAL IMPACT STATEMENT AND PROPOSED PLAN AMENDMENT FOR THE POWDER RIVER BASIN OIL AND GAS PROJECT, Vol. 1 at 2-74 (2003).

WATER QUALITY REGULATION²⁸

Under the Clean Water Act, as administered by states, CBM development is governed by water quality standards to protect designated uses of water such as drinking water, agriculture, or fisheries.²⁹ Standards include pollution limits to protect state water quality standards, anti-degradation requirements beyond water quality standards, and total maximum daily loads – maximum daily pollutant discharges that are assigned to point and non-point sources to ensure total pollution levels are not exceeded.³⁰ The standards consist of numeric pollution limits as well as narrative or descriptive standards that are typically applied to each category of use. If a body of water has more than one designated use, the more stringent standard applies.³¹

Section 401 of the Clean Water Act requires CBM companies to apply for and receive a National Pollution Discharge Elimination System (NPDES) permit if they are discharging produced water into surface waters of the state. Clean water regulations provide that there shall be no discharge of waste water pollutants into navigable waters from any source associated with production, field exploration, drilling, well completion, or well treatment (i.e. produced water, drilling muds, drill cuttings, and produced sand) without an NPDES permit.³² If technology-based limitations are insufficient to ensure water quality standards are met, states must develop “total maximum daily loads” (TMDLs) for each pollutant for which standards are being violated.³³ The TMDL determines the maximum amount of the pollutant that the water body can receive daily; states apportion the total load to point and non-point sources. Once the TMDL is fully allocated, no further discharges of pollutants into the water body are allowed.³⁴

The Safe Drinking Water Act (SDWA) governs re-injection of water produced from CBM extraction.³⁵ No underground injection is allowed

28. The discussion in this section relies heavily on Kate Zimmerman, *Federal, State, and Local Regulatory Framework for Permitting of CBM Development*, in COALBED METHANE DEVELOPMENT IN THE INTERMOUNTAIN WEST (NRLC CD-ROM), *supra* note 4.

29. 33 U.S.C. § 1313(c)(2)(A) (2004); 40 C.F.R. § 131.11(a)(1) (2003).

30. 33 U.S.C. §§ 1251-1387 (2004). Section 301 of the Act makes the “discharge of any pollutant by any person . . . unlawful.” *Id.* § 1311(a). Section 402 allows for the discharge of a pollutant by permit as long as existing water quality uses are not impaired. *Id.* § 1342(a). A discharge is defined as the addition of any pollutant from a point source. 40 C.F.R. § 122.2. A point source in turn is defined to include “any discernable, confined, and discrete conveyance, including but not limited to, any pipe” *Id.* A pollutant is defined as “a dredged spoil, solid waste, . . . and industrial, municipal, and agricultural waste discharged into water.” *Id.* CBM water with dissolved solids and minerals contains pollutants.

31. 40 C.F.R. § 131.11(a)(1).

32. *Id.* § 435.32.

33. 33 U.S.C. § 1313(d)(1)(C).

34. *Id.* § 1313(d)(1)(C).

35. 42 U.S.C.A. § 300h-8(d).

without a permit. Regulations define five classes of injection wells according to the type of fluid they inject and where the fluid is injected. With CBM, most re-injection is done into Class II wells. Class II wells cover fluids that are either brought to the surface in connection with oil and gas development or are used to enhance the recovery of oil and gas. Colorado, Wyoming, and other CBM states issue Class II permits through their oil and gas commissions and boards.³⁶ In general, operators are required to:

- site the wells in a location that is free of faults and other adverse geological features;
- drill to a depth that allows the injection into formations that do not contain water that can potentially be used as a source of drinking water;
- use an injection pipe that has multiple layers for containment of potentially contaminating injection fluids; and
- monitor to ensure the integrity of the well.³⁷

STATE WATER LAW GOVERNING CBM PRODUCED WATER

The Rocky Mountain states have all adopted the prior appropriation approach to water law. Under prior appropriation, ownership of land does not result in ownership of water, but water rights are created when water is diverted and used or appropriated for a beneficial purpose. The main provisions of prior appropriation include the following. First, the water right is the amount of water put to a beneficial use; there are no limits to the quantity used such as reasonable use, but state statutes typically require right-holders to show that all the water will be beneficially used and not wasted. Second, the date of the original appropriation establishes the water right priority date; the holder of the oldest or most senior priority right is entitled to delivery of the full right; junior right-holders are entitled to whatever water is available after senior rights-holders have withdrawn their water. Third, rights are acquired by use and may be lost by non-use: abandonment occurs when the right-holder intends to relinquish the water right. Fourth, water rights are "perfected" when an applicant receives a certificate or decree from the state water engineer or court recognizing that the water is being put to beneficial use and belongs to the applicant.³⁸ Fifth, beneficial use generally includes

36. Injections of other fluids or injections into drinking water aquifers normally are permitted by state departments of environmental quality. *See, e.g.*, 56 Fed. Reg. 9408-22 (Mar. 6, 1991).

37. The SDWA prohibits EPA from prescribing requirements that interfere or impede the underground injection of brine or other fluids that are brought to the surface in connection with oil and gas production unless the requirements are essential to assure that injection will not endanger an underground source of drinking water. 42 U.S.C. § 300(h)(b)(2).

38. Most states require rights-holders to apply for a permit; Colorado, in contrast, does not issue permits; priority is established when the applicant decides to put the water to beneficial use, and makes an open, overt demonstration of that intent.

domestic, municipal, industrial, commercial, agricultural, hydropower production, stockwatering, and mining; recreation, fish and wildlife maintenance, and preservation of environmental and aesthetic values have also been defined as beneficial use. Sixth, water rights are passed to new land owners when land is conveyed unless the grantor expressly reserves those rights, and water rights may be transferred separately from the land if allowed by state law. Finally, the prior appropriation doctrine is primarily applicable to surface waters. Water that occurs as a result of human labor is not subject to appropriation but belongs to those responsible for producing it.³⁹

Colorado Water Law

In Colorado, groundwater is broadly classified into designated groundwater (groundwater within a designated groundwater basin and not available to or required for fulfilling surface water rights) and non-designated groundwater (water located outside of designated groundwater basins). Designated groundwater is regulated by the Colorado Groundwater Commission (CGWC); non-designated groundwater is regulated by the State Engineer and Water Courts. Eight groundwater basins have been designated in the Front Range and in Eastern Colorado. Groundwater basins located outside of designated areas are classified into one of three following sub-categories: Tributary Groundwater, Non-tributary Groundwater, and Not Non-tributary Groundwater. Groundwater in Colorado is divided into designated basins, tributary water, non-tributary water, and not non-tributary water. The traditional prior appropriation system was modified when applied to groundwater in order to increase economic development. Developers are not required to apply for a permit from the state engineer when withdrawing non-tributary water unless that water will be put to a beneficial use.⁴⁰ If the produced water is put to a beneficial use, the state engineer must ensure that it will not cause “material injury to the vested water rights of others;” if injury will result, the permit must contain mitigation measures to avoid injury.⁴¹

The Colorado Oil and Gas Conservation Commission (COGCC) has jurisdiction over produced water, which appears to fall under its definition of “exploration and production waste.”⁴² COGCC Rule 907 covers the management of “E&P” waste, and it dictates how produced water shall be managed and disposed. Under the rule, if produced water is placed in a pit, it must first be treated to prevent crude oil and condensate from polluting the

39. This summary is based on JAN G. LAITOS, NATURAL RESOURCES LAW 384-99 (2002).

40. COLO. REV. STAT. § 37-90-137(7)(a) (2003).

41. *Id.* § 37-90-137(7)(b).

42. *Id.* § 34-60-103(4.5) (“‘Exploration and Production Waste’ means those wastes that are generated during the drilling of and production from oil and gas wells or during primary field operations and that are exempt from regulation as hazardous wastes under [RCRA.]”).

pit.⁴³ The rule also contains a number of disposal options including reinjection into a Class II well, evaporation or percolation in a permitted lined or unlined pit, disposal at commercial facilities or through road-spreading, or discharge into the waters of the state.⁴⁴ All of these provisions require the operator to receive the proper permits before undertaking any of these activities. The produced water may also be reused to aid in enhanced recovery, drilling, or other uses as long as the use follows established water quality standards and water rights.⁴⁵ Finally, the rule allows for the water to be used by the surface owner as an alternative domestic water supply that cannot be traded or sold.⁴⁶ When water is used in such a manner, it is not considered an implicit admission by the operator that his or her activities are impacting existing water wells.

In Colorado, juniors may pump underground sources if they augment surface right-holders with supplemental water to offset any loss in surface water from groundwater removal. To protect water quality, states may require that wells do not draw contaminants into an aquifer. If such contamination occurs, landowners may pursue tort claims against those who have contaminated their groundwater. If they have no water appropriation rights, landowners may still pursue nuisance claims if contamination unreasonably interferes with their use and enjoyment of the land above the aquifer.⁴⁷

Wyoming Water Law

Groundwater in Wyoming is defined as any water under the surface of the land or the bed of any stream, lake, reservoir, or other body of surface water, including water that has been exposed to the surface by an excavation;⁴⁸ by-product water is water that has not been put to a prior beneficial use, but is a by-product of some non water-related economic activity and has been developed only as a result of such activity such as the dewatering of a mine.⁴⁹ Any person who wants to appropriate this water must file a groundwater application with the state engineer.⁵⁰

Groundwaters of Wyoming are defined by law as the property of

43. COLO. RULES & REGS., OIL & GAS CONS. COMM'N, EXPLORATION & PRODUCTION WASTE MANAGEMENT, R. 907(c)(1) (Weil's 2003) available at <http://oil-gas.state.co.us/> (last visited May 2, 2004).

44. *Id.* § 907(c)(2).

45. *Id.* § 907(c)(3).

46. *Id.* § 907(c)(4).

47. *Id.*

48. WYO. STAT. ANN. § 41-3-904 (LexisNexis 2003).

49. *Id.* § 41-3-903.

50. *Id.* § 41-3-901(a)(ii).

the State.⁵¹ Under Wyoming water law, applications for the appropriation of groundwater “shall be granted as a matter of purpose, if the proposed use is beneficial and, if the state engineer finds that the proposed means of diversion and construction are adequate.”⁵² However, the state engineer may also deny the application if he finds that it would not be in the public’s water interest.⁵³ The state engineer retains jurisdiction over produced water from CBM wells, and developers are required to obtain groundwater appropriation permits.⁵⁴

Beneficial uses of water are outlined in Wyoming water law, and are ranked according to preferences.⁵⁵ Underground water appropriations for stock or domestic use “shall have a preferred right over the rights for *all other uses*, regardless of their dates of priority.”⁵⁶ The following order governs rights: (1) drinking water for man and animals; (2) municipal purposes; (3) steam engines and cooking, laundry, and bathing; and (4) industrial purposes (including mine dewatering).⁵⁷

Byproduct water is defined as, “water which has not been put to prior beneficial use, and which is a by-product of some non-water-related economic activity. . . . By-product water includes, but is not limited to, water resulting from the operation of oil well separator systems or mining activities such as dewatering of mines.”⁵⁸ In Wyoming, traditional deep oil and gas byproduct water is treated in this fashion, with no beneficial use permit required by the state engineer.⁵⁹ However, state officials have not applied the byproduct provision to CBM water and have required a beneficial use permit in order to monitor groundwater depletion rates in protecting water rights.⁶⁰

New Mexico Water Law

New Mexico law provides that the water of underground streams, channels, artesian basins, reservoirs or lakes, having reasonably ascertainable boundaries, are declared to be public waters and subject to appropria-

51. For a detailed discussion of Wyoming water law and CBM development, see Thomas F. Darin, *Waste or Wasted? Rethinking the Regulation of Coalbed Methane Byproduct Water in the Rocky Mountains*, in COALBED METHANE DEVELOPMENT IN THE INTERMOUNTAIN WEST 189 (NRLC CD-ROM), *supra* note 4.

52. WYO. STAT. ANN. § 41-3-931 (LexisNexis 2003).

53. *Id.*

54. *Id.* § 41-3-905.

55. *Id.* § 41-3-102(b) (by application of *id.* § 41-3-906).

56. *Id.* § 41-3-907 (emphasis added).

57. *Id.* § 41-3-102(b) (by application of *id.* § 41-3-906).

58. *Id.* § 41-3-903.

59. *Id.* § 41-3-903 (1973) (with historical reference to *id.* § 41-121.2 (1957)).

60. Darin, *supra* note 51, at n.180.

tion for beneficial use.⁶¹ The state engineer declares which underground sources are reasonably ascertainable.⁶² Once declared, these sources become available for appropriation, and withdrawal requires permits issued by the state engineer. No permit and license to appropriate underground waters for in-state use is required except in basins declared by the state engineer to have reasonable ascertainable boundaries.⁶³ A permit is required to drill a well, and a permit is also needed to use the water. There are two major exemptions from the permitting process. They are: minimal domestic uses and wells deeper than 2500 feet. Although not exemptions, replacement wells and supplemental wells also have less stringent requirements.⁶⁴

New Mexico passed the Mine Dewatering Act to promote maximum economic development of mineral resources while ensuring that development does not impair existing water rights.⁶⁵ The legislature recognized that administering water rights under prior appropriation might cause severe economic hardship when applied to mineral production. Under this act, a person needs a permit to engage in mine dewatering issued by the state engineer.⁶⁶ If the engineer finds there is no impairment to existing rights, he will issue the permit.⁶⁷ If the state engineer finds the mine dewatering would impair existing rights, he will notify the applicant, and the applicant may appeal or file a plan of replacement. The legislature allows replacement water to be used to counteract any impairment to existing water rights due to mine dewatering.⁶⁸ Application for replacement of water shall be made to the state engineer and shall be at the sole expense of the applicant.⁶⁹

Utah Water Law

All waters in the state, whether above or below the ground, are property of the public,⁷⁰ and beneficial use is the basis, limit, and measure of all rights to the use of water in the state.⁷¹ Surface water and groundwater appropriation are treated identically under Utah law. The appropriation must be for some useful and beneficial purpose. Prior appropriation gives the better right, but domestic purposes shall have preference over all other uses, and agricultural use shall have preference over all uses except domestic.⁷²

61. N.M. STAT. ANN. § 72-12-1 (Michie 1978).

62. Bliss, *State ex rel. v. Dority*, 225 P.2d 1007, 1101 (N.M. 1950). *See also* N.M. STAT. ANN. § 72-12-12.

63. N.M. STAT. ANN. § 72-12-20.

64. *Id.* § 72-12-12.

65. *Id.* § 72-12A-2.

66. *Id.* § 72-12A-6.

67. *Id.* § 72-12A-7.

68. *Id.* § 72-12A-4.

69. *Id.*

70. UTAH CODE ANN. § 73-1-1 (2003).

71. *Id.* § 73-1-3.

72. *Id.* § 73-3-21.

The state engineer may issue a permit for a limited amount of time.⁷³ At the expiration date the water reverts back to the public and again is subject to appropriation. No right to use water can be acquired by adverse use or adverse possession.⁷⁴

The state engineer also issues groundwater management plans for geographic regions where he suspects the safe yield of the aquifer may soon be reached. The engineer uses these plans to establish area specific guidelines for use when reviewing applications and managing groundwater. The purposes of these plans are specific to the area but may include promoting efficient use, maximizing the benefits, and protecting existing rights. The state engineer uses his statutory authority to administer the measurement, appropriation, and distribution of the groundwater of the state to implement these plans. The state engineer studies each area to find the annual precipitation, recharge rate, and discharge rate and estimate future needs and demands. In these management plans, he may limit the amount of new appropriations, set total maximum annual withdrawals, or even close the area to any new appropriations.

ENSURING BENEFICIAL USE OF CBM WATER

All states require that appropriated water be put to beneficial use, but the assumption underlying each state's regulation of water produced from CBM development is that it is waste and that state oil and gas commissions have jurisdiction over the produced water. While this may have made sense when the produced water was largely the brine resulting from conventional deep oil and gas drilling, it does not make sense for CBM water. Many of these statutes were passed in Utah, New Mexico, Colorado, Montana, and Wyoming in the 1950s and early 1960s, when the produced water was highly polluted, with total dissolved solids in some cases at 100,000 ppm, or nearly triple that of seawater. CBM production did not start until the late 1980s, with the real boom occurring in the mid-1990s, long after these models were developed.⁷⁵

Dealing with produced water in the Powder River Basin has been particularly challenging. Produced water quality varies considerably across the region and water in different areas is suitable for different uses, but only a relatively small amount of the water is beneficially used. Once the projected 51,000 CBM wells are operating in the Basin, some 700 million gallons of water are projected to be produced a day, enough to water 45 million cows or 325 million sheep, since one cow drinks (or seven sheep drink) about 14.5 gallons per day. But the Basin is currently home to only 500,000

73. *Id.* § 73-3-8(2).

74. *Id.* § 73-3-1.

75. Darin, *supra* note 51.

cattle and sheep. Because of the nature of the soil, the sodium and salinity in the produced water makes it unfit for agricultural use.⁷⁶

Given the high quality of some of the produced water in the Powder River, there are many possible beneficial uses, including livestock, dust control from construction and road traffic, industrial, fish and wildlife, recreation, irrigation, and aquifer recharge and storage. The most common use of the discharged water is building storage ponds for watering stock; some ranchers welcome the additional water, while others do not need it and do not want to inundate lands that could be used for grazing and other purposes.⁷⁷ Recharging aquifers, some argue, is the most valuable beneficial use.⁷⁸ The city of Gillette is experimenting with reinjecting produced water into the aquifer supplying the city's drinking water⁷⁹ and BLM officials have found CBM produced groundwater released on the surface recharges shallow sand aquifers faster than they expected.⁸⁰ Discharge water in some areas of the Powder River has been approved for agriculture as a beneficial use.⁸¹

Despite the Wyoming state engineer's classification of CBM produced water as a beneficial use, much of it appears to be wasted. There is clear legal authority for the state to conduct a public interest review of CBM produced water.⁸² The state constitution, for example, provides that the state shall equally guard all various water interests.⁸³ The state constitution provides that water appropriations should be denied when against the public interest.⁸⁴ The groundwater code specifically provides that appropriations not in the "public's water interest" may be denied⁸⁵ and that the state engineer may condition permits based upon the public interest.⁸⁶ The water of the state is held in trust for the public;⁸⁷ the state engineer's rules provide for denying a groundwater appropriation permit when not in the "public inter-

76. *Id.*

77. Jill Morrison, Presentation at The Natural Resources Law Center conference (Apr. 4-5, 2002).

78. Mike Day, Presentation at The Natural Resources Law Center conference (Apr. 4-5, 2002).

79. *Energy/Water Quality*, WESTERN STATES WATER (Sept. 7, 2001) available at www.westgov.org/wswc (last visited September 7, 2001).

80. Associated Press, *Aquifers refill faster than expected*, BILLINGS GAZETTE, July 9, 2002, available at www.billingsgazette.com/index.php?display=/rednews/2002/07/09/build/Wyoming/aquifers.inc (last visited May 2, 2004).

81. Jeff Tollefson, *EPA's Methane Study Irks Wyo; Mont. Gives Study Green Light*, BILLINGS GAZETTE, Apr. 13, 2001, available at www.billingsgazette.com/index.php?display=/rednews/2001/04/13/build/wyoming/coalbed.inc

82. Darin, *supra* note 51.

83. WYO. CONST. art. I, § 31.

84. WYO. CONST. art. VIII, § 3.

85. WYO. STAT. ANN. § 41-3-931 (LexisNexis 2003).

86. *Id.* § 41-3-933.

87. WYO. RULES & REGS., STATE ENGINEER, WYO. WATER ADMIN., Ch. 1, § 4(a) (Weil's 2003).

est” and the state engineer’s rules on groundwater require the agency to protect it against waste.⁸⁸ As Thomas Darin summarized the challenge:

CBM byproduct water across the West varies in quality; however . . . the quality in many cases makes it suitable for drinking, livestock watering, and if treated, for other uses. Put simply, these outdated models for handling oil and gas byproduct water do not fit CBM production and the associated byproduct water. In the process of handling and assuming *all* of this water to be “waste,” these states are in fact in the process of actually “wasting” a valuable resource.⁸⁹

As important as CBM resources are in the future of United States energy supply, at least as important is ensuring the beneficial use of produced water. How can states best protect existing water rights, preserve water for future generations, and ensure that scarce water is not wasted? A variety of approaches for governing the withdrawal and use of groundwater in CBM development have been suggested. (1) States could declare the owner of surface lands the owner of all the water under it as part of the soil; most states have rejected this approach since it provides no recourse when land owners deplete or contaminate groundwater. (2) States may allow landowners to withdraw reasonable amounts of water as long as that use is connected to the beneficial enjoyment of the land. (3) States may employ tort law to hold liable those whose withdrawal of water harms neighboring land owners, is beyond a reasonable share of water use, or affects surface water in ways adverse to right-holders of that water. (4) States may apply prior appropriations principles, but because senior right-holders might drain an aquifer, states may limit the protection provided for seniors through principles such as “unreasonable interference,” where the “lowering of the water table is not per se an unreasonable impairment of senior rights.”⁹⁰

RECOMMENDATIONS

States can take several steps to ensure that more of the produced water from CBM development is put to beneficial use. First, they can enact legislation that specifically provides for the use and disposal of produced water. If produced water is sufficiently clean, in natural or treated form, to be put to beneficial use, state law can clarify who owns the water and how beneficial use requirements apply. If states determine that developers of CBM also own the produced water, for example, that clarification of owner-

88. *Id.* § 1.

89. Darin, *supra* note 51, at 204.

90. LAITOS, *supra* note 39, at 407-09.

ship can encourage those companies to find beneficial uses of the water, including collecting, marketing, and transporting it to areas of greatest need.

Second, states can require companies to prepare Water Management Plans (WMPs) as part of every major CBM development to ensure that existing water laws and regulations are honored, the reasonable desires of the surface owners concerning the use and disposal of produced water satisfied, and that produced water is not wasted but used beneficially. Effective plans will likely require consultation with surface owners, upstream and downstream water users, and other water users in the watershed; sound hydrologic analysis that includes all relevant natural flow, runoff, other discharges, and other land uses; effective monitoring plans that include impacts of development on natural springs and the physical condition of discharge points and channels; measures to stabilize erosion, soil and water quality, the health of wetland/riparian areas, and vegetative changes; and regular inspections.⁹¹

Third, states can require CBM developers to include in their Water Management Plans provisions that deal with key issues, such as requiring that developers offer useable water to surface owners before injecting it and specifying the testing and analysis required before injection occurs; providing for the establishment of standards for reservoirs, spillways, and water containment structures; and establishing standards for protecting surface waters and aquifers to ensure that the quality of CBM water is equal to or better quality than that which it impacts. States can also specify beneficial uses of CBM water, such as bolstering seasonal flows of rivers, irrigation, and recharging aquifers. State standards can provide for locating discharge points and reservoirs that involve the least practicable surface disturbance and impacts on erosion and place limits on cumulative discharge of produced water so that it does not exceed natural peak flows. Standards can also include minimum requirements for the characterization of disposal sites, investigations of soils and vegetation, and mitigation plans.⁹²

Finally, states can develop a research program to carefully trace what happens to produced water and what its impacts are on surface ecosystems and groundwater. Laws and policies governing CBM development can be integrated with efforts to protect groundwater, such as ensuring that withdrawal and recharge rates are balanced, that pumping of groundwater meets both municipal and agricultural needs, and that human and ecosystem demands are satisfied.

Groundwater laws in western states are generally fragmented and out of date, and pressures surrounding CBM development, water shortages

91. WESTERN GOVERNOR'S ASSOC., COALBED METHANE BEST MANAGEMENT PRACTICES, Draft, Oct. 2003, at 12-13.

92. *Id.* at 14-21.

that are increasing in scope and severity, and other problems can all contribute to political pressure to update the patchwork of state laws governing groundwater to ensure that states are able to make decisions about allocating scarce water resources that reflect the public interest.⁹³

93. GARY BRYNER & ELIZABETH PURCELL, *THE GROUNDWATER LAW SOURCEBOOK* (2003).

