

A Seven Point Plan to Protect Groundwater

Unconventional Oil & Gas Development Requires Wyoming State Action



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POWDER RIVER BASIN *Resource Council*

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WHO WE ARE

Founded in 1973, Powder River Basin Resource Council is a citizen-based organization of individuals and affiliate groups dedicated to the stewardship of Wyoming's natural resources. Through member empowerment, strategic alliances, and a dedicated staff, we work to preserve Wyoming's unique quality of life and our precious air, land, and water quality.

Our mission is to preserve and enrich our agricultural heritage and rural lifestyle; conserve Wyoming's unique land, minerals, water, and clean air consistent with the responsible use of these resources to sustain the livelihood of present and future generations; and educate and empower Wyoming's citizens to raise a coherent voice to affect the decisions that will impact our environment and lifestyle.

We are a nonprofit, 501(c)(3) tax-exempt organization.

CREDITS

Our sincere appreciation goes to Amber Wilson, our 2012 summer intern, who conducted the initial research and writing for this publication. Additional thanks go to our staff, Shannon Anderson and Jill Morrison, and Board Member Bob LeResche for additional research, writing and editing. The most credit goes to our members who are living in areas impacted by oil and gas drilling and development throughout Wyoming. Theirs are the real-life stories that inspired this report and make it worthy of attention.

Executive Summary

Many Wyoming groundwater aquifers are already or will soon be in deficit water balance – being drained faster than they are recharged. This is largely due to increasing demands brought by the current boom in new oil and gas production techniques.

Traditional oil and gas wells have always required thousands of gallons of water to complete and produce. However, new wells using deep horizontal drilling and hydraulic fracturing (“fracking”) each require several millions of gallons of fresh water. These wells are being developed in many regions of the state where groundwater resources are marginal at best and where recharge commonly requires centuries or millennia.

Our current and coming oil and gas boom promises to bring new revenue to Wyoming. Unfortunately, it will also bring two types of groundwater management problems that threaten to overwhelm our water regulatory system. Wyoming’s water management system was established decades ago, before this volume of water demand was even dreamed of. Lack of timely changes to our water allocation and management process will expose much of Wyoming to:

- *Depletion of critical groundwater resources far beyond aquifers’ ability to recharge fast enough to support domestic and agriculture needs; and,*
- *Damage to existing aquifers from poorly managed injection or pit disposal of the massive volumes of flowback and produced waters resulting from new production techniques.*

This analysis concludes it is essential that Wyoming act swiftly to improve our water management techniques, programs and standards if we are to prevent irreparable disruption of the already tenuous balance among competing groundwater needs in our arid state.

The report recommends seven actions Wyoming should take:

- 1. A comprehensive groundwater inventory program should be conducted by the State Engineer, in partnership with the University of Wyoming and the Wyoming Geological Survey in areas of Wyoming most likely to be attractive to new energy production techniques. This analysis should include estimation of the water resources needed for oil and gas production, how extraction of these resources will impact groundwater aquifers and where those water resources will come from. The analysis should include projections for future water demands and aquifer recharge rates and available water to meet those demands. In other words, a water budget should be established for each major aquifer.*
- 2. Groundwater Control Areas should be established by the State Engineer in Campbell County and portions of Converse and Johnson counties where groundwater withdrawals in recent decades have outstripped the pace of recharge. Water supply and demand in other areas of the state should be carefully analyzed to determine if the establishment of Groundwater Control Areas is also appropriate elsewhere.*
- 3. The Wyoming Oil and Gas Conservation Commission and the Department of Environmental Quality should jointly analyze data to project the volumes of fracking flowback water and produced water that will need to be disposed of in the next decade in Wyoming. They should establish as soon as practicable a system to track and account for each truckload of flowback and produced water, to ensure safe and legal disposal methods are used and to track and verify the actual volumes of water involved. More on-the-ground inspectors should be hired to curb spills and illegal dumping of contaminated water and to ensure the new accurate tracking and record-keeping system is properly employed.*
- 4. The Governor should appoint a statewide task force to investigate the current condition of all Class 2 injection wells. The task force should project the number and capacity of injection wells that will be required over the next decade and plan for their development and monitoring. The task force should develop a plan for clean up of contaminated aquifers and land and should arrange for that plan to be followed to clean up and close any Class 2 injection wells with historic and ongoing violations.*
- 5. A Wyoming well plugging program should be developed that: 1) includes public outreach efforts to landowners and industry to help identify unplugged wells; 2) implements an inspection program to prioritize and address unplugged bore holes, oil and gas and uranium wells; and 3) establishes a fund to help plug these wells in an accelerated fashion with active drilling areas prioritized.*
- 6. The Governor should appoint a statewide task force to investigate the current condition of commercial oil field waste disposal facilities in the state. A plan for clean up of contamination of aquifers and land should be established and followed and facilities with historic and ongoing violations should be closed.*
- 7. The University of Wyoming School of Energy Resources should collaborate with the Wyoming Oil and Gas Conservation Commission, the Department of Environmental Quality and where appropriate, the Wyoming Water Development Commission to provide analysis and assistance to the energy industry to encourage recycling facilities and reuse of flowback and production water to the maximum extent feasible for oil and gas drilling and hydraulic fracturing.*

INTRODUCTION

THE IMPORTANCE OF GROUNDWATER IN WYOMING

Ninety-nine percent of those who live in rural America rely on groundwater, as do 51 percent of all Americans.¹ Sadly, our growing uses and demands of groundwater resources do not reflect an understanding that the water currently on Earth is the only water we will ever have.²

In Wyoming, nearly all surface water is already allocated to specific water right holder-users, and groundwater is often the primary water source for many citizens. But groundwater itself is becoming a limited resource. This is especially true in the Powder River Basin, where residents rely almost entirely on groundwater for domestic uses and for most industrial uses and livestock watering needs.³

Drawing down aquifers can have significant impacts both on our society and on the environment. Wyoming and the Mountain West have very few alternatives to maintaining healthy groundwater sources. If they ever become depleted or polluted beyond recovery, our economies and communities can only shrivel and disappear.

HISTORIC WATER CONFLICTS AND ENERGY PRODUCTION DEMANDS

In 1992, the Wyoming State Engineer permitted the pumping of unlimited quantities of groundwater for the production of coalbed methane (CBM) by issuing a determination that pumping out and discarding fresh water to facilitate production of methane gas was a “beneficial use” of the groundwater under Wyoming water law.

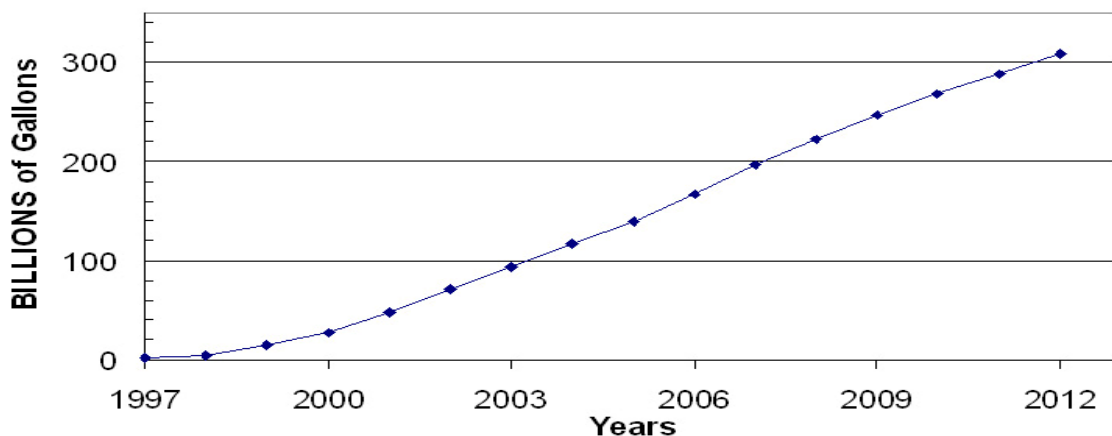
Ever since, this official determination has allowed unlimited water removal as long as gas is being produced. The majority of this groundwater has been discharged to the surface and has flowed downstream out of state, or evaporated. Some was re-injected or infiltrated back to Wyoming aquifers, but most has been lost forever.

Two decades of CBM drilling and production combined with nearly four decades of coal mining have drawn down many aquifers in the Powder River Basin. Significantly, one of these is the Fort Union Aquifer – Gillette’s primary water source.

A 2006 report by the Wyoming Geological Survey compiled groundwater drawdown data from monitoring wells in the Powder River Basin and found that from 1997 to 2006 the Fort Union aquifer had dropped by up to 625 feet, primarily as a result of CBM dewatering. The shallower Wasatch aquifer suffered groundwater drawdown of more than 250 feet.⁴

In the same report, the Wyoming Geological Survey documented that through 2006 a total of 390,000 acre feet or just over 127 billion gallons of groundwater had been withdrawn for CBM production. By 2012, Wyoming Oil and Gas Commission data showed the total volume of groundwater pumped for the production of CBM gas had more than doubled to 309 billion gallons of groundwater, or a total of 947,781 acre feet.⁵

Total Groundwater Discharged for CBM Production



Recharge of the Fort Union aquifer from precipitation is extremely slow. The same Wyoming Geological Survey report cites three sources which indicate the precipitation recharge to the Fort Union and upper Wasatch aquifers is approximately 0.15 inch per year.⁶ Simple math indicates that, at this rate, it will take 50,000 years to restore the Fort Union aquifer to its 1997 level, if all withdrawals had stopped in 2006. Clearly, this natural recharge cannot begin to keep pace with ongoing demands on the aquifer.

WATER CHALLENGES OF THE NEW BOOM

Although CBM production is presently on the decline due to a glut of natural gas and low prices, oil production is poised for a vigorous boom in Wyoming. In an area stretching from Cheyenne in the south

Drilling and Hydraulic Fracturing Water Consumption

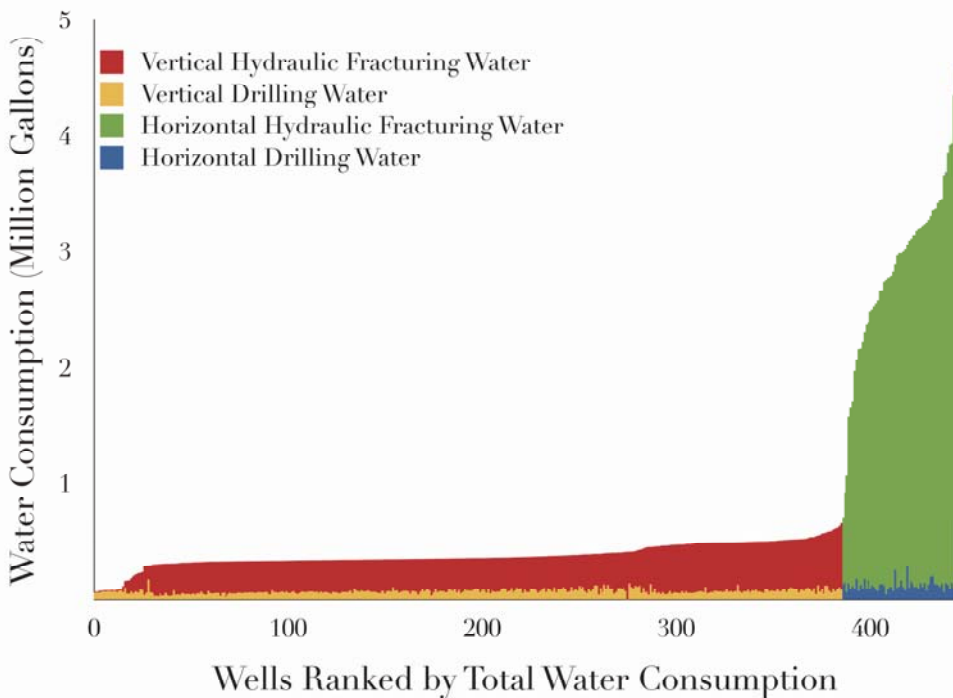


Illustration Source: *Niobrara Report Premier Issue 2012*

to Gillette in the north and toward Buffalo in the west, major operators including Chesapeake Energy Corp., EOG Resources Inc., Yates Petroleum, Anadarko Petroleum, Devon Energy, Samson Resources Co., and others are drilling into formations once thought to contain only non-productible oil.⁷ The perfection of horizontal drilling combined with new hydraulic fracturing techniques has turned these abandoned oil reserves into new economic opportunities for the companies, Wyoming and the nation.

The Bureau of Land Management estimates that approximately 3,800 new oil wells will be drilled in Campbell and Johnson Counties over the next decade.⁸ That is on top of the over 300 horizontal oil wells already drilled in the Powder River Basin and Southeast Wyoming and over a thousand more permitted to drill in Converse, Campbell, Johnson, Platte, Goshen, Niobrara, and Laramie Counties since the boom started taking off in 2010.⁹

Each of these oil wells, and the new horizontal drilling and fracking techniques they employ, will continue to consume the groundwater remaining in the Powder River Basin. According to industry data, up to 13 acre-feet of water is required to drill and frack one deep horizontal oil and gas well.¹⁰ This translates to approximately 4 million gallons of water for a one time drilling and fracking operation for each well in the Powder River Basin and Southeast Wyoming deep oil boom.¹¹ And, each well will likely be fracked multiple times during its life to maintain and enhance production.

In addition to water *quantity* concerns, there are also significant water *quality* concerns. The water required to frack a well is mixed with a variety of chemicals, gels, sand and often diesel fuel to facilitate the fracking process. When each frack job is complete, the resulting frack fluid mixture (“flowback”) is pumped back up the wellbore and trucked off (often many miles) to be disposed of in pits or ponds at Commercial Oil field Waste Disposal sites, or is injected into deep injection wells. Each fracked oil or gas well requires from 400 to 700 tanker truckloads to dispose of the contaminated flowback water which took approximately 700 tanker truckloads to haul into the site. The injection well sites and the pits and ponds where this flowback water is discarded pose additional contamination threats to drinking water aquifers, and little of the once-fresh water itself is ever again usable for domestic or agricultural purposes.

This report examines the legal framework of water management for oil and gas operations in Wyoming and recommends changes to better control freshwater use and contaminated water disposal during this new boom and others like it across the state.



WATER MINING: A Case Study of the Fort Union Aquifer and the City of Gillette

The Campbell County City of Gillette, the self-styled “Energy Capitol of the Nation,” lies within the Powder River Basin and survives on imported groundwater.

The Fort Union Aquifer, which has the best quality water in the area, was once the primary source of water for Gillette. No Longer. Over the past forty years the groundwater once filling the Fort Union Aquifer has been pumped out for municipal use and also discarded in order to produce coalbed methane and allow the mining of coal. Natural recharge has contributed insignificantly to replacing the water lost -- the Fort Union Aquifer has been mined along with the coal and the gas.¹² Groundwater drawdown in the Fort Union combined with increasing water demands in the Gillette area, prompted the State Engineer’s Office in 2008 to impose a limit on Fort Union Water withdrawals for water hauling for oil and gas drilling and fracking and construction operations in Campbell County near the City of Gillette. The SEO stated, “Use of a quality, declining ground water resource for use in construction, oil and gas activities, etc. is not in the public’s water interest.”¹³ However, it is important to note that the State Engineer still issues “temporary” but renewable permits for private wells to be used for pumping and water hauling from the Fort Union in Campbell County for industrial or oil and gas drilling and fracking operations.

Because of a dwindling Fort Union Aquifer, Gillette officials realized they would need to look elsewhere for water for the city’s growing population and its thirsty energy industry. They launched the Gillette Regional Water Supply Project and have embarked on constructing a second water pipeline from the Madison aquifer near the border of South Dakota. A study contracted by the city shows that this additional 42 mile pipeline to the Madison Aquifer is estimated to serve Gillette’s water needs through 2038 at an estimated cost of \$226 million.¹⁴

However, the same study also states that:

[T]he long-term steady state flow through the aquifer is relatively small compared to the potential demands of coal-fired generating plants, agricultural irrigation, municipal water use, and other demands for water in the regional aquifer area and its subareas, such as the Powder River Basin...It is therefore inevitable that any substantial development of the Madison aquifer will eventually lead to mining of groundwater in excess of the sustainable yield of the aquifer...the Madison aquifer is not conceptually different from the Fort Union aquifer regarding long-term sustainability. Long-term recharge is going to be less than long-term demands at some time in the future.”¹⁵

The taxing of Gillette’s water supplies is evident even now. In late June 2012, the City issued a three-day moratorium on all residential watering, with few exceptions.¹⁶ The residents of Gillette are consistently urged to participate in the city’s voluntary summer watering schedule in hopes of conserving scarce water supplies.¹⁷ But even in light of these restrictions, unlimited “temporary” water uses for oil and gas drilling and fracking, and construction operations are still permitted by the State Engineer -- hastening the day when Gillette will face a real water crisis.

WYOMING GROUNDWATER MANAGEMENT: THE STATE ENGINEER'S OFFICE

The Wyoming State Engineer's Office is the government agency responsible for regulating which water and how much water can be used for oil and gas operations. Because oil and gas production is considered by the State Engineer to be a temporary -- though still beneficial -- use of water, water rights are not granted directly to oil and gas operators.

Instead, oil and gas operators must obtain water in one of four ways: (1) by purchasing it from a local government under a usually very expensive limited water haul arrangement; (2) by borrowing or renting a right from another water permit holder, such as a rancher, in the form of a temporary (two year) water use agreement through the State Engineer's Office; (3) by ordering water from a water hauling company such as Kissik Water and Oil Services, K&M Energy Service or A&W Hotshot and Oilfield Service, which usually have their own temporary water permits or time-limited exchanges from other water permit holders.; or (4) by ordering water from a water hauling company, with its own water permit, such as Water Co., or Magna Energy Services.¹⁸



In the case of temporary water use agreements, the original holders of the water right agree not to use their allocated water, or a portion of their allocated water, and instead lend that temporarily forgone right to the oil and gas company for a fee. Just as water permits must be renewed every two years, temporary use agreements or temporary water permits must also be renewed at the end of each two-year agreement.¹⁹ In June, during our research for this report, the State Engineer's staff began requiring two new protective measures on any new wells permitted as temporary water haul wells. The first requires metering on the well to report the volumes of water used from these wells for temporary water haul permits and the second requires the installation of a flowback device on the well so any potential contaminants inside the tanker truck cannot flow back down the well into the aquifer.²⁰

Given the limited and decreasing supplies of groundwater in Wyoming, it seems evident that accurate reporting of water used for oil and gas operations, even under temporary use arrangements, should be required by the state, collected diligently and analyzed intensively. But these temporary water use permits are rarely denied or restricted, and better tracking is critical to safeguarding groundwater. The State Engineer's office believes they are required to approve any application unless they make a case that the water use would harm the public interest. A check placed by the applicant in a box on the application form is taken to constitute a valid statutory showing that the "public interest" will not be harmed.

GROUNDWATER CONTROL AREAS AS A WATER MANAGEMENT TOOL

Groundwater Control Areas are a statute based regulatory tool the state can use to foster more careful oversight of groundwater use. Because so many water users in Wyoming rely on groundwater as their sole water source, groundwater can become limited through the wrong combination of high demand and slow recharge rates. When this happens the State Board of Control, which consists of the State Engineer and Superintendents for each of the four water divisions in the state, can restrict the uses and users of water resources by designating a Groundwater Control Area, or GCA.²¹

Wyoming currently has three GCAs, all of which are in the southeastern part of the state: the Prairie Center Control Area (established in December 1977), the Laramie County Control Area (established in September 1981), and the Platte County Control Area (established in February 1982).²² Within GCAs, water users seeking to use 25 gallons per minute or more must complete the proper application process and receive approval from the State Engineer before using water. For GCA permit applications, regardless of the order an application is received by the State Engineer's office, priority is given first to stock and domestic uses where that use does not exceed 25 gallons per minute.²³ The basic underlying purpose of GCA designation is to allow the State Engineer's Office to more closely and effectively monitor and regulate water use in areas where there is concern about the amount of water available versus the amount of demand.

Wyoming Statute 41-3-912.

(a) "Control area" means any underground water district or sub-district that has been so designated by the board of control. The board of control may designate a control area for the following reasons:

(i) The use of underground water is approaching a use equal to the current recharge rate;

(ii) Ground water levels are declining or have declined excessively;

(iii) Conflicts between users are occurring or are foreseeable;

(iv) The waste of water is occurring or may occur; or

(v) Other conditions exist or may arise that require regulation for the protection of the public interest.

Specifically, after a hearing is held to determine that "the underground water in the control area is insufficient for all of the appropriators," the State Engineer can impose controls on water use, including (1) closing the area to further appropriation, (2) establishing a limit on the amount of water that is withdrawn, (3) stopping water withdrawal by junior water right holders, or (4) establishing a system to rotate water use among holders of water rights.²⁴

Our second recommendation in the following section urges Wyoming to establish and manage new GCAs in several areas of the state.

PROBLEMS & RECOMMENDATIONS

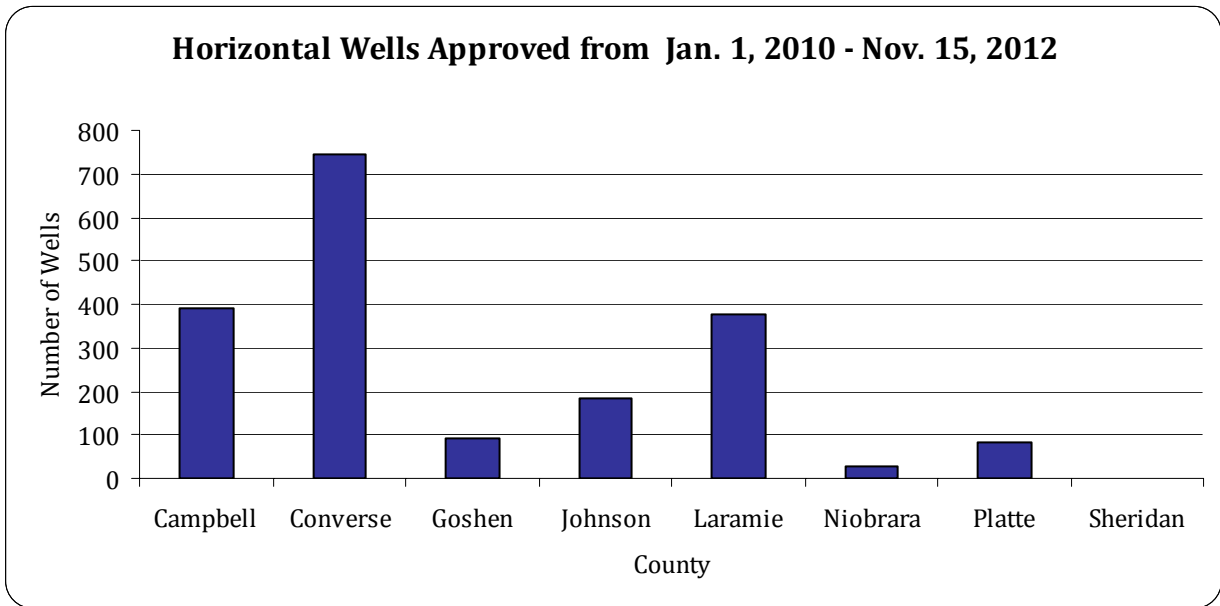
1. INADEQUATE KNOWLEDGE OF AQUIFER WATER LEVELS AND WATER REQUIREMENTS FOR OIL AND GAS DRILLING AND HYDRAULIC FRACTURING

Despite the critical scarcity of groundwater in Wyoming, oil and gas companies' projected needs for groundwater in the recent and coming drilling and fracking boom are poorly documented and virtually unregulated. With drought consuming most of the nation,²⁵ western population expansion, and the anticipation that these conditions will not ameliorate in the near future, oil and gas operations pose serious competition for other water uses. For instance, in Colorado, in the spring of 2012, natural gas companies successfully outbid farmers for water rights that the farmers had, in the past, been awarded.²⁶ Agricultural operations throughout the west are inseparable from water and the amount available to them in the near future may be curtailed because of other demands for water, causing severe losses or even shut down of multi-generational businesses.

But even from the seemingly bright perspective of oil companies with the financial upper hand, a real water shortage would be devastating. As water becomes increasingly needed by municipalities, the water purse strings are going to tighten. In 2008, the City of Gillette stopped selling water from the Fort Union Formation for oil and gas drilling and production²⁷ or other industrial activities.²⁸ Other cities and towns in states such as Kansas and Texas have done the same, even going so far as to entirely cut off industry from their water supplies. Water shortages across the nation are forcing oil and gas producers to seek other sources, place planned developments on hold, or curtail production plans.²⁹

Competition for drilling and fracking water resources in the arid Western U.S. is rising, as are prices buyers are willing to pay. A recent illustration is an agreement by the City of Aurora, Colorado to sell Anadarko Petroleum 1,500 acre-feet of wastewater a year over a five-year term for \$9.5 million dollars.³⁰ According to Anadarko, they paid more than \$1,200 an acre foot for this water even though the going rate had been "only" \$350.³¹

These water pricing pressures may soon be heading to Wyoming, if they are not already here. The situation demands better analysis that answers how much water will be required in Wyoming for oil and gas production and a plan for where that water will come from. Across the country, governments are learning that deep horizontal, hydraulically fracked wells require much more water than the predecessor vertical wells. Water demand, of course, multiplies with the number of wells. The Bureau of Land Management (BLM), as part of its Resource Management Planning processes, anticipates 3,865 new wells in the Powder River Basin.³² This is on top of the 578 wells already permitted by the Wyoming Oil and Gas Commission in Campbell, Johnson and Sheridan counties since 2010.³³ If we add Converse, Laramie, Goshen, Niobrara and Platte counties to the mix we add an additional 1,329 wells that have been permitted for a total of 1,907 wells permitted from 2010 through November 15, 2012.³⁴



If we use the rule of thumb that one acre-foot of water will sustain a family of four people for 1 year,³⁵ the minimum amount of water (10 acre feet per well) needed to drill and frack 600 oil wells in the Converse, Campbell and Johnson counties area just one time over the next two years is enough water to sustain 6,000 families for a year. This number amounts to roughly 24,000 people - more than 70 percent of the population of the City of Gillette, which is just over 33,000.³⁶

Some state officials and oil and gas operators attempt to justify water use as being only a fraction of water used for other needs across the state, like agriculture. But that is a false comparison. The fact is that water used for irrigation and municipal uses is returned to the hydrologic cycle – through infiltration, evaporation, evapo-transpiration, or surface runoff – and eventually is reusable. Nearly all of the water we use in our homes (90-95%) is returned to the system through wastewater treatment plants.³⁷ Water used for fracking, however, is of such poor quality that unless the operator reuses the fluid for more fracking, it is not useful for any other purpose and is too contaminated to be safely returned to the domestic hydrologic system.³⁸ Domestic water is recycled. Production and fracking water is usually mined and discarded.

Outside of the three Groundwater Control Areas of Southeast Wyoming, there is no comprehensive groundwater resource inventory and no public comprehensive analysis of groundwater availability in areas where oil and gas production is occurring or being planned. BLM environmental analysis documents provide virtually no details about specifically where drilling and fracking water will come from, what volumes will be consumed, or what the impacts will be to groundwater aquifers or nearby communities and rural water wells.

RECOMMENDATION: A comprehensive groundwater inventory program should be conducted by the State Engineer, in partnership with the University of Wyoming and the Wyoming Geological Survey in the areas of Wyoming most likely to be attractive to new energy production techniques. This analysis should also include estimation of the water resources needed for oil and gas production, how extraction of these resources will impact groundwater aquifers and where those water resources will come from. This analysis should include projections for future water demands in the area and the aquifer recharge rates and available water to meet those demands. In other words, a water budget should be established for each major aquifer.

2. INADEQUATE USE OF GROUNDWATER CONTROL AREAS IN WYOMING

As discussed above, Groundwater Control Areas (GCAs) create the opportunity for rational water management. Our state's ability to respond to concerns quickly before a problem is further exacerbated is critical, especially during a time already stricken with drought and long-term water supply concerns. GCAs provide an opportunity for parts of the state facing oil and gas booms, like Converse, Campbell, and Johnson Counties, to better control and protect groundwater supplies.

The ability to address water challenges quickly within Groundwater Control Areas was demonstrated in the spring of 2012 when citizens within the Laramie County Groundwater Control Area expressed concern to the State Engineer that increased water withdrawals, including withdrawals by growing oil and gas operations, were rapidly drawing down water supplies. Because of the area's designation as a Groundwater Control Area, the State Engineer's Office was able to quickly issue a temporary order to limit extraction of groundwater in Southeastern Wyoming for eighteen months. The temporary order will allow time for the area's groundwater resources and uses to be re-appraised and water to be more rationally allocated.

In order for an area to qualify for designation of a GCA, it must demonstrate at least one of the following: "The use of underground water is approaching a use equal to the current recharge rate; Ground water levels are declining or have declined excessively; Conflicts between users are occurring or are foreseeable; The waste of water is occurring or may occur; or other conditions exist or may arise that require regulation for the protection of the public interest."³⁹

The removal and discharge of nearly 1 million acre feet of groundwater from the Fort Union aquifer for the production of coalbed methane in the Powder River Basin has already resulted in a dramatic drawdown of that aquifer. There are significant additional pressures on the aquifer from coal mining operations and the city of Gillette's demands. We know from Wyoming State Geological Survey reports that drawdown and withdrawal of water from the Fort Union aquifer already dramatically exceeds the recharge rate of 0.15 inch a year. If there is any area of the state that deserves to be designated as a Groundwater Control Area - and managed accordingly - it is the eastern and central portions of the Powder River Basin.

RECOMMENDATION: Groundwater Control Areas should be established by the State Engineer in Campbell County and portions of Converse and Johnson counties where groundwater withdrawals in recent decades have outstripped the pace of recharge. Water supply and demand in other areas of the state should be analyzed to determine if the establishment of Groundwater Control Areas is also appropriate elsewhere.

3. MANAGEMENT AND DISPOSAL OF CONTAMINATED FRACKING FLOWBACK WATER AND PRODUCED WATER NEEDS BETTER TRACKING AND PLANNING FOR DISPOSAL

In addition to aquifer dewatering, the other significant water issue facing Wyoming is management and disposal of water that has been used in drilling, fracking and production. On average, 85% of the several million gallons of water required to frack each well comes back up the well bore contaminated with a mixture of chemicals, gels and sand. This contaminated flowback water is hauled away in several hundred tanker trucks for disposal. Once production starts, additional volumes of produced water that is often too salty and contaminated to be discharged to the surface are also pumped up with the produced oil and gas and must also be hauled offsite for disposal.

The cost of disposing of high volumes of fracking flowback water and produced water can be expensive. The costs include trucking – sometimes over long distances. Some companies pay drivers per truckload of contaminated water and this can be an incentive to illegally dump or discharge contaminated water closer to the well. For example, in August of 2012, a fracking services company was cited by the Department of Environmental Quality for illegal dumping on private property. According to a source within the company, the illegal dumping occurred because employees had to perform another job, did not have enough time to drive the distance for proper disposal, and were told by a company manager to just dump it on site.⁴⁰

The Wyoming Department of Environmental Quality (WDEQ) and the Wyoming Oil and Gas Conservation Commission (WOGCC) share the duty to regulate and protect the waters of the state from contamination as a result of oil and gas wastewater disposal.⁴¹ The legal method for disposal of fracking flowback water and produced water is through deep injection wells permitted by the WOGCC or WDEQ or on the surface in permitted Commercial Oilfield Produced Water Disposal Facilities. Both methods raise concerns, discussed below. More importantly, no agency comprehensively tracks the volumes of wastewater that are disposed of or where that water goes.

RECOMMENDATION: The Wyoming Oil and Gas Conservation Commission and the Department of Environmental Quality should jointly analyze data to project the volumes of fracking flowback water and produced water that will require disposal over the next decade in Wyoming. They should also establish as soon as practicable a system to track and account for each truckload of flowback and produced water, to ensure safe and legal disposal methods are used, and to track and verify the actual volumes of water involved. More on-the-ground inspectors should be hired to curb spills and illegal dumping of contaminated water and to ensure the new accurate tracking and record-keeping system is properly employed.



4. POOR PERMITTING AND INSPECTION OF DEEP INJECTION WELL DISPOSAL OF CONTAMINATED WATER THREATENS AQUIFERS

When injecting flowback or produced water for disposal, oil and gas operators may re-purpose old oil or gas production wells, or they may drill a new well specifically for disposal. These wells are categorized as “Class II” wells under the Safe Drinking Water Act and are regulated by the WOGCC.

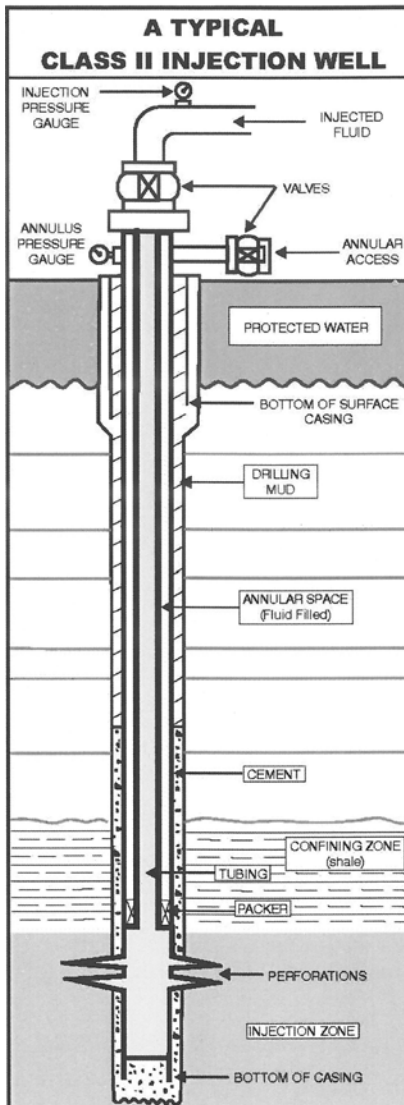


Illustration Source:

New Mexico Oil Conservation Division, Energy, Minerals and Natural Resources Department, New Mexico's Underground Injection Control (UIC) Program, Class II Well Facts

If an oil and gas company injects flowback fracking or produced water into a Class II underground injection well, the company must report the anticipated volumes to the WOGCC via a “sundry notice”.⁴² The WOGCC will then approve or deny the operator’s request to inject the flowback or produced water. According to the WOGCC staff, flowback or produced water is also being disposed of in some Enhanced Oil Recovery (EOR) Projects with WOGCC approval. When the WOGCC permits Class II injection wells they do not impose a limit on the volume of contaminated water that can be injected but rather impose a maximum pressure that cannot be exceeded for a given well.⁴³ As a result, volumes are not recorded or tracked.

A *ProPublica* investigative report reviewed groundwater contamination from injection wells and discovered, “well records, case histories and government summaries of more than 220,000 well inspections found that structural failures inside injection wells are routine.” *ProPublica* also found that:

From late 2007 to late 2010, one well integrity violation was issued for every six deep injection wells examined — more than 17,000 violations nationally. More than 7,000 wells showed signs that their walls were leaking. Records also show wells are frequently operated in violation of safety regulations and under conditions that greatly increase the risk of fluid leakage and the threat of water contamination.⁴⁴

The casing and mechanical integrity of injection wells are critical to ensuring groundwater will be protected, but injection wells are known to fail due to cracks and damage to casing. According to the report, 1 out of every 3 injection wells inspected in Texas was in violation of standards.

RECOMMENDATION: The Governor should appoint a statewide task force to investigate the current condition of all Class 2 injection wells. The task force should project the number and capacity of injection wells that will be required over the next decade and plan for their development and monitoring. The task force should develop a plan for clean up of contaminated aquifers and land and should arrange for that plan to be followed to clean up and close any Class 2 injection wells with historic and ongoing violations.

5. UNPLUGGED OR IMPROPERLY PLUGGED OIL, GAS, URANIUM OR EXPLORATORY BORE HOLES PROVIDE A CONDUIT FOR AQUIFER CONTAMINATION.

Further complicating the risk of injected wastes migrating and contaminating freshwater aquifers are the hundreds to thousands of old unplugged oil, gas, uranium or exploratory bore holes present in the Powder River Basin and throughout the state. The ability of waste and contaminants to migrate through old or unplugged holes is widely recognized.

In 2009, an Interstate Oil and Gas Compact Commission article highlighted the need to ensure oil and gas wells are properly plugged and stated, “The final, critical step oil and gas operators must take to prevent surface and groundwater contamination when a well reaches the end of its productive life is plugging the well so it may be safely abandoned. A properly cased and cemented well prevents fluids from migrating between formations or to the surface.”⁴⁵ The article noted further hazards saying, “An unplugged well creates a conduit allowing hydrocarbons, salt and groundwater to mingle.”⁴⁶

RECOMMENDATION: A Wyoming well plugging program should be developed that: 1) includes public outreach efforts to landowners and industry to help identify unplugged wells; 2) implements an inspection program to prioritize and address unplugged bore holes, oil and gas and uranium wells; and 3) establish a fund to help plug these wells in an accelerated fashion with active drilling areas prioritized.

6. COMMERCIAL OIL FIELD WASTE DISPOSAL FACILITIES POSE RISKS TO GROUNDWATER, LAND AND WILDLIFE

In addition to underground injection, Wyoming also utilizes a number of permitted Commercial Oilfield Waste Disposal Facilities, or COWDFs. COWDFs are disposal facilities that accept oil and gas exploration and production waste from more than one producer.⁴⁷ COWDFs are regulated by the WDEQ Water Quality Division.⁴⁸ WDEQ regulations require measures for groundwater protection, including (1) groundwater monitoring programs (if determined by the administrator),⁴⁹ (2) documentation that the facility poses no threat to groundwater,⁵⁰ (3) and an engineering design report that includes a facility description, the types of wastes the facility will accept, design conditions, baseline ground and surface water quality data, and detailed plans and specifications for the facility⁵¹

Unfortunately, existing Commercial Oilfield Waste Disposal Facilities (COWDF) were grandfathered in when the law and regulations governing these facilities were updated in 1991, 23 years ago. These facilities are still operating in Wyoming under an outdated and unsafe regulatory framework. Most of these older facilities were constructed and permitted thirty or more years ago and they all have ongoing violations and groundwater and soil contamination. The older facilities do not have financial assurance bonds required to address closure or contamination.



Linch Commercial Oil Field Waste Disposal Facility

At least two of these facilities which are still in operation, the Parkman Reservoir facility and the Linch facility, have had repeated violations of the state, EPA and Fish and Wildlife Service regulations. In a June 2012 inspection report the EPA determined that “The environmental condition of the [Parkman Reservoir] evaporation pond was deplorable.” The EPA report concluded, “Clearly, USDOI/USEPA/USFWS and the WDEQ-WQD need to discuss the plethora of chronic environmental concerns and subsequent federal/state violations which have become pervasive at the High Plains Resources – Parkman Reservoir COWDF.”⁵²

It is not uncommon for inspection reports at several of these facilities to document oil sheens, oily wastes, floating crude oil, operational upsets, contaminated soil and the deaths of migratory birds and other wildlife in the oily ponds. Review of the permitting documents and inspection reports reveals some operators have no fear of regulatory enforcement, have repeat violations and so far have ignored enforcement actions but suffered no consequence.⁵³

In addition to water contamination concerns, these facilities also impact Wyoming's wildlife. The U.S. Fish and Wildlife (FWS) says that these COWDFs, "pose a significant risk to migratory birds and other wildlife because they use large evaporation ponds (either passive or with aeration) to dispose of and treat oil and gas exploration and production wastes."⁵⁴ The FWS also reports that significant mortality incidents continue in COWDFs, particularly in older facilities permitted in the early 1980's. Inadequate operation and management of these COWDFs generally results in the discharge of oil into the large evaporation ponds posing a risk for birds and other wildlife.⁵⁵

Not only is oil on the surface of these pits and ponds a danger to migratory birds, but the FWS also reports that sodium toxicity and surfactants and fluids from hydraulic fracturing also pose substantial risks.⁵⁶

RECOMMENDATION: The Governor should appoint a statewide task force to investigate the current condition of commercial oil field disposal facilities in the state. A plan for clean up of contamination of aquifers and land should be established and followed and facilities with historic and ongoing violations should be closed.

7. THE NEED FOR WATER REUSE AND RECYCLING

The old mantra goes: reduce, reuse, recycle. The easiest way to eliminate a waste problem is to transform waste into another beneficial use. But in the case of wastewater from oil and gas production, almost all water is used once and then disposed of. Technologies to recycle wastewater are still in the formative stages and Wyoming has an opportunity to be a leader in research, development, and deployment of these technologies. The opportunity to develop economical, effective and efficient techniques for recycling billions of gallons of produced and flowback water across the nation could provide a profitable challenge for Wyoming industry and University of Wyoming School of Energy Resources.

RECOMMENDATION: The University of Wyoming School of Energy Resources should collaborate with the Wyoming Oil and Gas Conservation Commission, the Department of Environmental Quality and where appropriate, the Wyoming Water Development Commission to provide analysis and assistance to the energy industry to encourage recycling facilities and reuse of flowback and production water to the maximum extent feasible for oil and gas drilling and hydraulic fracturing.

CONCLUSION

Wyoming's water laws were written for a dry state, and in general contain all the authority needed to protect our groundwater resources for the long term. However, the rapid development of water-intensive energy production techniques, such as CBM aquifer de-watering and high-volume fracking, has over the last decade gotten ahead of the abilities of State of Wyoming agencies charged with using these authorities to protect our water resources for current and future generations. In addition, management and disposal of contaminated hydraulic fracturing flowback water and produced water lack planning, oversight and enforcement. This analysis makes it clear that the state should embark upon a proactive and thorough program to bring our water management systems up to date and should apply existing statutes to guard, conserve and recycle our groundwater from cradle to grave; and, should invest in analysis, regulation and perhaps infrastructure that will allow the energy industry to take advantage of profitable new production techniques while minimizing conflict with Wyoming's continuing need for beneficial stewardship of our scarce groundwater.



References

- ¹ The Groundwater Foundation, "How Much Do We Depend on Groundwater?" Last accessed 12 July 2012. <<http://www.groundwater.org>>.
- ² Groundwater Protection Council, "Groundwater Report to the Nation: A Call to Action." 2007. Last accessed 12 July 2012. <<http://www.gwpc.org/sites/default/files/GroundWaterReport-2007-.pdf>>
- ³ Morrison-Maierle Inc. and Burns and McDonnell. "City of Gillette Long Term Water Supply Level II Study." 8 Aug. 2007. Last accessed 25 July 2012. <<http://www.gillettewy.gov/index.aspx?page=1191>>.
- ⁴ Keith E. Clarey, Nicholas W. Gribb, Richard J. Hayes and J. Fred McLaughlin, "1993-2006 Coalbed Natural Gas Regional Groundwater Monitoring Report: Powder River Basin, Wyoming," Wyoming State Geological Survey Report, Open File Report 2010-02, Updated September 2010 at page 31.
- ⁵ Wyoming Oil and Gas Conservation Commission. Last accessed 14 November 2012. <<http://wogcc.state.wy.us/coalbedMenu.cfm?Skip='Y'&oops=#oops#>>
- ⁶ *Supra* note 4 at page 12.
- ⁷ Fugleberg, Jeremy. "Southern Powder River Basin Drilling Booms." *The Casper Star Tribune*. 24 May 2012. Last accessed 16 July 2012. <www.trib.com>.
- ⁸ Buffalo Bureau of Land Management, email between Tom Bills and Jill Morrison, November 14, 2012.
- ⁹ Wyoming Oil and Gas Conservation Commission data shows that 307 horizontal wells were drilled in 8 Eastern Wyoming counties from 2010 through November 2012. 1,907 wells were permitted in that time.
- ¹⁰ Ken Carlson, Colorado State University, "Improving Water Resource Management in the Niobrara," The Niobrara Report: Water Focus, Premier Issue 2012. <<http://viewer.epaperflip.com/Viewer.aspx?docid=2c142700-26fc-4909-8c1f-a06600d2719f#?page=24>>
- ¹¹ Water amounts needed for Niobrara oil development in Laramie, Goshen, and Platte Counties cannot be estimated because it is largely fee mineral development and there have not been public estimates of the anticipated number of wells.
- ¹² Morrison-Maierle and Burns and McDonnell 5-32, 5-128 – 5-134; Wyoming State Geological Survey 20.
- ¹³ Wyoming State Engineer's Office, "Background: Time Limited Water Haul Permits from the Fort Union Formation in Campbell County," April 9, 2008.
- ¹⁴ City of Gillette. "Gillette Regional Master Plan Level 1 Study - Final." Oct. 2009. Last accessed 12 July 2012. <<http://www.gillettewy.gov/index.aspx?page=1189>>.
- ¹⁵ Morrison-Maierle and Burns and McDonnell, 5-28.
- ¹⁶ Collins, Abby. "Water Woes: Wednesday's Water Use Was High Enough To Cause Alarm." *The Gillette News Record*. 28 June 2012. Last accessed 25 July 2012. <<http://www.gillettenewsrecord.com/stories/City-will-cut-water-use-for-three-days>>.
- ¹⁷ City of Gillette. *Water*. 2012. Last Accessed 12 July 2012. <<http://www.gillettewy.gov>>.
- ¹⁸ Johnson, Bobby. Wyoming State Engineer's Office, Groundwater Division, Personal interview 13 June 2012 and 12 Dec. 2012.
- ¹⁹ *Id.*
- ²⁰ *Id.*
- ²¹ W.S. §41-3-912
- ²² Wyoming State Engineer's Office. "Ground Water Control Areas and Advisory Boards." Last accessed 3

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- January 2013. <<https://sites.google.com/a/wyo.gov/seo/ground-water/groundwater-control-areas-advisory-boards>>
- ²³ W.S. § 41-3-912
- ²⁴ W.S. § 41-3-912
- ²⁵ Hargreaves, Steve. "Drought Strains U.S. Oil Production." *CNN Money*. 31 July 2012. Last accessed 4 August 2012. <<http://money.cnn.com/2012/07/31/news/economy/drought-oil-us/index.htm>>.
- ²⁶ Cooley, Heather and Kristina Donnelly. "Hydraulic Fracturing and Water Resources: Separating the Frack from the Fiction." *Pacific Institute*. June 2012.
- ²⁷ Cole, Mike. Gillette Utilities Project Manager. City of Gillette. Personal Interview. 21 Jun. 2012 & 12 Dec. 2012.
- ²⁸ *Supra* note 18.
- ²⁹ *Supra* note 25.
- ³⁰ Sara Castellanos, "*The Aurora Sentinel*" 12 July 2012, <<http://www.aurorasentinel.com/news/aurora-oks-9-5-million-fracking-water-deal-with-anadarko>>
- ³¹ *Id.*
- ³² Buffalo Bureau of Land Management, email communication between Tom Bills and Jill Morrison, November 14, 2012.
- ³³ Wyoming Oil and Gas Conservation Commission data provided to Powder River Basin Resource Council on 15 November 2012.
- ³⁴ *Id.*
- ³⁵ US Bureau of Reclamation. "Managing Water in the West: Facts & Information." Last Accessed 3 January 2013. <<http://www.usbr.gov/main/about/fact.html>>.
- ³⁶ Surface, Michael K. "Developing Gillette: The 2009 Annual Development Summary Including special segments on the Decade in Review." City of Gillette. Feb. 2010. Last accessed 19 July 2012. <<http://www.gillettewy.gov/Modules/ShowDocument.aspx?documentid=1277>>.
- ³⁷ Western Resource Advocates. "Fracking Our Future: Measuring Water and Community Impacts from Hydraulic Fracturing." June 2012. page 14
- ³⁸ *Id.* at page 15.
- ³⁹ W.S. § 41-3-912(a).
- ⁴⁰ James Chilton. "*Local Business Cited for Illegal Oil Dumping*" *Wyoming Tribune Eagle*, Aug. 31, 2012 available at http://m.wyomingnews.com/articles/2012/08/31/news/01top_08-31-12.txt.
- ⁴¹ "Memorandum of Agreement between the Wyoming Department of Environmental Quality and Wyoming Oil and Gas Conservation Commission," 1994, 1999. <http://wogcc.state.wy.us/craig/mou.htm>
- ⁴² Kropatsch, Tom, Wyoming Oil and Gas Conservation Commission Natural Resource Analyst. Phone Interview. 7 Aug. 2012.
- ⁴³ *Id.*
- ⁴⁴ Lustgarten, Abrahm. "*Injection Wells the Poison Beneath Us*" *ProPublica*, June 21, 2012 <http://www.propublica.org/article/injection-wells-the-poison-beneath-us>
- ⁴⁵ Interstate Oil and Gas Conservation Commission, "Orphaned and Abandoned Wells: Innovative Solutions", *Groundwork*, October 2009.
- ⁴⁶ *Id.*
- ⁴⁷ Wyoming Department of Environmental Quality. "Guidelines: Commercial Oilfield Wastewater Disposal

Facilities.” October 2008, revised February 2011.

<http://deq.state.wy.us/wqd/DELETE/COWDF%20Guidance%20Doc%20final.pdf>

⁴⁸ *Id.*

⁴⁹ *Id.*

⁵⁰ *Id.*

⁵¹ *Id.*

⁵² U.S. Environmental Protection Agency Region 8, Enforcement, Compliance & Environmental Justice Division, RCRA Compliance Evaluation Report for High Plains Resources – Parkman Reservoir operated by Dennis Lawrence. Inspection conducted by Randy Lamdin (USEPA), Pete Ramirez (USFWS), Dennis Lamb (WDEQ), Jack Morey (High Plains Resource. June 27, 2012.

⁵³ Information from a review of DEQ permit files for Commercial Oilfield Waste Disposal Facilities at Casper WDEQ office conducted by Jill Morrison, August and September 2012.

⁵⁴ U.S. Fish and Wildlife Service, “Contaminate Issues - Oil Field Waste Pits” Commercial Oilfield Waste Disposal Facilities. <http://www.fws.gov/mountain-prairie/contaminants/contaminants1b.html>

⁵⁵ Pedro Ramirez, “*Bird Mortality in Oil Field Wastewater Disposal Facilities*” Environmental Management (2010) 46: 820-826.

⁵⁶ *Id.*



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