

APPENDIX E

BENEFICIAL USE ALTERNATIVES FOR CBM PRODUCED WATER

Produced water quality, applicable regulations, and cost will generally dictate potential beneficial use of produced water. In some cases, produced water can be treated to make it suitable for a particular use, and treatment technologies are discussed in the next section. However, in accordance with 40 CFR, Part 435, produced water must be put to some use for livestock, wildlife, or agriculture. Otherwise, it is not to be discharged to surface waters of the Nation.

Agricultural Uses

The water provided by CBM discharge is a temporary and potentially valuable resource for agriculture, particularly in arid regions. CBM produced water has the potential for beneficial use in agricultural livestock and irrigation applications, depending on the quality. Livestock benefits have been realized with increased cattle density, increased weight gain in cattle, and subsequent improvement in range use when water is made available in otherwise dry areas. New water sources may also increase aquatic habitat and provide new fisheries. However, water law and compact requirements vary between states, so a full understanding of water issues is critical.

Alternative 1 - Stock Watering

The layout of many CBM projects is particularly conducive to stock watering because CBM wells are spread out on 80 acre spacing, or greater. Stock watering may be handled in several ways, including discharge to reservoirs and stream drainages, or discharge to small containment vessels, such as tire tanks. In either case, overflow of water from the containment ponds or tanks can provide water to livestock over a distance. Water impounded at the head of a drainage, if allowed to overflow from a small tank or reservoir, distributes water over a larger linear distance, potentially up to several miles. The result is an improved distribution of the herd, and ultimately an improved utilization of the grazing lease or ranch. Loss of the water in this scenario is largely a function of infiltration through the streambed and consumption by plant species along the banks, rather than direct consumption by livestock and wildlife.

The overflow of water into streams constitutes a discharge to surface waters thus to discharge the water as described would in most cases require a NPDES permit. There is also the potential to impact soils by allowing the water to run along the surface, depending on the water quality and soil types.

Alternative 2 - Irrigation

CBM produced water can be used for irrigation purposes when water quality, soil type, crop type and irrigation method are conducive for irrigation. The appropriateness of irrigation with CBM water is dependent on the site specific conditions (water quality, soils, vegetation, etc.) and the proposed management practices (application rates, soil amendments, treatment, etc.).

Industrial Uses

Other water management options for CBM produced water include the supply of CBM water to other industries for use in operational activities. A variety of existing industries could benefit from this water supply including: coal mines, animal feeding operations, cooling tower water for various industrial applications, car wash facilities, commercial fisheries, enhanced oil recovery, and fire protection. Industrial applications which may be less commonly considered but would still have the potential for the use of CBM produced water include: sod farming, bottled drinking water, brewery water, and solution mining of minerals. Each of the existing industries and emerging industrial applications would use produced water of varying quantities and quality.

Alternative 1 - Coal Mine Use

Coal mining in the United States is generally at or near the land surface. Mining related activities that require water include: dust suppression, slurry activities, and post mining restoration efforts.

Alternative 2 - Animal Feeding Operations

CBM produced water could be supplied to Animal Feeding Operations (AFOs) and Concentrated Animal Feeding Operations (CAFOs) for livestock watering and the management of animal wastes. Livestock watering applications in a CAFO would be similar to that previously discussed in the Agricultural Use. In addition to livestock watering at CAFOs, produced water could be used to assist in waste management activities. The EPA, as defined in 40 CFR 122.23, Appendix B, regulates NPDES permitted discharges from CAFO's for animal waste.

Alternative 3 - Cooling Tower Water

Numerous industrial activities and chemical plants use water as a cooling agent. Towers are a common means of removing heat from cooling water that has been heated through thermal exchange. Cold water enters the plant's heat exchanger that causes a thermal exchange of heat from within the plant to the water in the cooling loop; this water is then sent to the cooling tower where it flows over fill surfaces. As the water flows over the fill surfaces, air is passed through the tower either by natural flow or by electric fans, cooling the water by contact with the air. Once the water is cooled, it is recycled through the system; make-up water is usually added due to losses from evaporation. High quality CBM produced water can be used as make-up water in a cooling tower system. The produced water would need to be low TDS water because mineralization generally leads to clogging of the cooling system.

Alternative 4 - Field and Car Wash Facilities

Construction activities and other land disturbing activities are a concern because vehicles accessing land with noxious plants can cause them to spread. The problems associated with spreading noxious weeds include making site reclamation more difficult, as well as impacts to ecosystems, farmland and grazing land. One way to reduce the spread of noxious weeds is to wash vehicles and equipment before and after entering these areas. The construction of field equipment wash facilities and rural car washes supplied with produced water reduces the potential for distribution of noxious weeds by vehicles and equipment. These temporary wash facilities constructed near CBM development could be supplied with produced water. The field wash facilities are temporary and used to clean vehicles and equipment entering and leaving construction sites, recreational off road vehicles, farm and ranch equipment, and oil and gas

equipment. Many state and federal agencies (for instance USFS, BLM) recommend these facilities as part of their BMPs for controlling the spread of noxious weeds.

Alternative 5 - Enhanced Oil Recovery

Another management option of CBM produced water is to inject the water into a secondary or enhanced recovery well into conventional oil producing horizons. Primary recovery of oil is driven by the natural energy of the reservoir and can be supplemented by pumping. When primary recovery ends, secondary recovery begins and may be followed by enhanced recovery. Secondary and enhanced recovery is the process of injecting a fluid into a reservoir creating a waterflood that displaces the oil causing it to flow to the producing well (Collins and Carroll, 1987). Water is the fluid most commonly used in secondary and enhanced recovery of oil in non-CBM fields; CBM produced water could, therefore, be of beneficial use in secondary and enhanced oil recovery.

Alternative 6 - Fisheries

Commercial fisheries in the western United States could also benefit from available CBM produced water supplies. These fisheries have to obtain water rights to divert water into their operational ponds for surface waters; therefore, CBM produced water could be used in place of diverted surface water or groundwater. Produced water could also be used during dry summer months or droughts to supply water when traditional surface supplies have been drained or are dry.

Alternative 7 - Fire Protection

In municipal areas, fire hydrants and sprinkler systems are supplied with drinking quality water from municipal supply systems. In areas where CBM development is near a municipality, produced water could be used to supply both fire hydrants and sprinkler systems. Fighting fires does not require high quality water and could benefit from the use of produced water by not depleting drinking water supplies. Wildfires in the western United States are becoming larger and more dangerous during the current drought conditions that exist in many states. The normal supplies of water that are used for fighting fires are also being depleted by the drought. The supplies of CBM produced water stored in impoundments or stored in tanks at disposal wells could provide an accessible option for fighting fires in remote areas in states such as Colorado, Wyoming, New Mexico, Montana, and Utah.

Alternative 8 - Other Industrial Uses

Aside from those uses listed above which are either currently in practice or have been researched to show potential as a use for produced water, other options which have been considered, but not analyzed in detail. Some of these potential uses include options that have the potential to use large quantities of produced water. The potential industrial uses which are being mentioned here include: sod farming, solution mining for minerals, bottled drinking water, and brewery water.

Domestic and Municipal Water Use

Produced water associated with CBM development can be a valuable commodity, especially for arid regions in the western United States. CBM produced water is of greater value when it meets drinking water standards, or is near drinking water quality, because of the broad variety of uses high quality water provides. This water management alternative includes the use of CBM

produced water for domestic (e.g., public or residential) and municipal (e.g., city or county) water use and supply. Alternatives under this water management group include: the supply of high quality water from CBM production areas to rural landowners and municipalities; the use of lesser quality CBM produced water for recharge water systems; make-up water; and other residential non-potable water uses.

Alternative 1 - Domestic Use

Because of its overall high quality in many areas, produced water from CBM wells has the potential to be used by residences for potable and non-potable uses. Descriptions of these uses are provided below:

Potable Water Use: High-quality produced water that meets drinking water standards can be used for human consumption, although limited treatment may be required (e.g., chlorination). Depending on the circumstances, quality of the produced water, treatment requirements, and other factors, it may be feasible to use produced water as a sole source for residential or domestic use. It may likewise be feasible for use in supplementing existing supplies continuously or on a periodic basis.

Non-Potable Water Use: Non-potable produced water could be supplied to individual homes, perhaps using a dual water system, for uses such as lawn and garden irrigation, bathing, dishwasher and washing machine uses, vehicle washing, residential maintenance, and toilet flushing.

Alternative 2 - Municipal Water Use

In addition to supplying water to rural landowners, CBM produced water could be used to augment municipal water supplies both for potable and for non-potable uses, including:

Potable Water Use: Similar to domestic supply, high-quality produced water that meets drinking water standards could be used for human consumption. High quality water could be supplied upstream of the existing water treatment facilities and distributed through the existing infrastructure with some modifications (such as gas separators). Depending on the circumstances such as quality of the produced water, treatment requirements, and other factors, using produced water as a sole source may be feasible for a certain portion of the municipality, in mixed distribution with the existing supply, or as a seasonal or period augmentation of over appropriated supplies.

Non-Potable Water Use: The potential for the distribution of lesser quality produced water for non-potable uses within a municipality may be greater than potable use. The potential non-potable use for produced water in a municipality includes a dual water system for household uses as described in the previous section: showering, bathing, lawn and garden watering, and washing clothes and cars. In addition, municipalities could use produced water to supply water to fire hydrants, street cleaning equipment, and certain industries including commercial car washes. It may also be used to recharge depleted aquifers.