COMMENTS – 2007

PAW & Member Companies

Environmental Quality Council Hearings

CHAPTER 2 WATER QUALITY RULES AND REGULATIONS

Resubmitted by

PETROLEUM ASSOCIATION OF WYOMING

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Terri A. Lorenzon, Director
Environmental Quality Council

BEFORE THE ENVIRONMENTAL QUALITY COUNCIL
OF THE STATE OF WYOMING

IN THE MATTER OF THE PETITION OF POWDER RIVER BASIN RESOURCE COUNCIL TO AMEND WYOMING WATER QUALITY RULES, CHAPTER 2, APPENDIX H & I	))))	DOC #05-3102

COMMENTS OF MERIT ENERGY COMPANY IN OPPOSITION TO PROPOSED RULES

Merit Energy Company (Merit) appreciates the opportunity to submit comments to the Environmental Quality Council on this very important and far-reaching issue. It is the position of Merit that the rules proposed by the Powder River Basin Resource Council (PRBRC) are beyond the scope of this Council's authority to enact and are in violation of both the Wyoming Environmental Quality Act and the Federal Clean Water Act. The current regulatory framework has been subjected to proper rulemaking procedures and has proven effective in balancing the interests of industry, agriculture, and the environment. PRBRC's proposed rules are neither necessary, nor permissible, and should be rejected. The Department of Environmental Quality and the Environmental Quality Council lack the statutory authority to regulate water quantity or determine beneficial use. That authority is vested in the State Engineer and the Board of Control. Further, while both the Wyoming Environmental Quality Act and the Federal Clean Water Act utilize broad definitions of pollution, both the Federal and State statutes contemplate permissive discharges that meet certain requirements. Rules that effectively bar all discharges by imposing impossibly high and scientifically unsupported standards contravene both State and Federal law, and are beyond the power and authority of this Council. Finally, the proposed rules will result in a severe economic loss to Wyoming communities, the labor force, agricultural, and the State of Wyoming through loss of

business, a loss of wildlife and livestock habitat and beneficial use, and loss of tax revenues. The rules proposed by PRBRC must be rejected.

THE PETITION IS BEYOND THE STATUTORY AUTHORITY OF THE DEQ AND EQC AND CONFLICTS WITH THE CONSTITUTIONAL POWERS GRANTED TO THE STATE ENGINEER AND BOARD OF CONTROL

It is well settled in Wyoming law that an administrative agency has limited powers and can do no more than it is statutorily authorized to do. *U.S. West Communications, Inc. v. Wyoming Public Service Commission*, 988 P. 2d 1061, 1068 (Wyo. 1999). Because an administrative agency has only the powers granted to it by statute, the justification for the exercise of any authority by the agency must be found within the applicable statute. *French v. Amax Coal West*, 960 P.2d 1023, 1027 (Wyo 1998). An agency may not exceed the authority expressly delegated to it by the Legislature when the agency is promulgating regulations. *State Department of Revenue and Taxation v. PacifiCorp*, 872 P.2d 1163, 1166 (Wyo. 1994). Therefore, a statute will be strictly construed when determining the authority granted to an administrative agency, and reasonable doubt of the existence of the authority must be resolved against the exercise thereof. *In re LePage*, 18 P.3d 1177, 1180 (Wyo. 2001). "A doubtful power does not exist." *Id.* at 1181, quoting *French v. Amax Coal West*, 960 P.2d 1023, 1027 (Wyo 1998). "Any agency decision that falls outside the confines of the statutory guidelines articulated by the legislature is contrary to law and cannot stand." *LePage,* 18 P.3d at 1180, quoting *Tri County Telephone Assc., Inc. v. Wyoming Public Serv. Com'n.,* 910 P.2d 1359, 1361 (Wyo. 1996). The Wyoming Supreme Court summarized as follows:

> A regulatory agency ... has no inherent or common-law powers. Stated in another manner, an administrative body has only the power and authority granted by the constitution or statutes creating the same. Such statutes must be strictly construed or "any reasonable doubt of existence of any power must be resolved against the exercise thereof. A doubtful power does not exist.

Montana Dakota Util. v. PSC, 847 P.2d 978, 983 (Wyo. 1993), citing *Tri-County Elec. Ass'n. v. City of Gillette*, 525 P.2d 3, 8-9 (Wyo. 1974). The *Montana Dakota* Court concluded that:

> Since we strictly construe the statutes under which [the agency] exercises is regulatory power, it logically follows that we also must strictly construe the rules promulgated and adopted by [the agency] pursuant to those statutes.

Id. at 983-984, citing *International Ass'n. of Fire Fighters, Local No. 279, v. Civil. Serv. Comm'n.*, 702 P.2d 1294, 1297 (Wyo. 1985). When the proposed rules before this Council are measured against these fundamental principles of Wyoming law, there is only one conclusion -- -- the proposed rules are not authorized by law and are beyond the power of the Environmental Quality Council.

A search of the statutes that grant authority to the Environmental Quality Council, the Department of Environmental Quality, and the Water Quality Division does not reveal any specific authority for the regulation of water quantity. The authority to regulate water quantity rests solely with the Wyoming State Engineer and the State Board of Control pursuant to the Wyoming Constitution. Article 8, §5 of the Wyoming Constitution addresses the powers of the State Engineer, who "shall have general supervision of the waters of the state and of the officers connected with its distribution." Article 8, §2 of the Wyoming Constitution provides that the Board of Control shall "have the supervision of the waters of the state and of their appropriation, distribution, and of

the various officers connected therewith." The Board of Control has broad powers, both direct and the implied. *White v. Wheatland Irrigation District*, 413 P.2d 252, 258 (Wyo. 1966).

The determination of beneficial use of water is exclusively within the prerogative of the State Engineer. W.S. §§ 41-3-931, 41-4-502, Wyoming Constitution, Article 8, Section 3. In addition, Section 1104 of the existing DEQ regulations acknowledges that beneficial use determinations governing ground water are within the sole province of the State Engineer.

> "Section 3. Underground Water Protected.
>
> (a) All waters, including ground waters of the State, within the boundaries of the State of Wyoming are the property of the State; and control of the beneficial use of waters of the State resides with the Wyoming State Engineer.
>
> (b) Nothing herein contained shall be construed so as to interfere with the right of any person to use water from any underground water source for any purpose identified in W.S. 35-11-102 and 35-11-103(c)(i); or to limit or interfere with the jurisdiction, duties or authorities of other Wyoming State agencies or officials."

The Wyoming Legislature gave specific recognition to the authority of the State Engineer and the Board of Control when it established the Environmental Quality Act by limiting its applicability. W.S. 35-11-1104 provides, in pertinent part:

> "(a) Nothing in this act:
>
> ****
>
> (iii) **Limits or interferes with the jurisdiction, duties or authority of the state engineer, the state board of control*****." (Emphasis supplied)

The law is crystal clear. The only authority to regulate water quantity lies with the State Engineer and the Board of Control. Any attempt by the Department of Environmental

Quality or the Environmental Quality Council to adopt rules governing water quantity or beneficial use is beyond their authority and is unlawful.

The proposed rules violate the authority of the State Engineer and Board of Control to regulate water quantity in Wyoming. The State Engineer has stated that "storage of CBNG water is recognized as a beneficial use." See *State Engineer CBNG Surface Water Policy*, attached hereto as **Exhibit A**. The proposed rules attempt to limit discharge to the extent "actually used by livestock or wildlife." Actual consumed used by agriculture and wildlife is impossible to prove and is directly contrary to the expressed public policy and determination of the State Engineer.

In Formal Opinion Number 2006-001, the Wyoming Attorney General addressed the issue of whether the Environmental Quality Act grants the authority to regulate water quantity. In the Opinion, the Attorney General, citing from the Petition, stated "The Petition is clear that it wants DEQ to consider '... the impacts to land and water that [are the] result of quantity, rather than quality.'" *Opinion* at 2. The Opinion went on to state, "the EQA does not authorize such action." *Id.* The Attorney General reiterated its position in a letter to the EQC dated July 12, 2006. "As discussed in Formal Opinion 2006-001, it is our opinion that the Council does not have jurisdiction to address the quantity of water actually used, but does have the authority to address issues involving the quality of discharged water." Only the State Engineer has the authority to regulate water quantity, even with respect to water produced through oil and gas exploration and development. *See* W.S. 41-3-903 and 904. Attempts by the EQC, the DEQ, or any other entity, to regulate outside the purview of water quality, would run afoul of the existing statutory scheme and would be beyond the scope of EQC's authority.

As noted, the power to regulate water quantity is vested, by Constitution and statute, in the State Engineer and the Board of Control. The proposed rules purport to shift that authority to the DEQ and the EQC. In effect, the proposed rules would allow an individual landowner on a watershed, allegedly concerned with water quantity under the guise of water quality, to prevent all other users on the watershed from receiving water. This flies in the face of the Wyoming Constitution, Wyoming Statutes, and the well-established and effective practice of prior appropriation. It would effectively divest the State Engineer and the Board of Control of their authority and would disrupt over one hundred years of prior appropriation. Indeed, it would be completely contrary to Article 1, Section 31, of the Wyoming Constitution, which states,

> Water being essential to industrial prosperity, of limited amount, and easy of diversion from its natural channels, its control must be in the state, which, in providing for its use, shall equally guard all the various interests involved.

Any rule, such as those proposed by PRBRC, which entitles individuals to assert control over a watershed, is clearly a direct violation of the Constitution and should be rejected. The proposed rules are also contrary to the well-established principle that the State has an easement for a right of way to flow waters down the natural channels of the State. "The title to waters within this State being in the State, in concomitance, it follows that there must be an easement in behalf of the state for a right of way through their natural channels for such waters upon and over lands submerged by them or across the bed and channels of streams or other collections of water." *Day v. Armstrong*, 362 P.2d 137, 145 (Wyo. 1961). As noted above, W.S. 41-3-903 and 904 support the conclusion that produced water in a watercourse is water belonging to the State and subject to the State's easement to flow waters in the channel. The proposed rules ignore this well-established

principle of Wyoming water law and are not supported. The rules would also result in waste and in the inefficient use of the valuable waters of this State and would be contrary to public policy.[1]

The proposed rules are also unsupported by the Clean Water Act. Section 5 of the Clean Water Act, provides:

> "Except as expressly provided in this chapter, nothing in this chapter shall... be construed as impairing or in any manner affecting any right or jurisdiction of the States with respect to the waters (including boundary waters) of such States."

33 U.S.C. §1370(2). Any attempt to claim support for the proposed rules in the Clean Water Act is unsupported by the law as the rules cannot impair, abrogate, or supersede the power of the State Engineer over water quantity.

The DEQ and other State agencies addressed the Petitioner's comments on this subject previously in its Response to Comments submitted in connection with the revisions to Chapter 2, WQRR. In pertinent part, the June 2004 response of DEQ concerning Appendix H rejected the claims now being made by the Petitioner:

> "40 CFR allows for the discharge of produced water if the water is used by wildlife or agriculture during periods of discharge. **This was a provision that was supported by the Wyoming DEQ, Wyoming Game and Fish and many landowners within Wyoming to allow for the continued use of produced water rather than reinjecting the water. It is the DEQ's opinion that there should not be a quantity limitation related to the agricultural and wildlife use determination.** The federal regulations did not contemplate a maximum allowable flow rate but rather the water being discharged was actually used by wildlife or agriculture during periods of discharge. **It was not the intent of the federal regulations that all of the water be consumed.**" (Emphasis supplied)

[1] In a dissenting opinion, Chief Justice Hill stated, "As demonstrated by the events of this past summer, it is difficult to imagine a more important public policy issue in Wyoming than the continued viability of its water resources. *Polo Ranch Co. v. City of Cheyenne*, 61 P.3d 1255, 1265(Wyo. 2003).

The approach encouraged by the proposed rules has been addressed in detail and rejected. There is no reason to revisit these matters again.[2]

THE PROPOSED RULES WOULD BAN ALL PRODUCED WATER DISCHARGES WITHOUT THE EXCEPTIONS CONTEMPLATED IN THE CWA AND THE EQA

Pursuant to the Federal Clean Water Act (CWA), the discharge of water produced in oil and gas operations into the waters of the nation is generally prohibited. 40 C.F.R. 435.32. There are however, exceptions to the general rule, which permit the discharge of oil and gas produced water under approved circumstances. One exception, particularly relevant to the present case, exists for water that is used in agriculture and wildlife propagation. 40 C.F.R. §§ 435.51-52. The CWA defines such uses in terms of water quality. "The produced water is of good enough quality to be used for wildlife or livestock watering or other agricultural uses and that the produced water is actually put to such use during periods of discharge." 40 C.F.R. § 435.51(c). The rules proposed by PRBRC completely ignore this exception and would effectively ban the discharge of such water entirely by establishing impossible, and unsupported, water quality standards.

The Wyoming Environmental Quality Act (EQA) also seeks to prevent pollution generally. Like the CWA, however, the EQA does not indiscriminately ban all discharges, but recognizes exceptions to the general rule and allows the discharge of produced water under various circumstances. This is vitally important to an arid region like Wyoming. Indeed, the exception to the general prohibition on discharges is spelled out unambiguously in W.S. § 35-11-301, "(a) No person, **except when authorized by a**

[2] It is important to note that Chapter 2 was recently revised and adopted on November 10, 2004 after a lengthy and thorough four-year review process. This process indicates DEQ's support for the current

permit issued pursuant to the provisions of this act, shall: (i) Cause, threaten or allow the discharge of any pollution into the waters of the state..." (emphasis added.) The definition of pollution as used in the EQA is found at W.S. § 35-11-103(c)(i).

> "Pollution" means contamination or other alteration of the physical, chemical or biological properties of any waters of the state, including change in temperature, taste, color, turbidity or odor of the waters or any discharge of any acid or toxic material, chemical or chemical compound, whether it be liquid, gaseous, solid, radioactive or other substance, including wastes, into any waters of the state which creates a nuisance or renders any waters harmful, detrimental or injurious to public health, safety or welfare, to domestic, commercial, industrial, agricultural, recreational or other legitimate beneficial uses, or to livestock, wildlife or aquatic life, or which degrades the water for its intended use, or adversely affects the environment. This term does not mean water, gas or other material which is injected into a well to facilitate production of oil, or gas or water, derived in association with oil or gas production and disposed of in a well, if the well used either to facilitate production or for disposal purposes is approved by authority of the state, and if the state determines that such injection or disposal well will not result in the degradation of ground or surface or water resources;

While this definition is broad, one cannot overlook the explicit provision for exceptions permitting the discharge of produced water in Wyoming. The current regulatory scheme does more than merely provide a broad definition of pollution. It very clearly provides exceptions to the general rule that pollution cannot be discharged. After defining the term, the statutes and rules proceed to establish the guidelines for when, where, and how the "pollution" can be discharged. It is here that the current framework differs from the rules proposed by PRBRC. Whereas the existing scheme clearly and unambiguously provides for permissible discharges, the stringent standards proposed by these rules will result in a complete ban on all surface discharges. Indeed, DEQ, in its

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scheme. *Also see* DEQ Comments, filed January 5, 2007.

Comment Letter dated January 5, 2007, recognized the overreaching nature of the proposed rules and objected to them.

As noted by DEQ, utilizing the definition of "pollution" from the Environmental Quality Act, Subsection (a)(iii) of Appendix I would result in a complete ban on the issuance of any permit for any discharge of produced water. Subsection (a)(iii) of Appendix I unambiguously bans any discharge unless the permit applicant demonstrates that it would "not cause contamination or other alteration of the physical, chemical, or biological properties of any waters of the state." Adopting this approach would preclude all discharges of any produced water whose chemistry was not identical to that of the receiving stream. In application, this rule would prohibit all discharges. DEQ has stated: "Petitioners have taken the definition of 'pollution' from sections 35-11-103(c)(i) of the Environmental Quality Act (EQA), put it in the regulation, and have essentially stated that no CBM operator can discharge effluent which meets the definition of 'pollution' or would cause 'pollution' in the stream." Letter from John Wagner to Mark Gordon (Jan. 5, 2007) at 1. This provision, DEQ says, "would prohibit any CBM discharge if there were any physical, chemical or biological alterations to the receiving waters caused by the discharge." *Id.* at 2. DEQ effectively summarized as follows:

> The primary purpose of the EQA is to require the DEQ to control environmental degradation by establishing permitting rules, regulations, processes, guidance and policy that allow 'pollution' or changes to the environment to occur, but within clear and defined boundaries. . . . [I]t is not the intent [of the EQA] to prohibit every discharge or activity which meets the definition of 'pollution,' but to adequately control such discharges.

Id. at 2. The proposed rules are beyond the scope of EQC and DEQ's authority and must be rejected.

THE PROPOSED RULES ARE ILL ADVISED BECAUSE THEY WILL HARM PRODUCTION OF BENEFICIAL WATER AND ARE HARMFUL TO AGRICULTURE, THE ENVIRONMENT, AND THE ECONOMY OF WYOMING

Despite PRBRC's attempts mid-petition to apply the proposed rules only to CBM, Merit has reason to believe that the proposed rules could be applied to all produced water in Wyoming. Though Merit does not concede this point, it is possible that the more stringent rules proposed by PRBRC could be subject to legal challenge and possibly applied to conventional production. Should this happen, the rules would cause extensive damage to conventional oil production and the resulting benefits from that production. Merit Energy produces crude oil at the Hamilton Dome Field located 25 miles northwest of the Thermopolis, WY, in Hot Springs County, Wyoming. Merit holds two (2) NPDES permits (WY0000175 and WY0000680) to discharge produced water from Hamilton Dome Field into unnamed tributaries that eventually flow into Cottonwood Creek. The data below represents a summary of a Use Attainability Analysis filed by Merit with the Department of Environmental Quality concerning its Hamilton Dome operations and the impact on the economy and environment. The continual water discharge is estimated at 210,000 barrels of water per day, or 13 cfs. Requiring Merit to treat the water in order to meet the standards of the proposed rules is not economically feasible and the Field would have to be shut in.[3] The resulting loss to agriculture, wildlife, the environment, Hot Springs County, and Wyoming, would be devastating.

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[3] The average cost of reinjection is $200,000 per well, with an initial capital investment of $14 million. In addition, a disposal facility with storage capacity of 250,000 barrels and a sufficient pump capacity would require an additional $5 million investment, for a total capital cost of reinjection at Hamilton Dome of $19 million. Lease operating expense would increase by approximately $150,000 per month due to increased electrical demands and facility maintenance expense. Because wellbores that would have to be converted are currently producing oil wells, there is an estimated loss of oil production of 600 barrels of oil per day.

Treatment of the water on the surface would require a capital investment of approximately $500 per gallon per minute of treatment capacity. At the current discharge rate of 210,000 barrels per day, this would result in a $3 million capital expenditure. More important, the associated increase in operating expenses would be approximately $250,000 per month.

The agricultural community is largely in agreement that ranching operations along Cottonwood Creek would cease altogether with the closure of the Hamilton Dome Field. Produced water provides late season grass and hay irrigation and year-round livestock watering. The beneficial uses would be otherwise limited to scant resources from natural runoff in the early summer season, and would not viably support ranching operations. Attached to this submission as Appendix A are Landowner Questionnaire Responses and an Affidavit, which support the agricultural need for the water. Notable are the comments of Frank Rhodes, a rancher at Cottonwood Creek for 45 years. His Affidavit, under oath, includes the following comments:

> "The produced water was extremely valuable to my ranching operations.
>
> ***
>
> After produced water was discharged, I witnessed a large increase in the number of ducks, geese, pheasants, and mule and white deer on or around Cottonwood Creek.
>
> ***
>
> The produced water from the Hamilton Dome Oilfield has been invaluable to my ranching operations as well as the other ranches and farms that are along Cottonwood Creek below the confluence (sic) the produced water with Cottonwood Creek, and has created a very beneficial environment for the area's wildlife.
>
> ***
>
> Without the produced water, Cottonwood Creek and the surrounding area would return to the dry, arid condition that existed prior to Cottonwood Creek being a year-round stream due to produced water, and ranchers, farmers, and the wildlife would suffer greatly."

Neither reinjection nor reverse osmosis treatment of Hamilton Dome produced water is acceptably cost-effective. Merit would shut in and abandon the field.

In stark contrast to the Petitioner's theories and models, Landowner Assessments clearly demonstrate that, in real life, there are no adverse health effects on livestock or wildlife from Cottonwood Creek due to the produced water from Hamilton Dome. They show positive impacts, no adverse health effects, and vast improvement of wildlife.

The loss of Hamilton Dome discharge into Cottonwood Creek would result in a corresponding loss of:

> 1600 acres of irrigated cropland;
>
> 4000 tons of annual hay production;
>
> 15 to 20% reduction in herd size (about 3200 cows) and eight $2 million reduction in related sales receipts (based on $650 per head); and
>
> 20 full-time and seasonal jobs in the ranching industry.

Merit has conducted an extensive economic evaluation of the economic significance of the Hamilton Dome Field. It is attached as Appendix B. A summary of the assessment follows.

The IMPLAN model was used to estimate the total economic losses to Hot Springs County, if the Hamilton Dome Field were shut in. Excluding losses from cessation of Merit's Hamilton Dome production operations, Hot Springs County is estimated to lose $3.3 million in total economic output, a loss of $645,000 in annual labor income, and a net loss of 32 full and part - time jobs.

Fiscal contributions of Hamilton Dome are significant. Annual crude production from the Hamilton Dome Field averages approximately 1.67 million barrels. Hamilton Dome supports an estimated total of 186 jobs in the State of Wyoming, including 136 jobs in Hot Springs County and 50 jobs elsewhere in Wyoming. The associated

Hamilton Dome labor income impact in Hot Springs County totals $4.07 million and $2.54 million elsewhere-in Wyoming.

Merit Energy is the largest taxpayer in Hot Springs County. Merit Energy is the county's largest source or property tax. The property tax revenue from Hamilton Dome averages 29% of the total property tax revenue of all countywide taxing entities ($1.9 million). Hamilton Dome accounts for the following revenue contributions to major funds and entities in Hot Springs County:

County General Fund: 9% of total General fund revenues.

Library, fair board, hospital: 27% of the library system's total revenues, 15% of the Fair Board's total revenues, and 2% of the Hot Springs County Memorial Hospital District's total revenues.

Hot Springs County Weed and Pest District. 9% of the District's pest eradication budget and 29% of its mosquito control budget.

Hot Springs County Rural Fire Protection District: 29% of the district's budget.

Hot Springs County School District #1: $1.4 million annually for school related funds. This loss would increase the school debt service mill levy for other county taxpayers by 2.8 mills, and based upon a five-year average. Assuming no change in enrollment levels, the Wyoming School Foundation Fund would experience a net cost of $1.235 million from lost revenues and additional entitlement costs.

Hamilton Dome production has provided severance taxes of approximately $1.8 million annually to the State of Wyoming. Federal mineral royalty payments for Hamilton Dome production average $4.4 million. Wyoming's share of those royalties averages approximately $2.2 million annually. Merit pays over $400,000 in sales and

use taxes on the purchase of goods and services for the Hamilton Dome Field. Hamilton Dome's crude production represents approximately 33% of the daily feedstock supply needed to sustain Wyoming's refineries at full production. Hamilton Dome supplies more than 20% of the crude necessary to sustain asphalt and road oil production. Loss of this production would have a direct impact on Wyoming's refineries.

Merit has studied the impact on wetlands caused by the loss of Hamilton Dome produced water. The wetlands were inventoried and mapped. Soils were analyzed. The study, completed in early 2003, demonstrated that a loss of Hamilton Dome discharge would eliminate approximately 600 acres of high quality wetlands. This totally includes nearly 100 acres supported directly by discharge and another approximately 500 acres along Cottonwood Creek that are indirectly supported by the discharge.

Conversion of Cottonwood Creek from a perennial to an ephemeral stream would impact riparian vegetation, and result in a decline of wildlife population and displacement of wildlife species. Francis Petera, the Director of the Wyoming Game and Fish Department, wrote to John Wagner of the Water Quality Division on June 20, 1990 and commented on produced water from Hamilton Dome:

> "Without further evidence that points to harming the wildlife or people in the area, the produced water does provide substantial benefits to the wildlife resource which is using this area."

The water produced from the Hamilton Dome Field would not meet the levels suggested in the proposed rules for Total Dissolved Solids and Sulfates and surface discharges of the water would cease. Because the produced water from the Hamilton Dome Field would not meet the standards in the proposed rules, the loss of that produced water would have a devastating impact on the environment, wildlife, the agricultural

community, the labor force, and Hot Springs County, in addition to Wyoming's General Fund. For all of the reasons set forth in these comments, Merit Energy Company respectfully urges the Environmental Quality Council to reject the rules proposed by PRBRC.

RESPECTFULLY SUBMITTED this 16th day of January, 2007.

MERIT ENERGY COMPANY

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CERTIFICATE OF SERVICE

I certify the foregoing pleading was served on this 16th day of January, 2007, and that copies were served as follows:

Kate Fox Davis and Cannon 422 West 26th Street Cheyenne WY 82001	[✓] U.S. Mail [____] Fed Ex [____] Fax [____] Hand Delivered
John Corra, Director Department of Environmental Quality Herschler Building, 4W 122 W. 25th Street Cheyenne, WY 82002	[✓] U.S. Mail [____] Fed Ex [____] Fax [____] Hand Delivered

Isaac N. Sutphin

EXHIBIT
A

State Engineer's Office

Herschler Building, 4-E Cheyenne, Wyoming 82002
(307) 777-7354 FAX (307) 777-5451
seoleg@state.wy.us

DAVE FREUDENTHAL
GOVERNOR

PATRICK T. TYRRELL
STATE ENGINEER

REVISED INTERIM POLICY MEMO

TO: State Engineer's Office

FROM: Patrick T. Tyrrell, State Engineer

DATE: April 26, 2004

SUBJECT: State Engineer's Office permitting requirements for water produced during the recovery of coal bed methane (CBNG)

THIS POLICY SUPERSEDES THE INTERIM POLICY MEMO DATED AUGUST 2, 2002.

THIS POLICY APPLIES TO BY-PRODUCT WATER DEVELOPED BY CBNG WELLS ONLY!! THE 1978 POLICY REGARDING 10 ACRE-FEET RESERVOIRS ASSOCIATED WITH GROUNDWATER ONLY DOES NOT APPLY TO CBNG WELLS!!

Prior to drilling a water well for the purpose of extracting methane gas from coal beds, a ground water (well) permit, using form U.W.5, must be obtained from the State Engineer. The beneficial use of this water, as stated on the application form, is water produced in production of coal bed methane gas. Unless specified in the well permit, there is no other beneficial use of this produced water authorized by the issuance of the well permit.

In accordance with § 41-3-301, W.S., 1977, as amended, a reservoir permit is required from the State Engineer for any impoundment that stores, for beneficial purposes, the un-appropriated waters of the state of Wyoming. Unless specified in the ground water permit, water produced in the production of coal bed methane gas has no other implied use and is considered to be un-appropriated waters of the state of Wyoming.

GROUND WATER

If the CBNG-produced water will be discharged and not used for any other beneficial purposes, no further ground water permitting is required.

If the CBNG-produced water will be used for any purposes other than coal bed methane production, these uses must be specified in the well application at the time of filing. If the CBNG-produced water will be stored in some type of impoundment, Surface Water reservoir filing procedures must be followed unless there will be no other beneficial use of the water and the impoundment is located off the channel of a

Surface Water (307) 777-6475 | Ground Water (307) 777-6163 | Board of Control (307) 777-6178

natural water course. Under these specific conditions, the Wyoming Oil and Gas Conservation Commission rules will apply.

SURFACE WATER

If an impoundment will be used to store CBNG-produced water for additional beneficial uses, a reservoir permit must be obtained from the State Engineer prior to commencement of construction of the impoundment.

The reservoir permitting process for on channel, CBNG-produced water impoundments falls into two general categories:

1. Impoundments with a capacity of twenty (20) acre-feet or less and with a dam height of twenty (20) feet or less.

2. Impoundments with a capacity in excess of twenty (20) acre-feet or with a dam height exceeding twenty (20) feet.

The storage of CBNG produced water is recognized as a beneficial use.

FILING METHODS

METHOD A: For use when CBNG water storage is the sole use and the operator/producer is the applicant.

Reservoir applications filed under these procedures will be limited to a life of fifteen (15) years or until the facility ceases to receive CBNG water discharges, whichever is sooner, and will carry a mandatory breach limitation to occur upon cancellation of the permit.

For impoundments that fall into category (1), Form SW-CBNG should be used and it need not be accompanied by a USGS Quadrangle map.

For impoundments that fall into category (2), the SW-3 application form must be used with a beneficial use of CBNG water storage and the application must be accompanied by a certified, blackline, mylar or linen map. The map may be certified by either a Wyoming -licensed professional engineer or land surveyor unless the impoundment falls under the auspices of the Safety of Dams Law (dam height greater than 20 feet or storage capacity of 50 acres-feet or more, in which case, the map must be certified by a Wyoming-licensed professional engineer. This certified map must be prepared in accordance with the policies established by the State Engineer's Office.

METHOD B: When the reservoir is intended to remain after storage of CBNG water ceases and the where the underlying landowner is the permit applicant or co-applicant.

For impoundments that fall into category (1), the Special Application filing procedures may be used which allow for the use of a USGS

Quadrangle map to serve as the permit map to accompany the SW-3 and SW-3A application forms. If a stock reservoir will be constructed, the SW-4 application form should be used. A stock reservoir filing using the SW-4 application form need not be accompanied by a USGS Quadrangle map.

For impoundments that fall into category (2), the SW-3 application form must be used and the application must be accompanied by a certified, blackline, mylar or linen map. The map may be certified by either a Wyoming-licensed professional engineer or land surveyor unless the impoundment falls under the auspices of the Safety of Dams Law (dam height greater than 20 feet or storage capacity of 50 acre-feet or more), in which case, the map must be certified by a Wyoming-licensed professional engineer. This certified map must be prepared in accordance with the policies established by the State Engineer's Office.

ON-CHANNEL IMPOUNDMENTS

All on-channel impoundments must have a storage permit from the State Engineer prior to commencement of any construction (or modification/improvement of an existing reservoir) of the reservoir. An existing reservoir to be used to store CBNG-produced water, without a State Engineer permit, has no standing and, as such, will be treated as if it doesn't exist and will be subject to all requirements of a new, properly-authorized CBNG reservoir constructed within the law. Any unpermitted, on-channel impoundment is subject to breach at all times.

Any new on-channel impoundment that will be built to store CBNG-produced water must be equipped with a controllable, low-level outlet pipe to allow for proper regulation. The minimum size of the low-level outlet pipe is 12 inches in diameter. A larger outlet may be required if conditions warrant. Larger drainages may require larger outlets. The potential for a call for priority regulation by downstream senior appropriators may also require the installation of a larger outlet pipe. The operator should contact the State Engineer's Office in this regard.

Any new on-channel impoundment that will be built to store CBNG-produced water may not capture natural runoff from the drainage on which it is located unless said runoff exceeds the average annual peak runoff event. To accomplish this, the on-channel facility must be equipped with a self-regulating runoff by-pass facility that will prevent flows up to and including the average annual peak runoff event from being stored. If a runoff event exceeds that of the average annual peak runoff event, that portion of the runoff in excess of the average annual peak runoff event may be stored in the impoundment but must be released to satisfy downstream, senior appropriators should it be required under priority regulation.

In lieu of the requirement for a self-regulating runoff by-pass facility, an application for a permit for an on-channel impoundment must be accompanied by a water administration plan that can demonstrate that the proposed reservoir will not negatively impact the drainage upon which the reservoir is proposed to be built. The water administration plan must either show how runoff (either the average annual peak or some lesser amount if approved by the SEO) will be made available to the drainage downstream of the reservoir irrespective of existing, downstream development (reservoirs) or channel conditions, or how in some other fashion senior, downstream water rights will be satisfied.

Any existing, permitted on-channel reservoir will not be subject to the above stipulations.

If an existing, permitted on-channel reservoir is to be enlarged to provide additional storage of coal bed methane water, a self-regulating runoff by-pass facility must be installed or a water administration plan filed. The by-pass facility and water administration plan must meet the same requirements listed above.

If the height of the dam on an existing, permitted on-channel reservoir is to be increased to provide additional freeboard, an uncontrolled primary spillway must be installed with its invert elevation at the historic high water level such as to allow inflow above the historic volume to pass through the reservoir. This primary spillway shall not be less than 12-inches in diameter and must meet the same requirements listed above for a self-regulating runoff bypass facility.

OFF-CHANNEL IMPOUNDMENTS

An off-channel impoundment may be built to store CBNG-produced water. The off-channel impoundment should be positioned so the potential to store surface runoff is minimal. By-pass facilities or berms may be used to preclude surface runoff from entering the pond. Off-channel impoundments that store no surface runoff (direct precipitation is considered to be negligible) need not be designed with an outlet. The operator must be aware that any runoff that is impounded in the reservoir may have to be passed to downstream, senior appropriators in the event of a call for priority regulation.

BENEFICIAL USE OF CBNG-PRODUCED WATER

The beneficial use of CBNG-produced water may be classified into two (2) categories:

1. Inactive use of CBNG-produced water due to evaporation and/or infiltration.

2. Active use of CBNG-produced water by discharging from the

reservoir such as land application or in a leach field.

CBNG-produced water use under category (1) needs no further discussion.

For use of CBNG-produced water under category (2) the operator must specify the points of land application on the map which accompanies the reservoir application. This is accomplished by the use of X's in the appropriate 40-acre subdivisions where water will be applied. The pipeline/nozzle system should be shown in sufficient detail so it is clear where the water will be applied. No water right will be established at the points of land application of CBNG-produced water.

Due to the fact that CBNG-produced water is not native to the drainage, a CBNG-produced water storage reservoir will be allowed multiple or continuous fills from CBNG sources only. The following limitations will be placed on any reservoir permit where water will be evacuated for CBNG-produced water use:

> Nothing herein is intended to create a water right that attaches to the land application or leach field points of use. The points of land application/leach field are shown for informational purposes only.
>
> For most of the year, this drainage has flow as a result of CBNG wells discharging in the area. Therefore, if there is not natural flow available, this water is not subject to a downstream priority call for regulation and, as such, the reservoir IS NOT subject to the one-fill rule.

BREACHING REQUIREMENTS

Dams designed to hold CBNG-produced water and natural runoff will be conditioned to allow breaching (or reduction in size) upon cessation of receiving CBNG-produced water. Contingent requirements are as follows:

1. If the structure is situated off-channel and captures no natural runoff, breaching may not be required.

2. On-channel structures may remain if down sized to stock pond capacity and dam height if the landowner's written consent is obtained.

3. All other structures are subject to a breaching requirement:

    a. The "permissive" requirement, which would apply in most cases, is worded as follows: This reservoir stores only water that is produced as a by-product of coal bed methane production. When coal bed methane

production ceases, the State Engineer may require the owner to breach the dam or reclaim the pit to allow for proper water administration.

b. The "mandatory" requirement will be used in drainages and locations where the Superintendent of the water division in which the reservoir is located has predicted administrative problems. That wording is as follows: This reservoir stores only water that is produced as a by-product of coal bed methane production. When coal bed methane production ceases, the owner of this reservoir shall breach the dam or reclaim the pit to allow for proper water administration.

The above requirements are for ponds holding only CBNG-produced water. If stock, fish and wildlife, fish propagation or other uses are included, some consideration will be given to maintaining those storage capacities post-CBNG. Landowner consent must be obtained to leave these reservoirs with the concurrence of the Superintendent. All landowner consents to leave CBNG reservoirs in place must include language committing the landowner to proper long-term maintenance of the structure.

RESERVOIR OWNERSHIP

LANDOWNER: It is acceptable to file an application for a CBNG reservoir in the name of the landowner. If no agent has been listed, the landowner will receive all correspondence regarding the application and the reservoir.

OPERATOR/PRODUCER: It is acceptable to file an application for a CBNG reservoir in the name of the operator/producer. The operator/producer must submit a certification supplying the name and address of the landowner on which the reservoir will be constructed. The certification must also certify that the operator/producer has contacted the landowner and made them aware that they intend to construct the reservoir on lands owned by the landowner. Applications filed in this manner will be issued with mandatory breach limitations to occur after CBNG water production ceases. Dam site reclamation may also be required. Once approved, a copy of the permit will be sent to the landowner as well as the operator/producer. The operator/producer will be responsible for all actions regarding the application, permit, and reservoir.

JOINT APPLICANTS: The operator/producer and the landowner may file jointly. Both parties will then be contacted about the application unless one party is designated as the agent to receive and respond to inquiries about the application during processing or the reservoir after construction. Both parties will then be responsible for inquiries about the application, permit, or reservoir. Mandatory

breach limitations will be placed on the permit unless the landowner has indicated their desire to retain the reservoir after CBNG water production is complete.

These guidelines are the State Engineer's Office requirements for dealing with CBNG-produced water. The CBNG operators should be advised that they must contact the Wyoming Oil and Gas Conservation Commission and the Department of Environmental Quality/Water Quality Division for their requirements concerning water produced from the development of coal bed methane.

LANDOWNER AFFIDAVIT AND TESTIMONY

APPENDIX A

BEFORE THE WYOMING DEPARTMENT OF ENVIRONMENTAL QUALITY, WATER QUALITY DIVISION

RENEWAL OF MERIT ENERGY	)
COMPANY'S PERMITS TO	)
DISCHARGE, PERMIT NUMBERS	)
WY0000175 AND WY0000680	)

AFFIDAVIT OF FRANK RHODES

I, Frank Rhodes, being duly sworn upon his oath, being of lawful age and otherwise competent to testify and having personal knowledge of the matters contained herein do state:

1. I was a rancher on six to eight miles of Cottonwood Creek from 1948 to 1993, just north of Hamilton Dome, Wyoming.

2. During this time, I ranched approximately 13,000 acres of deeded land, and approximately 26,000 acres of land leased from the Bureau of Land Management.

3. I ranched on Cottonwood Creek prior to the time when produced water was discharged from the Hamilton Dome oil field into Cottonwood Creek.

4. Prior to produced water being discharged, Cottonwood Creek would only flow from approximately March to July or August, and would sometimes be dry as early as June. For the rest of the year, Cottonwood Creek was dry with the exception of intermittent flows of rain or snow melt.

5. Prior to the discharge of produced water, I had to use well water to water my livestock.

6. After produced water was discharged into the Cottonwood Creek, the creek would flow year-round.

7. My ranch, which was sold in 1993, has water rights for water out of Cottonwood Creek and one of the unnamed tributaries into which the produced water is discharged.

8. I used the produced water to water my livestock and irrigate hay. The produced water was extremely valuable to my ranching operations.

9. Additionally, after produced water was discharged, I witnessed a large increase in the number of ducks, geese, pheasants, and mule and white-tail deer on or around Cottonwood Creek.

10. The produced water from the Hamilton Dome oil field has been invaluable to my ranching operations as well as the other ranches and farms that are along Cottonwood Creek below the confluence the produced water with Cottonwood Creek, and has created a very beneficial environment for the area's wildlife.

11. Without the produced water, Cottonwood Creek and the surrounding area would return to the dry, arid condition that existed prior to Cottonwood Creek being a year-round stream due to produced water, and ranchers, farmers, and the wildlife would suffer greatly.

FURTHER AFFIANT SAYETH NAUGHT.

Frank Rhodes

Frank Rhodes

STATE OF WYOMING)
)**SS:**
COUNTY OF HOT SPRINGS)

The foregoing instrument was subscribed and sworn to before me by Frank Rhodes on the 26 day of August, 2002.

James A Mitchell Jr

Notary Public

My Commission Expires: April 24, 2006

NOTARY PUBLIC
JAMES A. MITCHELL JR.
COUNTY OF WASHAKIE
STATE OF WYOMING
My Commission Expires Apr. 24, 2006

HAMILTON DOME WATER DISCHARGES
TO COTTONWOOD CREEK:

LANDOWNER ASSESSMENTS

GROUNDWATER HYDROLOGY ISSUES

1. Does the current flow of Cottonwood Creek affect the water table level on your property? If yes, do you see increased vegetation in areas of high groundwater table? (i.e. along stream banks) How much? (5 feet, 5 yards, 20 yards, etc.)

2. How many additional livestock can you operate with due to this increased vegetation from the raised groundwater table? (None, 5%, 10%, 20%, etc.)

3. Have you seen any affect of the water table in any water wells in the area? If yes, "What is the depth of the well(s)?"

SURFACE WATER HYDROLOGY ISSUES

States West will assess the current hydrology of Cottonwood Creek and predict the hydrology if the discharges were to cease.

1. Do you have any knowledge of conditions of Cottonwood Creek before 1950? If Yes: How many years out of 10 would it normally be dry at some time during the year? What month would it normally go dry? In the spring, when would water start running in the stream above Hamilton Dome?

2. Do you irrigate with water solely from Hamilton Dome discharges?

3. Do you irrigate with water that is mixed with runoff? If yes: How do you determine if the water quality is adequate for irrigation?

4. How many times a year do you irrigate?

5. Have you seen any impact to your fields from irrigating with Cottonwood Creek water?

6. Have you ever seen any adverse health effects on livestock or wildlife from Cottonwood Creek?

HAMILTON DOME WATER DISCHARGES
TO COTTONWOOD CREEK:

LANDOWNER ASSESSMENTS

GROUNDWATER HYDROLOGY ISSUES

1. Does the current flow of Cottonwood Creek affect the water table level on your property? If yes, do you see increased vegetation in areas of high groundwater table? (i.e. along stream banks) How much? (5 feet, 5 yards, 20 yards, etc.) yes, yes

2. How many additional livestock can you operate with due to this increased vegetation from the raised groundwater table? (None, 5%, 10%, 20%, etc.)

3. Have you seen any affect of the water table in any water wells in the area? If yes, "What is the depth of the well(s)?" no

SURFACE WATER HYDROLOGY ISSUES

States West will assess the current hydrology of Cottonwood Creek and predict the hydrology if the discharges were to cease.

1. Do you have any knowledge of conditions of Cottonwood Creek before 1950? If Yes: How many years out of 10 would it normally be dry at some time during the year? What month would it normally go dry? In the spring, when would water start running in the stream above Hamilton Dome? no

2. Do you irrigate with water solely from Hamilton Dome discharges? yes

3. Do you irrigate with water that is mixed with runoff? If yes: How do you determine if the water quality is adequate for irrigation? yes, historic use of this same water proves it is adequa

4. How many times a year do you irrigate? most fields get 2 per year

5. Have you seen any impact to your fields from irrigating with Cottonwood Creek water? no

6. Have you ever seen any adverse health effects on livestock or wildlife from Cottonwood Creek? no

HAMILTON DOME WATER DISCHARGES
TO COTTONWOOD CREEK:

LANDOWNER ASSESSMENTS

GROUNDWATER HYDROLOGY ISSUES

1. Does the current flow of Cottonwood Creek affect the water table level on your property? If yes, do you see increased vegetation in areas of high groundwater table? (i.e. along stream banks) How much? (5 feet, 5 yards, 20 yards, etc.)

2. How many additional livestock can you operate with due to this increased vegetation from the raised groundwater table? (None, 5%, 10%, 20%, etc.)

3. Have you seen any affect of the water table in any water wells in the area? If yes, "What is the depth of the well(s)?"
   I Can't Really Answer These first Three questions Because The Creek has Always Run Since we have owned The Property

SURFACE WATER HYDROLOGY ISSUES

States West will assess the current hydrology of Cottonwood Creek and predict the hydrology if the discharges were to cease.

1. Do you have any knowledge of conditions of Cottonwood Creek before 1950? If Yes: How many years out of 10 would it normally be dry at some time during the year? What month would it normally go dry? In the spring, when would water start running in the stream above Hamilton Dome?

2. Do you irrigate with water solely from Hamilton Dome discharges?

3. Do you irrigate with water that is mixed with runoff? If yes: How do you determine if the water quality is adequate for irrigation?

4. How many times a year do you irrigate?

5. Have you seen any impact to your fields from irrigating with Cottonwood Creek water?

6. Have you ever seen any adverse health effects on livestock or wildlife from Cottonwood Creek? NO

ECONOMIC ISSUES

1. What is your typical season/period of use of water from Cottonwood Creek?

   Begin: _____
   End: _____

2. For what purpose(s) is the water used? (May indicate more than one answer)

   Livestock watering (immediate use): _____
   Livestock watering (stored/impounded for later use): _____
   Irrigate Pastures: _____
   Irrigate Cropland: _____

3. How long has your operation used this water?

4. If you checked livestock watering in Question #2, what kind and how many head of livestock are supported by the water?

   _____/_____/_____
   Cattle / Sheep / Horses
   (cow-calf pairs)

5. Does the livestock watering occur on your own land, leased private land, or federal/state grazing allotments?

6. If you checked irrigation in Question #2, please describe the type and use of the irrigated acreage.

   Acres: _____/_____
   Pasture / cropland

   If cropland, the type of crop grown:_____

   Average productivity/acre over the past 3 seasons: _____

   If the crop is alfalfa or grass hay, is it used as winter feed for your herd or is it sold? _____

7. How many people, including family members, work or are employed by your operation?

   Year-round: _____
   Seasonal: _____

Please review the analysis of the effects of the loss of Hamilton Dome produced water on Cottonwood Creek (i.e., reduced average flow volumes by month). Then address questions 8-12:

8. How would a reduction/loss of the water affect your operation, (e.g., reduce herd size by _____, reduce crop production by _____%, or _____)?

9. Estimate the reduction in your operations annual net income associated with the effects identified in Question #8 above? _____

10. Is there an alternative source of water available to replace this water? If yes, please describe, including the costs associated with obtaining water from the alternative source. _____

11. How would you adjust your operation's labor to deal with the effects associated with the reduction in water? _____

12. Would your operation remain viable with the reduction in volume or the loss of this water?

ECOLOGICAL ISSUES

1. What changes have you noticed with regard to wildlife use of the area since the stream became perennial rather than intermittent?

2. Has the ability to produce alfalfa using discharge water increased use of the area by wildlife, especially big game and game birds?

3. What would become of the irrigated hayfields if you could no longer irrigate?

4. Has there been a change in plants (more willows, cottonwoods, marshes, etc.?)

ECONOMIC ISSUES

1. What is your typical season/period of use of water from Cottonwood Creek?

   Begin: June
   End: October

2. For what purpose(s) is the water used? (May indicate more than one answer)

   Livestock watering (immediate use): X
   Livestock watering (stored/impounded for later use): _____
   Irrigate Pastures: _____
   Irrigate Cropland: _____

3. How long has your operation used this water?
   3 years

4. If you checked livestock watering in Question #2, what kind and how many head of livestock are supported by the water?

   _____ / _____ / 25
   Cattle / Sheep / Horses
   (cow-calf pairs)

5. Does the livestock watering occur on your own land, leased private land, or federal/state grazing allotments? Private Land

6. If you checked irrigation in Question #2, please describe the type and use of the irrigated acreage.

   Acres: 320 / _____
   Pasture / cropland

   If cropland, the type of crop grown: _____

   Average productivity/acre over the past 3 seasons: _____

   If the crop is alfalfa or grass hay, is it used as winter feed for your herd or is it sold? _____

7. How many people, including family members, work or are employed by your operation?

   Year-round: _____
   Seasonal: 4

Please review the analysis of the effects of the loss of Hamilton Dome produced water on Cottonwood Creek (i.e., reduced average flow volumes by month). Then address questions 8-12:

8. How would a reduction/loss of the water affect your operation, (e.g., reduce herd size by 100%, reduce crop production by _____%, or _____)?

9. Estimate the reduction in your operations annual net income associated with the effects identified in Question #8 above? 5000 to 12,000

10. Is there an alternative source of water available to replace this water? If yes, please describe, including the costs associated with obtaining water from the alternative source. Possible well, 8,000

11. How would you adjust your operation's labor to deal with the effects associated with the reduction in water? We would Be OUT of Bussiness

12. Would your operation remain viable with the reduction in volume or the loss of this water? NO

ECOLOGICAL ISSUES

1. What changes have you noticed with regard to wildlife use of the area since the stream became perennial rather than intermittent? WE havent owned The Land Long Enough to Answer This Question

2. Has the ability to produce alfalfa using discharge water increased use of the area by wildlife, especially big game and game birds?

3. What would become of the irrigated hayfields if you could no longer irrigate?

4. Has there been a change in plants (more willows, cottonwoods, marshes, etc.?)
No Change. But we have lots of willows and trees on our property.

irby Creek mule Co.
Jeff Van Antwerp
224 S. 9th Street
Theemopolis, WY 82443

Clay Van Antwerp
805 Bushnell
Rock Springs, WY
307-362-4898

ECONOMIC ISSUES

1. What is your typical season/period of use of water from Cottonwood Creek?

   Begin: March
   End: Nov

2. For what purpose(s) is the water used? (May indicate more than one answer)

   Livestock watering (immediate use): ✓
   Livestock watering (stored/impounded for later use): ✓
   Irrigate Pastures: ✓
   Irrigate Cropland: ✓

3. How long has your operation used this water? mine for 2 years, but this ranch has used the water since 1905 that I know of and probably longer

4. If you checked livestock watering in Question #2, what kind and how many head of livestock are supported by the water?

   450 / 40 / 25
   Cattle / Sheep / Horses
   (cow-calf pairs)

5. Does the livestock watering occur on your own land, leased private land, or federal/state grazing allotments? My own + state and fedral allot.

6. If you checked irrigation in Question #2, please describe the type and use of the irrigated acreage.

   Acres: 66 / acres
   Pasture / cropland

   If cropland, the type of crop grown: _____

   Average productivity/acre over the past 3 seasons: 2 ton per acre hay

   If the crop is alfalfa or grass hay, is it used as winter feed for your herd or is it sold? fed.

7. How many people, including family members, work or are employed by your operation?

   Year-round: 7
   Seasonal: 4

Please review the analysis of the effects of the loss of Hamilton Dome produced water on Cottonwood Creek (i.e., reduced average flow volumes by month). Then address questions 8-12:

8. How would a reduction/loss of the water affect your operation, (e.g., reduce herd size by 50, reduce crop production by 50 %, or more)?

9. Estimate the reduction in your operations annual net income associated with the effects identified in Question #8 above? 100,000.00 or more

10. Is there an alternative source of water available to replace this water? If yes, please describe, including the costs associated with obtaining water from the alternative source. no. not that I'm aware of

11. How would you adjust your operation's labor to deal with the effects associated with the reduction in water? I would have to let them all go.

12. Would your operation remain viable with the reduction in volume or the loss of this water? no

ECOLOGICAL ISSUES

1. What changes have you noticed with regard to wildlife use of the area since the stream became perennial rather than intermittent? N/A

2. Has the ability to produce alfalfa using discharge water increased use of the area by wildlife, especially big game and game birds? lots of wildlife in this area

3. What would become of the irrigated hayfields if you could no longer irrigate? the would become weed fields

4. Has there been a change in plants (more willows, cottonwoods, marshes, etc.?) N/A

HAMILTON DOME WATER DISCHARGES
TO COTTONWOOD CREEK:

LANDOWNER ASSESSMENTS

GROUNDWATER HYDROLOGY ISSUES

1. Does the current flow of Cottonwood Creek affect the water table level on your property? If yes, do you see increased vegetation in areas of high groundwater table? (i.e. along stream banks) How much? (5 feet, 5 yards, 20 yards, etc.)
   YES – 10 yds
2. How many additional livestock can you operate with due to this increased vegetation from the raised groundwater table? (None, 5%, 10%, 20%, etc.)
3. Have you seen any affect of the water table in any water wells in the area? If yes, "What is the depth of the well(s)?" YES 80'

SURFACE WATER HYDROLOGY ISSUES

States West will assess the current hydrology of Cottonwood Creek and predict the hydrology if the discharges were to cease.

1. Do you have any knowledge of conditions of Cottonwood Creek before 1950? NO If Yes: How many years out of 10 would it normally be dry at some time during the year? What month would it normally go dry? In the spring, when would water start running in the stream above Hamilton Dome?
2. Do you irrigate with water solely from Hamilton Dome discharges? NO – BUT solely from Cottonwood Creek.
3. Do you irrigate with water that is mixed with runoff? If yes: How do you determine if the water quality is adequate for irrigation? YES – Clarity & water testing
4. How many times a year do you irrigate? 8-9 months
5. Have you seen any impact to your fields from irrigating with Cottonwood Creek water? Positive impact only
6. Have you ever seen any adverse health effects on livestock or wildlife from Cottonwood Creek? NO

ECONOMIC ISSUES

1. What is your typical season/period of use of water from Cottonwood Creek?

   Begin: MARCH
   End: November

2. For what purpose(s) is the water used? (May indicate more than one answer)

   Livestock watering (immediate use): YES
   Livestock watering (stored/impounded for later use): Well
   Irrigate Pastures: YES
   Irrigate Cropland: YES

3. How long has your operation used this water?

   This property has used Cottonwood Creek water Since 1904

4. If you checked livestock watering in Question #2, what kind and how many head of livestock are supported by the water?

   200 / 0 / 2
   Cattle / Sheep / Horses
   (cow-calf pairs)

5. Does the livestock watering occur on your own land, leased private land, or federal/state grazing allotments? OWN LAND

6. If you checked irrigation in Question #2, please describe the type and use of the irrigated acreage.

   Acres: 340 / 300
   Pasture / cropland

   If cropland, the type of crop grown: HAY

   Average productivity/acre over the past 3 seasons: 4 TONS/ACRE

   If the crop is alfalfa or grass hay, is it used as winter feed for your herd or is it sold? BOTH

7. How many people, including family members, work or are employed by your operation?

   Year-round: 5
   Seasonal: 6

Please review the analysis of the effects of the loss of Hamilton Dome produced water on Cottonwood Creek (i.e., reduced average flow volumes by month). Then address questions 8-12:

8. How would a reduction/loss of the water affect your operation, (e.g., reduce herd size by 50 %, reduce crop production by 80 %, or _____)?

9. Estimate the reduction in your operations annual net income associated with the effects identified in Question #8 above? Cause for Liquidation

10. Is there an alternative source of water available to replace this water? If yes, please describe, including the costs associated with obtaining water from the alternative source. None

11. How would you adjust your operation's labor to deal with the effects associated with the reduction in water? Property would be Liquidated ALL Associated Jobs would be Lost.

12. Would your operation remain viable with the reduction in volume or the loss of this water? NO – ALL operations would cease.

ECOLOGICAL ISSUES

1. What changes have you noticed with regard to wildlife use of the area since the stream became perennial rather than intermittent?

   MORE WildLiFe OF every Kind

2. Has the ability to produce alfalfa using discharge water increased use of the area by wildlife, especially big game and game birds? YES TO BOTH

3. What would become of the irrigated hayfields if you could no longer irrigate?

   DRY Land pasture – WASTE Land

4. Has there been a change in plants (more willows, cottonwoods, marshes, etc.?)

   Profoundly Yes

HAMILTON DOME WATER DISCHARGES
TO COTTONWOOD CREEK:

LANDOWNER ASSESSMENTS

GROUNDWATER HYDROLOGY ISSUES

1. Does the current flow of Cottonwood Creek affect the water table level on your property? If yes, do you see increased vegetation in areas of high groundwater table? (i.e. along stream banks) How much? (5 feet, 5 yards, 20 yards, etc.)
   Doesn't Run by my Land.
2. How many additional livestock can you operate with due to this increased vegetation from the raised groundwater table? (None, 5%, 10%, 20%, etc.)
3. Have you seen any affect of the water table in any water wells in the area? If yes, "What is the depth of the well(s)?" I have two wells over 300' deep. Since the drought, they haven't been Good water- full of heavy minerals or metals, Sulphur + ~~[illegible]~~ Sodium

SURFACE WATER HYDROLOGY ISSUES

States West will assess the current hydrology of Cottonwood Creek and predict the hydrology if the discharges were to cease.

1. Do you have any knowledge of conditions of Cottonwood Creek before 1950? If Yes: How many years out of 10 would it normally be dry at some time during the year? What month would it normally go dry? In the spring, when would water start running in the stream above Hamilton Dome? Only been using since about 1974 or 75- We start as soon as theres water in spring + thru fall, if there's water- This is Second Bad Drought We Have
2. Do you irrigate with water solely from Hamilton Dome discharges?
   Solely From whats in Cottonwood Creek-
3. Do you irrigate with water that is mixed with runoff? If yes: How do you determine if the water quality is adequate for irrigation?
4. How many times a year do you irrigate? From April thru Oct. or Nov. As Long as we can before Freezes up.
5. Have you seen any impact to your fields from irrigating with Cottonwood Creek water? No.
6. Have you ever seen any adverse health effects on livestock or wildlife from Cottonwood Creek? No.

ECONOMIC ISSUES

1. What is your typical season/period of use of water from Cottonwood Creek?

   Begin: early Spring
   End: late fall

2. For what purpose(s) is the water used? (May indicate more than one answer)

   Livestock watering (immediate use): Not Allowed
   Livestock watering (stored/impounded for later use): Not Allowed
   Irrigate Pastures: _____
   Irrigate Cropland: X

3. How long has your operation used this water?
   Since about 74 or 75, when there was water

4. If you checked livestock watering in Question #2, what kind and how many head of livestock are supported by the water?

   _____ / _____ / _____ N/A
   Cattle / Sheep / Horses
   (cow-calf pairs)

5. Does the livestock watering occur on your own land, leased private land, or federal/state grazing allotments? N/A

6. If you checked irrigation in Question #2, please describe the type and use of the irrigated acreage.

   Acres: _____ / 311 Not Adjudicated for Rest of Property.
   Pasture / cropland

   If cropland, the type of crop grown: Alfalfa Hay - Grain

   Average productivity/acre over the past 3 seasons: Depends on water - 2001 - No crops at all - Had no water at all -

   If the crop is alfalfa or grass hay, is it used as winter feed for your herd or is it sold? Used for Livestock

7. How many people, including family members, work or are employed by your operation?

   Year-round: 1 + wife
   Seasonal: 1

Please review the analysis of the effects of the loss of Hamilton Dome produced water on Cottonwood Creek (i.e., reduced average flow volumes by month). Then address questions 8-12:

8. How would a reduction/loss of the water affect your operation, (e.g., reduce herd size by _____, reduce crop production by _____%, or _____)?
   I have No idea - My cattle drink well water - But I Need the Creek 100% for crop production.
9. Estimate the reduction in your operations annual net income associated with the effects identified in Question #8 above? _____

10. Is there an alternative source of water available to replace this water? If yes, please describe, including the costs associated with obtaining water from the alternative source. None.

11. How would you adjust your operation's labor to deal with the effects associated with the reduction in water? My partner Would probably have To Seek employment AWAY FROM Ranch IN winter time -
12. Would your operation remain viable with the reduction in volume or the loss of this water? No.

ECOLOGICAL ISSUES

1. What changes have you noticed with regard to wildlife use of the area since the stream became perennial rather than intermittent? Before the Drought we have lots of Wildlife + Wild fowl -
2. Has the ability to produce alfalfa using discharge water increased use of the area by wildlife, especially big game and game birds? yes, when available
3. What would become of the irrigated hayfields if you could no longer irrigate?
   Have to lay fallow -
4. Has there been a change in plants (more willows, cottonwoods, marshes, etc.?)
   We don't have a tree on our 520 acres -

HAMILTON DOME WATER DISCHARGES
TO COTTONWOOD CREEK:

LANDOWNER ASSESSMENTS

GROUNDWATER HYDROLOGY ISSUES

1. Does the current flow of Cottonwood Creek affect the water table level on your property? If yes, do you see increased vegetation in areas of high groundwater table? (i.e. along stream banks) How much? (5 feet, 5 yards, 20 yards, etc.) Varies from 15-25 yds.

2. How many additional livestock can you operate with due to this increased vegetation from the raised groundwater table? (None, 5%, 10%, 20%, etc.) 15%

3. Have you seen any affect of the water table in any water wells in the area? If yes, "What is the depth of the well(s)?" Well @ house is 95' and produces in excess of 40 gpm.

SURFACE WATER HYDROLOGY ISSUES

States West will assess the current hydrology of Cottonwood Creek and predict the hydrology if the discharges were to cease.

1. Do you have any knowledge of conditions of Cottonwood Creek before 1950? No If Yes: How many years out of 10 would it normally be dry at some time during the year? What month would it normally go dry? In the spring, when would water start running in the stream above Hamilton Dome?

2. Do you irrigate with water solely from Hamilton Dome discharges? – NO

3. Do you irrigate with water that is mixed with runoff? Yes If yes: How do you determine if the water quality is adequate for irrigation? – When there is enough water you utilize it – have had no problems.

4. How many times a year do you irrigate? 2 - 6 depending on water

5. Have you seen any impact to your fields from irrigating with Cottonwood Creek water? Without it they will die.

6. Have you ever seen any adverse health effects on livestock or wildlife from Cottonwood Creek? Absolutely none

ECONOMIC ISSUES

1. What is your typical season/period of use of water from Cottonwood Creek? - Non-drought yrs.

   Begin: April 1-20 - - - - - - - Sept. 1-30
   End: May 20-June 30 - - - - - - Oct. 1-30

2. For what purpose(s) is the water used? (May indicate more than one answer)

   Livestock watering (immediate use): Year round
   Livestock watering (stored/impounded for later use): _____
   Irrigate Pastures: Spring & fall
   Irrigate Cropland: Spring & fall

3. How long has your operation used this water? - We have owned and used this property for 5 years.

4. If you checked livestock watering in Question #2, what kind and how many head of livestock are supported by the water?

   20-40 / 0 / 2-4
   Cattle / Sheep / Horses
   (cow-calf pairs)

5. Does the livestock watering occur on your own land, leased private land, or federal/state grazing allotments? Own land

6. If you checked irrigation in Question #2, please describe the type and use of the irrigated acreage.

   Acres: 25 / 30-35
   Pasture / cropland

   If cropland, the type of crop grown: HAY

   Average productivity/acre over the past 3 seasons: 1-1½ T (drought years)

   If the crop is alfalfa or grass hay, is it used as winter feed for your herd or is it sold? Winter feed

7. How many people, including family members, work or are employed by your operation?

   Year-round: 2 [Wife + myself]
   Seasonal: 0

Please review the analysis of the effects of the loss of Hamilton Dome produced water on Cottonwood Creek (i.e., reduced average flow volumes by month). Then address questions 8-12:

8. How would a reduction/loss of the water affect your operation, (e.g., reduce herd size by 50-100%, reduce crop production by 50 %, or _____)?

9. Estimate the reduction in your operations annual net income associated with the effects identified in Question #8 above? $13,500

10. Is there an alternative source of water available to replace this water? If yes, please describe, including the costs associated with obtaining water from the alternative source. No

11. How would you adjust your operation's labor to deal with the effects associated with the reduction in water? Economically unfeasable to operate

12. Would your operation remain viable with the reduction in volume or the loss of this water? No - cease operations.

ECOLOGICAL ISSUES

1. What changes have you noticed with regard to wildlife use of the area since the stream became perennial rather than intermittent? Much more wildlife using stream as a water source & the riparian areas.

2. Has the ability to produce alfalfa using discharge water increased use of the area by wildlife, especially big game and game birds? Absolutely - lots of deer, chuka and pheasants.

3. What would become of the irrigated hayfields if you could no longer irrigate? They would a

4. Has there been a change in plants (more willows, cottonwoods, marshes, etc.?) Yes, without the water the cottonwood community and surrounding riparian areas would cease to existi

THE ECONOMIC SIGNIFICANCE OF THE HAMILTON DOME OILFIELD

APPENDIX B

The Economic Significance
of the
Hamilton Dome Oilfield

November 6, 2002

Prepared for
Merit Energy Company

Blankenship Consulting LLC

Hammer Siler George Associates

in association with
States West Water Resources Corporation

EXECUTIVE SUMMARY

Ongoing production of petroleum crude from Merit Energy Company's Hamilton Dome field is a significant source of economic stimulus for Hot Springs County and the State of Wyoming. This report provides an assessment of the contributions of Merit's Hamilton Dome oilfield to the economy of Hot Springs County and the State of Wyoming. In fact, these contributions are proxy measures of the adverse impacts that would result from the premature closure of the Hamilton Dome field. The report focuses on the following aspects of the economy:

- the economic stimulus associated with Hamilton Dome employment, purchases of goods and services, payment of taxes and the associated multiplier effect,
- the effect of Hamilton Dome tax payments on the Hot Springs County tax base and the taxing entities who rely on these payments to help fund services provided to residents, including students enrolled in local public schools,
- hay and livestock production along Cottonwood Creek supported by the discharge of produced water from the Hamilton Dome; and,
- the significance of Hamilton Dome crude oil to the Wyoming refining industry and the production of asphalt and road oil.

The substantial negative economic impacts in Hot Springs County that would accrue to residents, businesses and local governmental entities with premature closure should be taken into account in the overall assessment of the benefits and costs associated with compliance with Class 2C water quality standards.

Economic Contributions of Hamilton Dome

Annual crude production from the Hamilton Dome field averaged 1.67 million barrels over the past five years.

- Employment and Labor Income: Based on annual operating expenses averaged over the past five years, Hamilton Dome supports an estimated 186 jobs in the State of Wyoming including 136 jobs in Hot Springs County (about 4 percent of total employment in the county in 2000) and 50 jobs elsewhere in Wyoming. The associated Hamilton Dome labor income impact in Hot Springs County totals $4.07 million (about 7 percent of total labor income in the county in 2000) and $2.54 million elsewhere in Wyoming.

- Overall Economic Output: The economic contribution of the Hamilton Dome oilfield is conservatively estimated at nearly $28.7 million annually, most of which occurs in Hot Springs County.

Fiscal Contributions of Hamilton Dome

Merit Energy Company is the largest taxpayer in Hot Springs County and the Hamilton Dome field is the county's largest source of property tax.

Property Tax

Over the past 5 years, Hamilton Dome property tax revenue has averaged 29 percent of total property tax revenue for all countywide taxing entities ($1.9 million out of a total $6.6 million). Property taxes are the largest source of locally-derived funding for local governmental entities and represent a major source of non-earmarked revenue subject to discretionary spending control. Counties are statutorily limited to a 12-mill cap for basic county operating purposes (general fund, hospital, library and fair board), limiting their capacity to increase property taxes to offset reductions in revenues. Hot Springs County's property tax rates are at the 12-mill limit. Consequently, a major reduction in revenues associated with the premature shutdown of the Hamilton Dome field would likely trigger reductions in basic service levels.

Over the past five years, property taxes from Hamilton Dome have accounted for the following revenue contributions to major funds and entities:

- County General Fund: 9 percent of total general fund revenues.
- Library, Fair Board, Hospital: 27 percent of the library system's total revenues, 15 percent of the Fair Board's total revenues and 2 percent of Hot Springs County Memorial Hospital's total revenues.
- Hot Springs County Weed and Pest District: Two separate levies fund operations of the Weed and Pest District. Hamilton Dome property tax revenues provide 9 percent of the district's pest eradication budget and 29 percent of its mosquito control budget.
- Hot Springs County Rural Fire Protection District: Hamilton Dome property tax revenues fund 29 percent of the district's budget. Because the district is staffed by volunteers, a loss of that revenue would not reduce services, but would delay the purchase of needed equipment, supplies and training.
- Hot Springs County School District # 1: Over the past five years, Hamilton Dome property taxes for school-related funds averaged $1.4 million annually. Of that amount, $910,000 was for operational purposes and $188,000 for debt service. The Wyoming School Foundation Fund received an average of $325,000. The entitlement provisions of the state foundation program would offset any loss in Hamilton Dome property tax revenue on the operating budget. Based on the five-year average, the Wyoming School Foundation Fund would experience a net cost of $1.235 million from lost revenues and additional entitlement costs, assuming no change in enrollment levels. Reductions in the number of Hamilton Dome-related students would reduce School District #1's entitlement and revenue with little reduction in educational costs. Loss of the Hamilton Dome property tax revenues would increase the school debt service mill levy for other county taxpayers by 2.8 mills, based on the five-year average.

Severance Tax

Over the last two years, severance taxes on Hamilton Dome production have averaged $1.8 million annually.

Federal Mineral Royalties

Over the past two years, federal mineral royalty payments for Hamilton Dome production averaged $4.4 million. Wyoming's share of these royalties averaged an estimated $2.2 million annually.

Sales and Use Tax

In 2001, MEC estimates that it paid over $400,000 in sales and use taxes on purchase of goods and services for the Hamilton Dome field.

The Role of Hamilton Dome Produced Water in the Cottonwood Creek Ranching Economy

Approximately 35 Cottonwood Creek-area landowners benefit directly or indirectly from water discharged from the Hamilton Dome field into the creek. These landowners use the water for irrigation and stock watering purposes. Based on a survey of several of these landowners, the loss of Hamilton Dome discharges into Cottonwood Creek would result in a corresponding loss of:

- 1,600 acres of irrigated cropland,
- 4,000 tons of annual hay production,
- 15 to 20% reduction in herd size (about 3,200 cows) and a $2 million reduction in related sales receipts (based on $650 head) and,
- 20 full time and seasonal jobs in the ranching industry.

Additional losses would be likely for ranches not included in the survey. Several ranchers contacted for the survey expressed concern for the economic viability of their operations without the Hamilton Dome water.

The IMPLAN model was used to estimate the total economic losses in Hot Springs County, including the indirect and induced impacts on other sectors, associated with the direct reduction in annual livestock receipts. Those losses, which include a net reduction of $3.3 million (1.7%) in the county's total annual economic output, a loss of $645,000 in annual labor income, and a net loss of 32 full and part-time jobs, would be in addition to those impacts directly attributable to the cessation of Merit's Hamilton Dome production operations.

The Role of Hamilton Dome in the Wyoming Refining Industry

Hamilton Dome crude production represents about 3.3 percent of the of the daily feedstock supply needed to sustain Wyoming's five refineries at full production. However, Hamilton Dome supplies more than 20 percent of the crude necessary to sustain asphalt and road

oil production. The loss of this production coupled with the absence of an alternate supply could threaten the economic viability of one or more Wyoming refineries.

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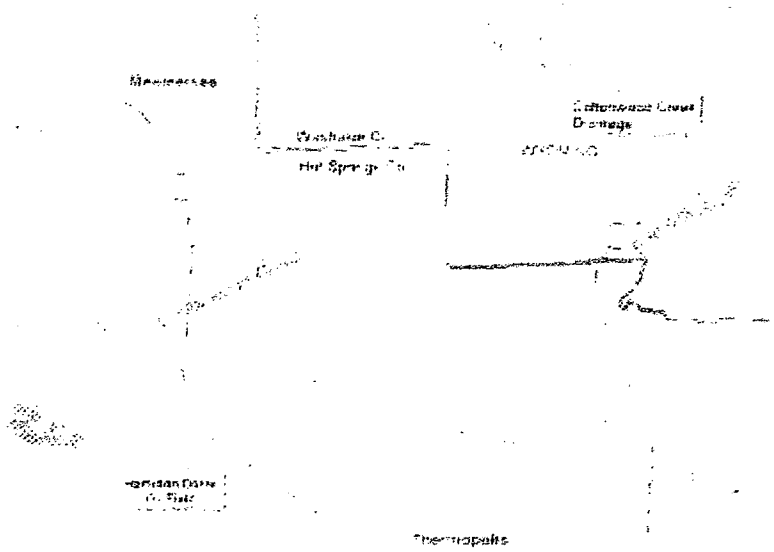
INTRODUCTION

The Hamilton Dome oil field, discovered in 1918, is located 25 miles northwest of the Town of Thermopolis in Hot Springs County, Wyoming. Through 2001, Hamilton Dome had produced 256 million barrels of oil and 1.59 billion cubic feet of natural gas (WOGCC 2001). Merit Energy Company (MEC), the operator of the field, anticipates 2002 production to total 4,250 barrels of oil per day (BOPD), primarily from the Tensleep and Phosphoria reservoirs; the field no longer produces marketable quantities of natural gas. Over the last five years, the Hamilton Dome Field has been on average the eighth most productive oil field in the State of Wyoming, averaging 42 percent of total Hot Springs County oil production and 2.7 percent of total statewide oil production. Oil produced from the field is sold and transported by pipeline to refineries in Wyoming and adjacent states.

Vicinity Map: Hamilton Dome Oilfield and Cottonwood Creek



Source: States West Water Resources Corporation

Also during 2002, Hamilton Dome is anticipated to produce 285,000 barrels of water per day (BWPD). An average of 85,000 BWPD is re-injected to enhance oil recovery. The remaining 200,000 BWPD is discharged from two separate points into unnamed tributaries that eventually flow into Cottonwood Creek (MEC 2002). Discharges of water produced from

Hamilton Dome into the Cottonwood Creek drainage have occurred since the early 1970's. Two NPDES permits, WY0000175 and WY0000680, authorize these discharges.

Cottonwood Creek flows generally eastward from its source in the Owl Creek Mountains at Cottonwood Peak in Township 45 North, Range102 West. It flows eastward 47 river miles into the Bighorn Basin to its confluence with the Bighorn River in Township 45 North, Range 94 West. Hamilton Dome discharges enter Cottonwood Creek at approximately river miles 12 and 19, measured from the upstream end (Jessen 2002).

Until recently, Cottonwood Creek and the tributaries receiving the Hamilton Dome discharge were classified by the Wyoming Department of Environmental Quality, Water Quality Division (WQD) as Class 4 streams. The water discharged from Hamilton Dome meets standards for Class 4 waters. The WQD recently updated Chapter 1 of the *Wyoming Water Quality Rules and Regulations* to comply with the federal Clean Water Act. As a result of this reclassification, Cottonwood Creek is now classified as 2C and the tributaries that receive Hamilton Dome discharges are classified as 3B. The Hamilton Dome discharges exceed Class 2C standards for several constituents including chloride and selenium.

In order to renew its discharge permits, MEC could be required to treat the Hamilton Dome discharge water to meet Class 2C standards. The company believes the financial impact of treating the discharge to meet Class 2C standards would result in closure of the field (Diem 2002). MEC is working with the Wyoming DEQ/WQD to either reclassify the stream or establish site-specific criteria allowing discharge of the produced water to continue without additional treatment. The company also believes that closure of the field prior to the full recovery of the available crude oil resources would trigger significant economic distress on the local economy. The following regional economic analysis has been prepared to examine those economic implications.

The objectives of this economic analysis are to describe the contributions of the Hamilton Dome oil field to the economies of Hot Springs County and the State of Wyoming, to the tax base of Hot Springs County and its relevant taxing entities, to the ranching economy along Cottonwood Creek, and to the Wyoming petroleum refining industry. The contributions described below are proxy measures of the adverse economic impacts that would result from the premature closure of the Hamilton Dome field. In other words, although the narrative typically discusses the economic contributions in positive or beneficial terms, these contributions are measures of what is "at-risk" from requiring compliance with the more stringent water quality standards, the anticipated result of which would be to halt production.

ECONOMIC CONTRIBUTIONS OF MERIT ENERGY COMPANY'S HAMILTON DOME OPERATIONS

On-going production of petroleum crude from the Hamilton Dome field is a source of significant economic stimulus for the Thermopolis and Hot Springs County economies. Moreover, the economic repercussions of that production extend to the broader statewide economy.

With respect to the local economy, the primary economic stimulus encompasses the company's direct payroll and its purchases of goods and services from oil field service companies, utilities and other suppliers and the consumer purchases of its employees. These direct economic infusions indirectly support yet other local businesses and jobs through what is known as the "economic multiplier effect." Finally, production and ad valorem taxes paid by the company, as well as taxes paid by its employees and the businesses and employees whose jobs are supported indirectly by the company's operation help support public education and governmental functions.

A second dimension of the field's economic stimulus derives from its linkages to local farming and ranching located along Cottonwood Creek. Oil production from the Hamilton Dome field yields a substantial quantity of water as a byproduct. Further production is supported by reinjecting a portion of that water into the oil-bearing formations. However, much of that water, about 6,700 acre-feet of water in 2001, discharges into the Cottonwood Creek drainage from where local ranchers subsequently use it for irrigation, stock watering and other agricultural purposes. That water is vital to helping sustain the local agricultural industry because of the region's semi-arid climate. The water also supports wildlife and wildlife habitat in the area.

Yet a third dimension of the field's economic significance is its role in supplying crucial feedstock for the Wyoming refining industry. More specifically, crude from the Hamilton Dome field is transported via pipelines to refineries in Casper and Sinclair, supplying a portion of the total feedstock for those facilities. That supply not only helps sustain the operating viability of those refineries and the economies of the respective communities, but the refined products supply fuel and asphalt to help support the state's economy and highway infrastructure.

Finally, the economic benefits associated with the Hamilton Dome field extend beyond the local communities. Economic linkages between local service firms and suppliers and wholesale and service firms located elsewhere in the state and the flows of consumer purchases to larger regional economies, result in a portion of the indirect and induced "multiplier" effects being captured elsewhere, such as in Cody, Riverton or Casper.

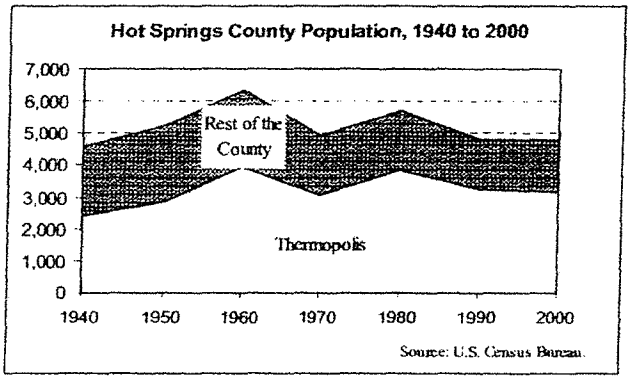
This section of the report examines each of those key economic linkages, quantifying their significance in terms of the numbers of jobs, labor income and annual economic output supported.

Local Setting

The Hamilton Dome field is located in Hot Springs County, Wyoming and is part of a broader region known as the Big Horn Basin. The field is 25 miles northwest of Thermopolis, the county seat and its largest community.

Hot Springs County covers an area of more than 2,000 square miles (1,294,080 acres). Approximately 30 percent of the land in the county is in private ownership. Various federal or state agencies manage the remaining lands or hold them in trust for the Eastern Shoshone and Northern Arapaho tribes as part of the Wind River Indian Reservation.

Hot Springs County is rural. Its population has fluctuated over time, primarily in response to energy and mineral exploration and development. Population peaked at 6,365 residents in 1960. By 1990, the county's population had declined to 4,809 with little population growth in the ensuing decade as the county registered a population of 4,882 residents in the 2000 census. Consequently, Hot Springs County ranked 22nd among Wyoming's 23 counties in terms of population in 2000.



Throughout its contemporary history, most of the county's residents have lived in Thermopolis. In 2000, Thermopolis had 3,172 residents compared to 1,710 residents in the outlying areas of the county.

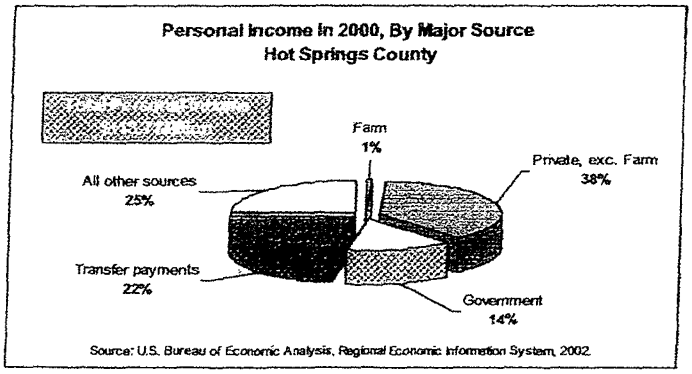
The economic mainstays of the county's economy include agriculture, energy and mineral production, and tourism/outdoor recreation. These "basic" industries generate much of the inflow of wealth into the economy through their sales of goods and services. In turn, the respending of business and employee incomes and local taxes support local retail trade, services and the local public sector. There is little manufacturing or regional wholesale trade activity based in Hot Springs County. Unlike the stagnation characterizing the county's recent population growth, total employment in Hot Springs County increased 334 jobs, nearly 12 percent, between 1990 and 2000 – see Table 1 below. Most of the increase was in the retail trade and services sectors.

TABLE 1
HOT SPRINGS COUNTY EMPLOYMENT, BY MAJOR CATEGORY

Category	1990	1995	2000
Farm	206	198	205
Oil, Gas & Mining	230	150	200
Other Private Sector	1,763	2,075	2,155
Government	614	557	587
Total	**2,813**	**2,980**	**3,147**

Source: U.S. Bureau of Economic Analysis, 2002.

Local retail trade and service businesses, as well as local government, gain additional support from consumer expenditures by the relatively large number of retirees living in the county. According to the 2000 census, more than one of every four local households depend on retirement, social security or some other form of government payments for their income. Income from such transfer payments accounted for 22 percent of the total personal income of $113.7 million in 2000. While such income serves an important function in supporting the local economy, it tends to be relatively fixed over time. When combined with the limited number of higher-paying jobs in the basic industries, this fact translates into comparatively low per capita income in Hot Springs County. In 2000, Hot Springs County ranked 15th among Wyoming counties with a per capita personal income of $23,393, nearly 15 percent below the statewide average of $27,372 per person.



Other major sources of income in Hot Springs County include labor earnings, income derived from dividends, interest and rent, and miscellaneous other income. Private sector earnings, excluding local farming and ranching operations but, including education, is the largest contributor to total income, paying more than $43.4 million to employees and owners in 2000 (38% of the total). That amount was nearly triple the aggregate government payroll of $15.7 million. Local farmers and ranchers had a combined income of $874,000 in 2000, less than 0.8 percent of the total. Dividends, rent and other non-earnings sources of revenue accounted for the remaining $28.2 million in personal income of local residents.

Merit Energy's Hamilton Dome Operations

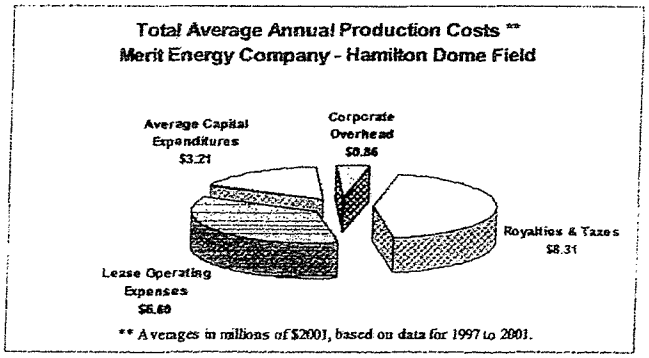
As described above, Merit Energy's primary economic stimulus arises from its production-related expenditures, including the consumer-related purchases of its employees, and its support of public education and government through the taxes it pays. Merit Energy's Hamilton Dome office is the operational base for eight oil fields in Wyoming's Big Horn Basin.

Presently, fifteen (15) of the employees in that office are directly associated with the Hamilton Dome field. Suspending production from the field prior to full recovery of the crude reserves would result in a premature loss of these jobs, their associated incomes and the business volume, jobs, incomes and state and local taxes supported indirectly by the company's operations. Those impacts would be significant.

An analysis of the company's operations, completed using a regional economic model, demonstrates the economic significance of Merit Energy's Hamilton Dome operation. The model uses actual production and operating data for the company for the five-year period, 1997 through 2001. The use of a multi-year data set to summarize the company's economic contributions compensates for much of the market induced year-to-year variability in operating and capital expenditures frequently associated with oil and gas production.

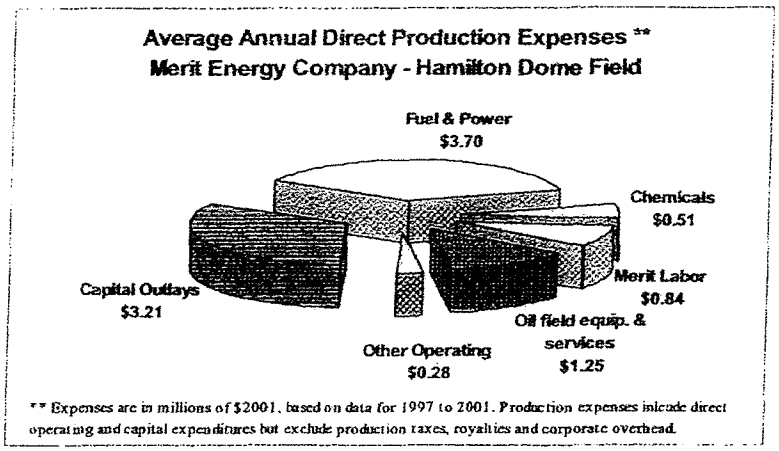
The economic analysis completed for this study, used cost of production data supplied by Merit Energy and the IMPLAN economic modeling software. IMPLAN (**IM**pact Analysis for **PLAN**ning) is an input-output based model originally developed to assist the U.S. Forest Service in land resource management planning. Subsequently, the model and related software were transferred into the private sector, where it is the subject of ongoing refinement and enhancements to provide the analytical capacity to address a broader range of economic and impact planning issues. IMPLAN is widely recognized and accepted in regional economic and economic impact assessment circles. Results of the analysis include direct and total jobs, income and output associated with the operation.

Merit's annual crude production from the Hamilton Dome field averaged 1.67 million barrels of over the past five years. Average annual total costs of production over that same period were $18.98 million ($2001). Royalties and taxes account for the single largest category of production costs, $8.31 million or 44 percent of the total. By comparison, the actual lease operating expenses, which include labor, chemical, equipment, etc., averaged $6.60 million annually -- the distribution of costs, by major category, are shown in the accompanying figure.



Of primary relevance to this analysis are the $9.81 million in lease operating and capital expenses made by Merit Energy in a typical year. These expenditures represent the day-to-day purchases of goods and services and payroll outlays to staff that cycle into and through the local and statewide economies, supporting other businesses, jobs for Wyoming residents, and taxes to support government. Fuel and power are the company's single largest production expense category, about $3.70 million annually. Other major categories include labor, replacement

equipment, chemicals, and capital outlays – see the figure below for the direct production expenses by major category.



In addition to the annual volume of purchases, another key determinant of Merit's economic contribution is the extent to which local suppliers provide goods and services. In that regard, Merit Energy actively strives to support local business. It estimates that almost 99 percent of all its annual purchases are from Wyoming businesses and the bulk of those, totaling more than $5.54 million annually, are from contractors and suppliers with an operational presence in Hot Springs County. Table 2 below presents the estimated distribution of Merit's annual operating and capital outlay expenses, by major industrial sector.

TABLE 2
AVERAGE ANNUAL DIRECT PRODUCTION EXPENSES
MERIT ENERGY COMPANY'S HAMILTON DOME FIELD ($2001)

Major Industrial Sector	Hot Springs County	Elsewhere In Wyoming	Total in Wyoming
Oil-field Services, incl. capital outlays	$ 3,365,100	$ 558,300	$ 3,923,400
Electrical Power	$ 167,100	$ 3,342,600	$ 3,509,700
Wholesale Trade	$ 1,125,700	$ 47,300	$ 1,173,000
Retail Trade	$ 6,900	$ 59,200	$ 66,100
Other Services	$ 117,200	$ 55,000	$ 172,200
Merit Energy Payroll	$ 760,100	$ 84,500	$ 844,600
TOTAL	**$ 5,542,100**	**$ 4,146,900**	**$ 9,689,000**

Source: Merit Energy Company, 2002.

Oil field services is the largest category of expenditures, and most of the company's annual outlays for such services are to local contractors. With no major electrical generating facilities in Hot Springs County, electrical power is the single largest production expense from outside the local economy.

Merit Energy currently has 15 employees assigned to the Hamilton Dome operations. However, the significant volume of oil field services and repairs the company contracts to others and its other purchases combine with the jobs supported by employee spending to generate a much higher overall employment impact. Based on the average annual operating expenses, the IMPLAN model estimates a total employment impact from Merit's Hamilton Dome field of 186 jobs statewide; 136 jobs in Hot Springs County and an additional 50 jobs elsewhere in Wyoming – see Table 3. The statewide estimate is exclusive of jobs supported by the expenditures of royalty payments and severance and sales taxes budgeted through the state. The total local jobs supported represents about 4% of total employment in Hot Springs County in 2000.

TABLE 3
PRIVATE SECTOR JOBS SUPPORTED IN WYOMING BY MERIT ENERGY COMPANY'S HAMILTON DOME FIELD

	In Hot Springs County	Elsewhere In Wyoming	Total Wyoming Jobs
Merit Energy	15	0	15
Oil-field services & suppliers	36	25	61
Other private sector	24	23	47
Government and Education	61	2	63
TOTAL	**136**	**50**	**186**

Note: The numbers of jobs supported were derived using IMPLAN, based on Merit Energy Company's average annual expenditures for 1997 through 2001.

The largest number of jobs supported is in local government and education (63 jobs). The strong support for these jobs stems from the company's substantial annual tax payments (these payments are discussed further in a later section.) [1]Another 61 jobs in the oil field service and supply industries followed by 47 jobs in wholesale and retail trade, services, construction and other private sector industries.

A corollary dimension of Merit's positive employment impacts is the beneficial impact on personal income. Over the past five years, Merit Energy Company's direct payroll has averaged about $844,000 annually, though it presently is at about $740,000 on an annual basis. The incomes supported by Merit's operations in government, education, oil field services and other industries magnify that direct impact. When summed across all industries, the estimated labor income impact in Hot Springs County totals $4.07 million annually, with another $2.54 million elsewhere in the state –see Table 4 on the following page. The total local labor income represents nearly 7% of the corresponding total labor income in Hot Springs County in 2000.

[1] The IMPLAN estimates of the number of jobs in education reflect the proportion of the district's total locally derived property taxes paid by Merit. In reality, increases in state school foundation funds would offset much of the loss of Merit's taxes, resulting in a more limited reduction in staffing. Consequently, though the IMPLAN estimates likely overstate Merit's actual employment impacts, they are representative of the company's fiscal support for education.

TABLE 4
ANNUAL LABOR INCOME SUPPORTED BY MERIT ENERGY COMPANY'S HAMILTON DOME FIELD (MILLIONS OF $2002)

	In Hot Springs County	Elsewhere In Wyoming	Total
Merit Energy Direct	$ 0.84	$ 0.00	$ 0.84
Oil-field services & suppliers	$ 1.13	$ 1.02	$ 2.15
Other private sector	$ 0.56	$ 1.46	$ 2.02
Government and education	$ 1.54	$ 0.06	$ 1.60
TOTAL	**$ 4.07**	**$ 2.54**	**$ 6.61**

Note: Estimated annual labor incomes were derived using the IMPLAN model and Merit Energy average annual expenditures for 1997 through 2001.

Another measure of the economic contributions of Merit Energy's Hamilton Dome operation is its impact on overall economic output. A conservative estimate of the total statewide impact is nearly $28.7 million annually, most of which occurs in Hot Springs County. The largest portion of the total is represented by Merit's operations, including contracted services – see Table 5 below. By way of comparison, the total estimated 1999 economic output of Hot Springs County was about $195 million. The estimate is conservative as it does not account for the output associated with subsequent rounds of government spending and investments supported by the royalty and production tax payments or that associated with the subsequent refining and consumption of refined petroleum products across Wyoming supported by Merit's Hamilton Dome production.

TABLE 5
ANNUAL STATEWIDE OUTPUT SUPPORTED BY MERIT ENERGY'S HAMILTON DOME FIELD (MILLIONS OF $2002)

Category	Annual Amount
Direct Production Expenses	$ 9.81
Corporate Overhead	$ 0.86
Royalties, Taxes and Gross Net Revenue	$ 13.59
Indirect and Induced Private Sector Output	$ 4.40
Total Annual Statewide Output	**$ 28.66**

Note: The output estimates were derived using IMPLAN and Merit Energy expenditure data for 1997 through 2001

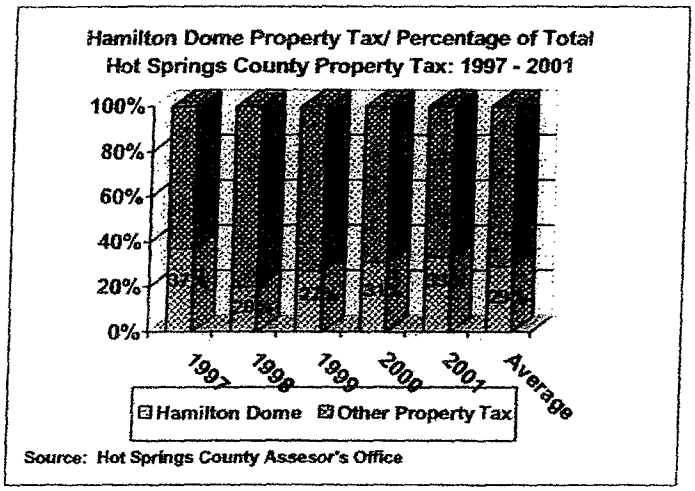
FISCAL CONTRIBUTIONS OF THE HAMILTON DOME OILFIELD

Wyoming oil producers pay ad valorem property taxes on production and on oilfield facilities, severance taxes on production, and sales and use taxes on some purchases of goods and services. Revenues from these taxes accrue to counties, school districts, and certain special districts, to the state general fund, and to a variety of other state funds and accounts. Additionally, the State of Wyoming receives half of the mineral royalties oil producers pay to the federal government and a portion of these revenues is distributed to local governments.

Ad Valorem Property Taxes

Oil producers pay property taxes on the assessed (taxable) value of production and oilfield facilities. Oil production is assessed at 100 percent of the fair market value (wellhead sales price) and facilities are assessed at 11.5 percent of fair market value (depreciated replacement value).

Property tax revenue from production and oil field facilities has accounted for two-thirds to three-quarters of the total property tax revenues received by county-wide taxing entities in Hot Springs County in recent years, (WTA 1997 - 2001). Crude oil production alone accounted for 73 percent of Hot Springs County assessed valuation in 2001 and has averaged 65 percent of total valuation between 1997 and 2001.



MEC is the largest taxpayer in Hot Springs County, and Merit's Hamilton Dome oil field is the county's largest single source of property tax. In 2001, Hamilton Dome accounted for 33 percent of total countywide property taxes paid in Hot Springs County ($2.7 million out of a total $8.3 million). Property tax revenue from Hamilton Dome production averaged 29 percent of total property tax revenue over the last five years ($1.9 million out of an average $6.6 million) (Deromedi 2002).

Property Tax Distribution

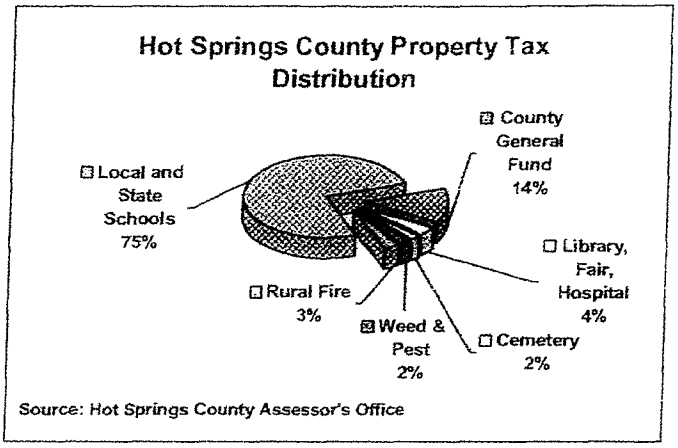
Schools receive the lion's share of property tax revenue in Wyoming. In Hot Springs County, an average of 75 percent of total countywide property tax revenue (including the state school

foundation program and the local school bond issue) has been distributed to schools over the last five years.

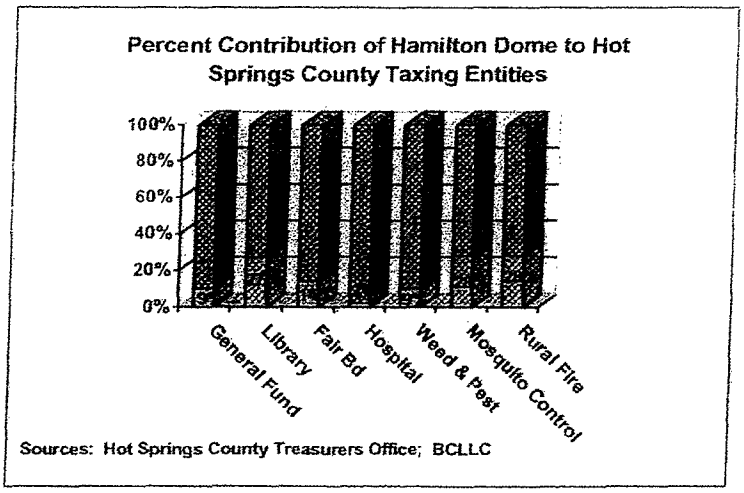
Hot Springs County General Fund

On a countywide basis, property tax revenues accrue to the Hot Springs County General Fund, and to the Library, County Fair and County Hospital funds. These entities are limited to a combined total levy of 12 mills, by state statute.

The county general fund provides revenues for all major county functions. Property tax revenues accounted for 40 percent of Hot Springs County general fund revenues during 2001[2], and averaged 37 percent of general fund revenues over the past four years[3] (Hot Springs County Treasurer's Office).



The relative importance of property tax revenue to the county general fund is greater than its percentage of total revenue however. Much of the county's non-property tax revenue is received from federal or state sources and is earmarked for specific programs or items. In Hot Springs County, property tax is the major source of revenue over which the commissioners exercise discretionary control. Consequently, any substantial reduction in property tax revenue will trigger reductions in basic county services because the commissioners cannot raise the mill levy above the 12-mill limit (Ford 2002).



Hamilton Dome property tax revenue accounted for 12 percent

[2] Total general fund revenues for 2001 were adjusted to account for an early federal PLT payment.
[3] County revenue data for 1997 were not readily available.

of total Hot Springs County General Fund revenue in 2001[4] ($356,000 out of a total $2.986 million), and averaged 9 percent of total revenues over the past four years ($241,000 out of average total $2.576 million).

Hot Springs County Library

The Hot Springs County Library receives property tax revenues from an average one-mill levy. Property tax revenues make up an estimated 95 percent of the library's budget (Bendlin 2002). Based on that estimate, Hamilton Dome property taxes have accounted for an average of 27 percent of the library's budget over the past five years ($27,000 out of an average total of $100,000). Because the library is included within the county 12-mill limit, a 27 percent reduction in revenues would result in a corresponding reduction in library services.

Hot Springs County Fair Board

The Hot Springs County Fair Board receives property tax revenues from a mill levy that has averaged six-tenths of one mill over the last five years. In 2002, property taxes received from a 0.79 mill levy will account for an estimated 52 percent of the fair board's total revenues (Smith 2002). Based on the 1997 through 2001 average property tax contributions, Hamilton Dome Property taxes would account for about 15 percent of the fair board's revenues ($16,000 out of an average total of $108,000).

Hot Springs County Memorial Hospital

The Hot Springs County memorial Hospital receives property tax revenues from a mill levy that has averaged nine-tenths of one mill over the last five years. Property tax accounts for an average of about 6 percent of the hospital's total revenues (Nading 2002) and Hamilton Dome property tax revenue accounts for an average of about 2 percent of the hospital's total revenues.

In addition to the entities identified above, whose property tax levies must fit under the 12-mill cap, other local government entities (districts) also collect property tax revenues. These entities include the Hot Springs County Weed and Pest District, the Hot Springs County Rural Fire Protection District, and Hot Springs County School District # 1.

Hot Springs County Weed and Pest District

The Hot Springs County Weed and Pest District receives property tax revenues from two separate one-mill levies. A statutory one-mill levy funds 30 percent of the district's weed and pest eradication program, the remainder is funded through payment for services. A one-mill special levy funds 100 percent of the district's mosquito control program (Smith 2002). Over the past five years, Hamilton Dome property tax revenues account for about 9 percent of the district's weed and pest eradication budget ($27,000 out of an average total of $312,000) and about 29 percent of the district's mosquito control budget[5] ($27,000 out of an average total of $94,000).

[4] Adjusted revenues as discussed in footnote #3.
[5] Based on 2002 budget

Hot Springs County Rural Fire Protection District

The Hot Springs County Rural Fire District receives property taxes from a mill levy that has averaged 2.2 mills over the past five years. The rural portion of the district relies totally on property taxes for funding its operations[6]. The department is staffed by volunteers. Property tax revenues are used to purchase equipment and supplies and to defray training costs. Hamilton Dome property taxes have funded an average of 29 percent of the rural fire district's budget over the past five years ($60,000 out of an average total $207,000). A reduction of 29 percent in total revenues would not result in a reduction of services, but it would mean that some needed equipment would not be purchased or replaced in a timely manner (Taylor, 2002).

Hot Springs County School District # 1

Hot Springs County School District # 1 receives property tax revenues from three different mill levies: a 26.5 mill special school levy, a 6 mill mandatory school levy, and a school levy to fund debt service on a bond issue. The latter has averaged 7.4 mills over the past five years. Property tax revenues from the special school and mandatory levies fund school district operations, and have comprised between 44 to 55 percent of the district's total operating budget in recent years (Cady 2002). The district also receives entitlement payments from the Wyoming school foundation fund. Revenues from the debt service levy go toward retiring a school bond issued for facilities construction. The bonds are scheduled to be retired in 2010.

Revenues from a 12-mill levy are distributed to the Wyoming School Foundation Fund. The foundation program guarantees a minimum level of funding, known as entitlement, for all public school students in Wyoming. School districts that cannot raise the specified amount from local resources receive payments from the school foundation fund to make up the difference. School districts whose local property tax base yields revenues substantially above the specified amount are subject to recapture, and the excess funds are paid to the state foundation account by the district. In general, reductions in Hot Springs County School District #1 property tax revenues from the special district and mandatory school levies would be made up by payments to the district from the school foundation fund.

If the Hamilton Dome field were to cease production, the Wyoming School Foundation fund would lose the revenue associated with the Hamilton Dome field, which have averaged $325,000 annually over the past five years. Additionally, the state foundation fund would have to increase entitlement payments to makeup for the loss of Hamilton Dome-related revenues from the 26.5 mill special school levy and the 6-mill mandatory school levy. Combined revenue from these levies has averaged $910,000 over the past five years. Therefore, the annual net cost to the Wyoming School foundation fund would total $1.235 million, based on the five-year average.

Because the school district's entitlement is based in large part on attendance, the district would lose revenue if Hamilton Dome employees moved out of Hot Springs County. The reduction in enrollment would likely be spread across a number of grades and schools; therefore,

[6] The district also provides coverage within the municipal areas, which is funded by contract, and on occasion receives grants to purchase equipment.

the loss in revenues would not be accompanied by a corresponding reduction in costs. If District # 1 were to lose enrollment, the net cost to the state foundation program would decrease.

The Hot Springs School Bond levy is funded 100 percent by property tax. Over the past five years, the school bond levy would have been an average of 2.8 mills higher without Hamilton Dome property tax revenues.

Wyoming Severance Tax

Wyoming oil producers pay a 6 percent severance tax[7] on oil produced in the state. In 2000, the Hamilton Dome field generated about $2.1 million in severance tax revenues. In 2001, severance tax revenues from the field totaled about $1.6 million[8]. These payments represent about 4 and 2 percent of total oil severance taxes for those years, respectively, and 0.08 and 0.04 percent of total severance tax payments.

Severance tax proceeds are distributed to the Mineral Trust Fund, Leaking Underground Storage Tank (LUST) account, the State General Fund, Water Development funds (I and II), Highway Fund, counties, county roads, cities and towns, capital construction, Budget Reserve Account.

Royalty Payments

Oil produced from the Hamilton Dome field generated about $5.1 million in federal mineral royalties in 2000, and about $3.7 million in 2001. The federal government distributes 50 percent of federal mineral royalties to the state where the minerals were produced. Hamilton Dome federal mineral royalty revenues to the State of Wyoming totaled $2.55 million in 2000 and $1.85 million in 2001.

In Wyoming, Federal Mineral Royalties are distributed to many different entities and funds. These include the University of Wyoming, the Wyoming School Foundation Fund, the Highway Fund, the Highway Fund for County Roads, and local municipal entities. Funds are also provided to special district and school districts for capital construction, state aid to county roads, Legislative Impact Royalty Account, community colleges, transportation enterprise account, general fund administrative account and others.

In 2000, federal mineral royalties generated by Hamilton Dome accounted for an estimated 1.7 percent of all federal mineral royalties to the state[9], in 2001, Hamilton Dome's contribution was about 0.8 percent of total.

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[7] Between 1/99 and 11/99 the severance tax rate was 4 percent. Severance tax rates are less for stripper oil, oil recovered from tertiary methods, new wells, incremental oil from workovers and completions and renewed production.

[8] Prior to 2000, Hamilton Dome was partially owned by another company, therefore total severance tax payments are not available for prior years.

[9] Including coal lease bonuses.

Sales and Use Tax

In Wyoming, sales and use taxes are levied on gross receipts from sales of tangible personal property and selected services including receipts from public utilities. The state levies a 4 percent sales and use tax; 28 percent of the revenues from this tax (less administrative costs) is distributed to the county and incorporated municipalities in the county of origin, according to a population-based formula. Hot Springs County also levies a 1- percent general revenue sales and use tax; proceeds from this tax are distributed to the county and its incorporated municipalities in the same manner as the local portion of the state tax.

It is conservatively estimated that MEC paid $400,000 in sales and use taxes on purchases of goods used in the Hamilton Dome field during 2001 (Kobielusz 2002). This is about 12 percent of all sales and use taxes collected in Hot Springs County during fiscal year 2001. However, because some vendors may have reported sales and use tax collections in their home counties, it is likely that not all of the local share of these revenues were distributed to Hot Springs county and its incorporated municipalities.

ECONOMIC LINKAGES BETWEEN THE HAMILTON DOME OILFIELD AND HOT SPRINGS COUNTY AGRICULTURE

As across most of Wyoming, farming and ranching in Hot Springs County is a way of life and a mainstay of the local economy. Though constrained by the limited amount of land in private ownership, an arid climate, and the difficult economic market conditions affecting livestock and commodity producers, the county's agriculture sector supports the economic livelihood of many Hot Springs county households.

Every five years the U.S. Census Bureau conducts a census of the nation's agriculture industry. Conducted at the end of those years ending with the number "2" and "7", the census compiles and reports data on production, size and other operating parameters for all farms and ranchers. According to the 1997 census, results of which were published in 1999, a total of 147 farms and ranches operated in Hot Springs County.

The census provides additional insights into these operations and the individuals and families who operate them. In terms of size, 64 of the 147 local farming and ranching operations are small, less than 180 acres. Another 42 are between 180 and 999 acres in size, with 41 operating on 1,000 or more acres. Farming and ranching is the principal occupation of the operator in 85 of 147 cases, while 62 operators are part-time or hobby operators with a principal occupation other than farming.

In terms of tenure or ownership, most of the farms and ranches are family owned and operated; 99 of the farms and ranches are operated by full owners, with another 44 operated by part owners. Among the operators, 38 reported operating the present farm for less than 5 years, compared t 62 operators who had been on the present farm 10 years or longer.

Most of the local agricultural operations engage in cattle ranching, with 17 raising sheep. In 1997, Hot Springs county farmers and ranchers reported a total inventory of 33,279 head of cattle, with sales of another 15,849 head during the previous year. Nearly a third of the total operations are farms engaged primarily in growing alfalfa, barley and other crops.

Local farmers and ranchers reported an aggregate total of 944,205 acres of land in use as part of their operations. The total includes land nearly 899,000 acres of private land and state and federal lands covered by grazing allotments used as pastureland or grazing range. Only about 38,000 acres of the total is irrigated, half of which is pastureland and the other half is cropland. Hay used for winter feed is the predominant crop raised in Hot Spring County. In 1997, more than 30,000 tons of hay was grown on just over 17,300 acres. Because these irrigated lands provide vital winter and spring range and winter-feed for the cattle and sheep herds, they are vitally important to the economic viability of the local agriculture industry.

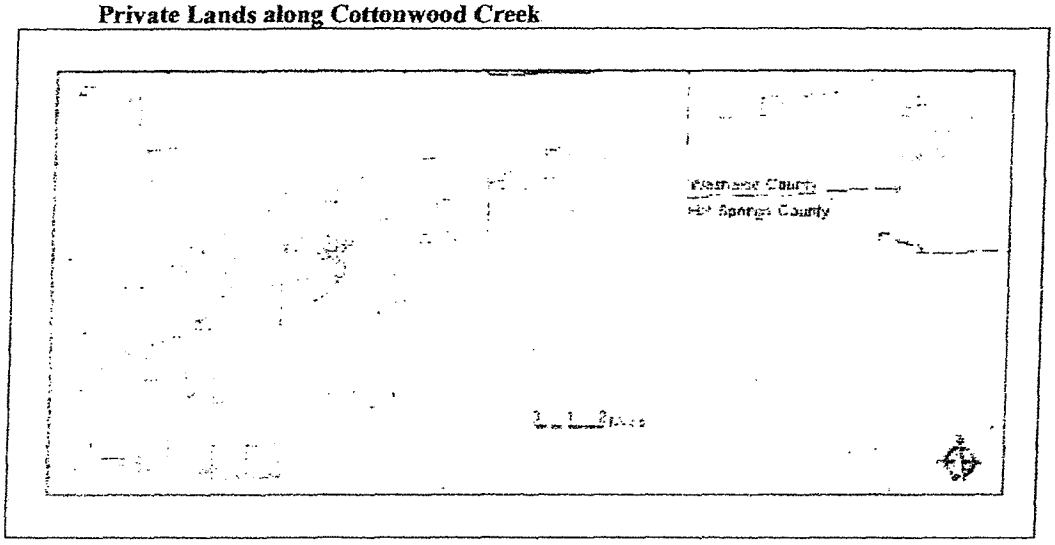
The combined marketing receipts from livestock and commodity sales totaled $9.6 million in 1997, an average of about $65,000 per operation. Of the total, $8.6 million was derived from livestock sales compared to $1.0 million from crop sales. However, operators incurred $7.6 million in production expenses to produce those sales. The major expenses included livestock, feed, fuel, hired labor, interest on loans, rent and property taxes. When these

expenses were combined with other costs, they left a residual net cash return of about $1.5 million, or an average of only about $10,200 per operation.

Cottonwood Creek

Approximately 35 landowners have property on or near Cottonwood creek. Virtually all of these landowners benefit directly or indirectly from the water discharged from the Hamilton Dome field. Three ranches immediately adjacent Hamilton Dome have rights to the discharged water, which is used for irrigation and stock watering. Water unused by these ranches flows down Cottonwood Creek and is used by landowners who have rights to Cottonwood Creek water, again for irrigation and stock watering.

Private Lands along Cottonwood Creek



Source: States West Water Resources Corporation

The indirect benefits of the Hamilton Dome water are substantial. Cottonwood Creek is known to have an intermittent flow above the Hamilton Dome discharge points. Natural flow along the creek is strongest in spring and early summer, diminishing to a trickle in mid-summer and in some years, disappearing altogether during late summer and fall.

Because the Hamilton Dome discharge provides a year-round flow, the water table along Cottonwood Creek is continually saturated and the resultant riparian growth stabilizes the streambed. This means that runoff into Cottonwood Creek from snowmelt and rainfall does not have to recharge the water table; virtually the full flow from these events is available for water users along the creek. Likewise, the stabilized streambed reduces siltation of the stream, resulting in more usable water during spring snowmelt and rainstorms.

Another important benefit of the Hamilton Dome discharge is that the temperature and constant volume minimizes icing of Cottonwood Creek in winter, particularly in the upper reaches. This allows year-round stock watering from the creek, enhancing its value for ranchers.

Although it varies from parcel to parcel, it is likely that more than two thirds of the crop production on irrigated land along Cottonwood Creek is made possible by the availability of water discharged from Hamilton Dome. Most of the irrigated land along the creek is used to irrigate pastures and produce an alfalfa/hay/grass crop, which is used as winter feed for cattle that are grazed on BLM grazing allotments during summer. This ability to graze livestock on leased rangeland during summer, pasture livestock on deeded land along Cottonwood Creek during winter, feed them on hay grown using Hamilton Dome discharge and water them from creek water kept running and open because of Hamilton Dome is key to the continued economic viability of many of the ranches along the creek.

Owners of several of the larger ranching operators along Cottonwood Creek were contacted to discuss the potential impact of curtailed water discharges on their operations. Collectively, these ranchers produce hay on approximately 2,250 acres of irrigated cropland, which in turn supports about 4,650 cows. These estimates reflect "normal" conditions, not the drought conditions that currently exist. In addition, they also create 29 full-time and seasonal jobs for ranch hands. On average, these ranchers estimated that 70% of their annual hay production was dependent on Hamilton Dome water. Prematurely cutting off the water flows would force the ranchers to cut back their herds and reduce the amount of hired labor they use.

For the purposes of this analysis, the loss of Hamilton Dome water is assumed to have a direct, proportional impact on the annual hay and beef production and use of hired labor for these operations. The estimated direct impacts under such a scenario are as follows:

- 1,600 acres converted from irrigated cropland to pasture or non-irrigated cropland
- 4,000 tons less of hay per year (@ net reduction of 2.5 tons per acre)
- A combined herd reduction of 3,200 cows
- An annual reduction of $2,000,000 in livestock sales receipts (@ $650 per head)
- A loss of 20 full-time and seasonal jobs in the ranching industry

Additional losses would be likely for ranches not included in the survey

The IMPLAN model was used to estimate the total economic losses in Hot Springs County, including the indirect and induced impacts on other sectors, associated with the direct reduction in annual livestock receipts. Those losses, which include a net reduction of $3.3 million (1.7%) in the county's total annual economic output, a loss of $645,000 in annual labor income, and a net loss of 32 full and part-time jobs, would be in addition to those impacts directly attributable to the cessation of Merit's Hamilton Dome production operations.

A further economic effect of the loss of produced water from the Hamilton Dome field would be a reduction in value of the agricultural property along Cottonwood Creek; the value of non-irrigated land is substantially less than the value of irrigated land.

THE SIGNIFICANCE OF HAMILTON DOME PRODUCTION TO WYOMING'S REFINING INDUSTRY

Wyoming is home to five operating petroleum refineries. With a combined daily average refining capacity of 140,386 barrels per day, Wyoming's refineries represent approximately 5% of the nation's domestic petroleum refining capacity. The refineries, their respective operators, location and daily distillation capacity are listed in the following table.

TABLE 6
WYOMING PETROLEUM REFINERIES, JANUARY 2001

Refiner	Location	Daily Capacity (barrels per day)
Frontier Refining Inc.	Cheyenne	38,670
Little America Refining Co.	Evansville	24,500
Silver Eagle Refining	Evanston	3,000
Sinclair Oil Corporation	Sinclair	62,000
Wyoming Refining Co.	Newcastle	12,216
STATEWIDE TOTAL		140,386

Source: U.S. Dept. of Energy, Energy Information Administration, 2001.

In 1997, the refining industry produced more than $1.2 billion in output, accounting for about 40 percent of the total statewide manufacturing output. Direct employment at the refineries totaled more than 700 jobs in 1997, those jobs averaging about $50,000 in wages and salaries to yield a combined annual payroll of over $35 million. Many more jobs and additional payrolls were indirectly supported in the pipeline, trucking and other related industries, as well as through consumer expenditures by the households directly and indirectly employed by the industry.

Crude oil from the Hamilton Dome field plays an important role in supporting the state's refining industry. Hamilton Dome crude is transported via pipeline to one of the in-state refineries via pipeline. Production presently averages about 4,600 barrels per day from the Hamilton Dome field. That production represents about 3.3% of the daily feedstock supply needed to sustain the in-state refineries at full production. In reality, Hamilton Dome's production is especially critical because the oil produced from Hamilton Dome is asphaltic crude, the primary source of asphalt and road oil.

Asphalt is a crucial component of highway construction and maintenance, airport runways and aprons and parking lots. As such, it is vital to sustaining Wyoming's economic health and that of surrounding states through its ties to the construction industry and by providing safe, efficient and reliable transportation capacity for residents, commercial traffic and tourists visiting the state. Furthermore, though accounting for only about 2% of the nation's asphalt and road oil refining capacity, asphalt and road oil production in the state has accounted for almost 10% of the nation's production in recent years.

Having a "local" supply of asphaltic crude is, therefore, important to the economic viability of the in-state refining industry. It helps minimize transportation costs and is vital to maintaining the overall operating efficiency and, hence, the cost competitiveness of the existing

refineries. Without the supply from Hamilton Dome crude, the economic viability of one or more of the refineries could be threatened.

Such a situation arises because petroleum refineries are not standardized industrial facilities, each able to process the same types of feedstock or produce the same outputs. Rather, refineries are built to different specifications with respect to inputs and outputs. The differences are manifest in the production capacity of different production streams.

Across the nation, the asphalt and road oil production capacity accounts for approximately 5.2% of the total refining capacity. In Wyoming, such capacity represents more than 13% of the total statewide refining capacity and 15% when adjusted to reflect the capacity of the three refineries that produce asphalt. Hamilton Dome supplies more than 20% of the crude needed to sustain those operations. While the prospect of eliminating the Hamilton Dome production might appear of limited consequence, the loss of that supply, coupled with uncertainty regarding the availability and costs of alternative supplies, could adversely affect the operating economics and profitability sufficiently to curtail asphalt production or even undermine the long-term economic viability of one of more Wyoming refineries. Such an event would trigger substantial job and income losses in the affected community and significant negative fiscal impacts for the affected local governments and school districts. Increased reliance on out-of-state supplies risks higher costs and increased potential for delays or disruption of deliveries, both of which have broad economic implications for the state.

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Rec'd 1-17-07

Animal Risk of Produced Water Surface Discharges in Wyoming

Penny Hunter
Geomega

January 17, 2007

The issue: are current effluent limits protective of wildlife and livestock?

	Barium (mg/L)	Sulfate (mg/L)	TDS (mg/L)
Current Limit:	None	3,000	5,000
Proposed Limit:	0.2	500	2,000

Note: Sulfate is a component of TDS but is addressed by a separate regulatory limit. CBNG water is typically sodium-chloride or sodium-bicarbonate dominated. Therefore, discussion of TDS components is exclusive of sulfate.

Petitioners' Reasons:

- **Petitioners claim that current EL are not "protective of stock and wildlife"**
- Support for barium @ 0.2 mg/L:
  - Utah Ext. Bull. → refs don't check out for 0.2 mg/L
  - CSU Ag. Ext. → revised its guidelines, none for Ba
- Support for sulfate @ 500 mg/L:
  - Kober 1993 → recommends < 4,500 mg/L
- Support for TDS @ 2,000 mg/L:

  All references support a 5,000 mg/L limit except SD Ag Ext. (2002), which focuses on sulfate-dominated water (recommendation: up to 3,000 mg/L "safe")

⟹ **Conclusion: petitioners' statements are not supported by references provided.**

What are the risks of TDS, Sulfate, Ba?

Lines of evidence:

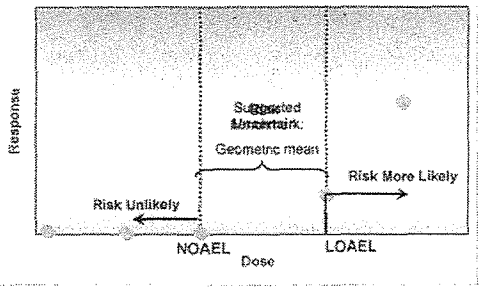
1. Other published guidelines
2. Literature-based toxicity studies
3. Ranchers' and other Wyoming resident experiences

Existing peer reviewed guidelines

- Barium:
  - 5 – 300 mg/L livestock WQ guideline (Canada)
  - 20 - 100 ppm livestock (NRC 1980, 2005)
- Sulfate:
  - 1,000 – 3,000 mg/L livestock WQ (Canada)
  - 2,500 mg/L feedlotted cattle (NRC 2005)
- TDS:
  - 5,000 – 15,000 mg/L livestock (EPA 1976)
  - 5,000 mg/L livestock (NRC 1974)

→ **Existing guidelines are supportive of current limits, but do not support proposed changes to limits.**

Toxicity Studies



Toxicity Studies

	Nonruminant mammal (rodent)	Ruminant (growing heifer)	Ruminant (adult steer)	Waterfowl (mallard)
Barium (mg/L)*	100	13	N/A**	360
Sulfate (mg/L)	5,070*	5,100	3,010	4,590
TDS (mg/L)	7,460	7,800	N/A**	5,680

*Lowest concentration derived for each receptor shown

**N/A. Not applicable. No toxicity studies exist for this type of receptor

Ranchers' experiences

Why is it important?

- Wyoming conditions differ from toxicity studies
  - Johnson and Patterson (2004)
- Adaptation / inc'd tolerance can occur w/o long-term adverse effects
  - NRC (1974), Spafford (1941), Ballantyne (1957)
- Toxicity study limitations (NOAEL vs LOAEL)

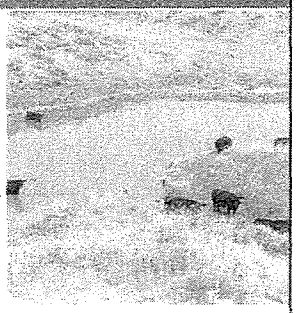
→ Ranchers in Bighorn and Powder River basins weigh in

Thanks to: Flatners, McCarty, Patterson, Shepperson, Schlaf, Mikie, and others

Ranchers' experiences

Thanks to: Fitners, McCarty, Patterson, Shepperson, Schlaf, Mikla, and others

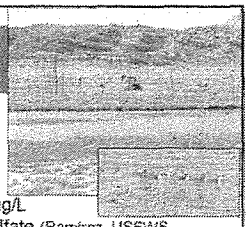
- No adverse effects on livestock (cattle, sheep, horses) that drank water containing:
  - Sulfates ≤ 3,100 mg/L
  - TDS ≤ 5,390 mg/L
- Adverse effects apparent when exposed to:
  - Sulfates ≥ 4,000 mg/L
  - TDS ≥ 7,000 mg/L



Rancher's experiences

- Fitners: 7-year weaning rate averages as good or better on land w/ produced water (2,700 mg/L SO4, 5,000 mg/L TDS)
- Mr. McCarty: No adverse effects on land w/ produced water (3.100 SO4; 5,390 TDS); body condition, mortality, weaning rates/weights, breeding rate
- Meike, Schlaf, Shepperson: No adverse effects
- Letters- Garland, Grabbert, Mantle, Pattison, Shultz, Wilsons, Baird, McCarty, F.O.A.L, etc.

Wildlife Effects



- Loch Katrine
  No adverse effects on wildlife at Loch Katrine from produced water contributions of 5,000 mg/L TDS and 2,050 mg/L sulfate (Ramirez, USFWS 2002)
- Ranchers' observations
  Wildlife observed utilizing produced water sources in greater densities than natural sources, without adverse effects.

➡ **Experiences in the field are supportive of current limits, but do not support proposed changes to limits.**

Recommended water quality benchmark

Benchmark/Limit	Barium mg/L	Sulfate mg/L	TDS mg/L
Recommended benchmark:	13	3,010	5,600
Current effluent limit:	None	3,000	5,000
Petition proposed limit:	0.2	500	2,000

Social and economic value of produced water surface discharge

- Letters of beneficial use by Wyoming residents
  - Cattle, sheep herds largely maintained by produced water sources in areas of Bighorn and Powder River basins;
  - Increased capacity for irrigated crop and pasturelands attributed to produced water sources;
  - Wild horse populations supported in Bighorn basin (F.O.A.L).
- Use attainability analyses[1]
  - Salt Creek discharges support >4,600 head of cattle and 3,300 head of sheep;
  - Cottonwood Creek discharges support 2/3rds of all crop production in the area;
  - Wildlife: game species abundant in discharge areas -- supports tourism;
  - Loch Katrine enhanced by produced water supports sensitive/threatened species.

1 Gene R. Gerrain 2003, RETEC 2004, SYWRC et al. 2002

Effects of eliminated produced water surface-discharge

- Cottonwood Creek: 15 – 20% loss of cattle ($2 million)
- Dry Creek: 30 – 50% loss of cattle (~$0.6 million)
- Salt Creek: 20 – 40% loss of cattle ($0.6 – 1.1 million)
- Hot Springs County – loss of cattle results in:
  - $3.3 million total economic output,
  - $645,000 annual labor income
  - 8% loss of pasture
- Additional costs to ranchers to develop alt water sources
- Lost revenue from tourism, hunting, fishing
- Lost access to federal funding for Loch Katrine

Effects of eliminated produced water surface-discharge

Effects of reduced exploration and development:

- Lost tax and export revenue to counties
  - Hot Springs County (Hamilton Dome) = $28.7 million (1997 dollars);
  - Natrona County (S. Casper Creek) = $3 million (2002 dollars).
- Lost jobs
  - Hot Springs (Hamilton Dome) = 136 jobs, $4.1 million annual labor;
  - Natrona & Johnson counties (Salt Creek fields) = $4.6 million ann. labor.
- Lost contributions to social programs
  - Hot Springs (Hamilton Dome) = $1.4 million for schools, etc
  - Natrona & Johnson counties (Salt Creek fields) = $2.9 million property and severance tax.

Study Conclusion:

Geomega's analysis shows that current WDEQ effluent limits pose no measurable adverse effect to the health and well-being of domestic livestock and wildlife, and there would be no incremental reduction in wildlife or livestock injury if limits were changed to the petitioners' requested limits. In addition, associated social and economic impacts of reduced water discharges and/or reduced exploration and development would be harmful to Wyoming residents.

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Rec'd 1-17-07

Rob Harlan

Effects from the PRBRC's Proposed Effluent Limits for Barium, Sulfate, and TDS

EQC PRBRC Petition Hearing
1/17/07

CBM Associates, Inc.

OBJECTIVE

- Contrast the current limits for total recoverable barium (Ba) 2000 ug/l, dissolved sulfate (SO_4) 3,000 mg/l; and, TDS (5,000 mg/l), against those proposed in the PRBRC petition: Ba = 200 ug/l; SO_4 = 500 mg/l; and, TDS = 2,000 mg/l; and
- Evaluate potential effects on oil and gas production and the availability of water due to the more restrictive proposed standards.

Data Sources

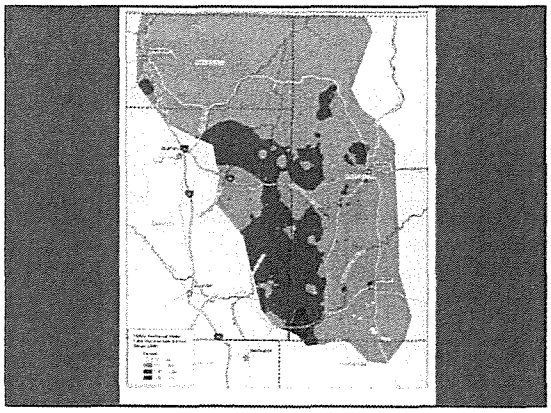
The produced water data used for CBNG production was the average of the reported values for the constituents of concern in Powder River Basin (PRB) WYPDES DMRs for the period of 1999 to 2006.

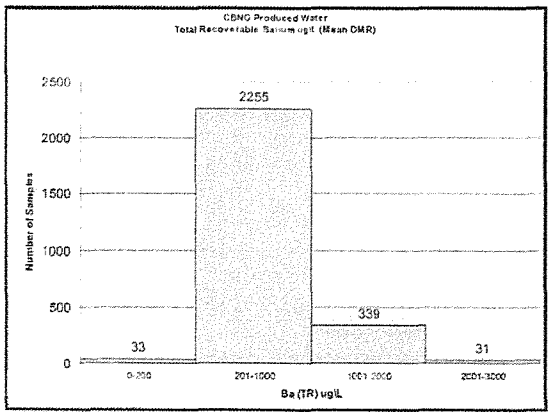
The Conventional Oil & Gas produced water data was the average of the reported values for the constituents of concern from all WYPDES DMRs for the period of 2001 to 2006 and other studies from 2003 to 2006.

Barium: CBNG Produced Water

An examination of the CBNG produced water from WYPDES DMRs for 2658 individual outfalls indicates that 99% (2625) outfalls had mean concentrations of total recoverable Ba that would exceed the proposed standard of 200 ug/l.

Under the current standard of 2000 ug/l, less than 1% of the outfalls exceed. Therefore, under the proposed effluent limit, virtually all CBNG production in the PRB would require treatment, injection, or shut-in due to barium limits.





Barium: CBNG Produced Water

Treating barium to the proposed limit at each outfall would require an individual ion exchange system similar to those currently used to treat CBNG. Conservative cost for such treatment currently ranges from $.35 to $.60 /BW (WOGCC: 2006 PRB CBNG produced water)

The conservative cumulative cost to treat PRB CBNG produced water for barium alone range from $147 to $252 million/year under the proposed standard.

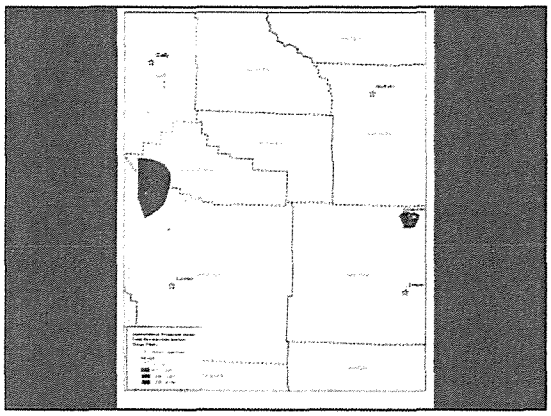
Barium: CBNG Produced Water

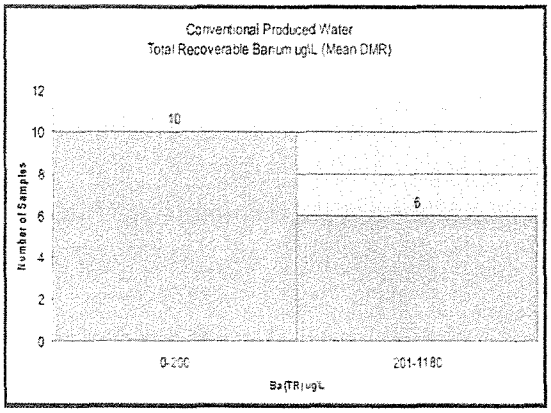
Barium treatment alone would result in an estimated cost increase that ranges from $.63 to $1.08/MCF of CBNG gas produced (WOGCC: 2006 PRB CBNG production).

This will make many producing CBNG wells and reserves uneconomic.

Barium: Conventional Oil & Gas Produced Water

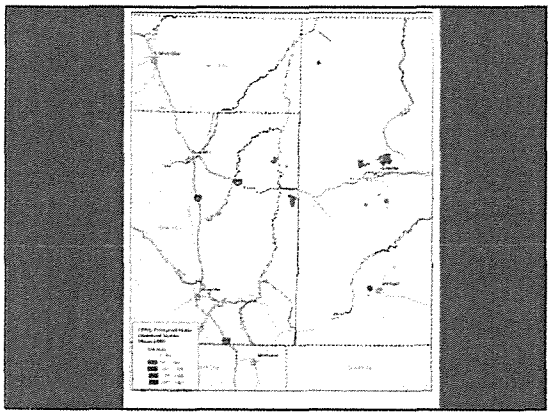
An examination of the available Ba sample data from Conventional Oil & Gas produced water from WYPDES DMRs for 16 individual outfalls indicates that 38% of all outfalls examined showed mean concentrations of total recoverable Ba that exceed the proposed limit of 200 ug/l.

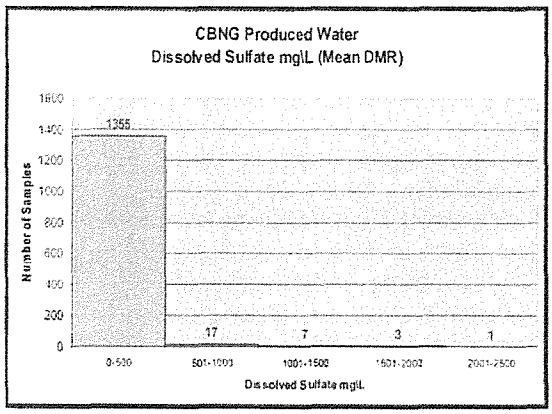




Sulfates: CBNG Produced Water

An examination of the CBNG produced water from WYPDES DMRs for 1383 outfalls indicates that 2% (28) of the currently operating outfalls would not comply under the proposed dissolved sulfate limit of 500 mg/l.

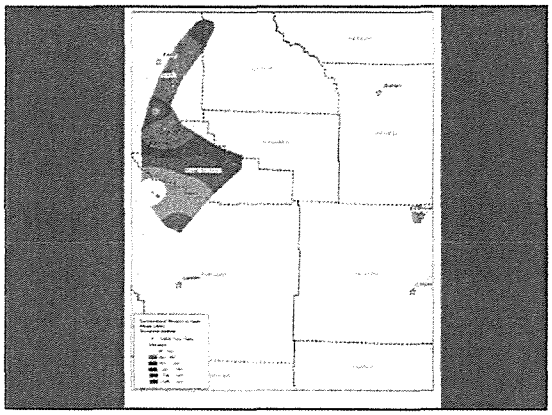


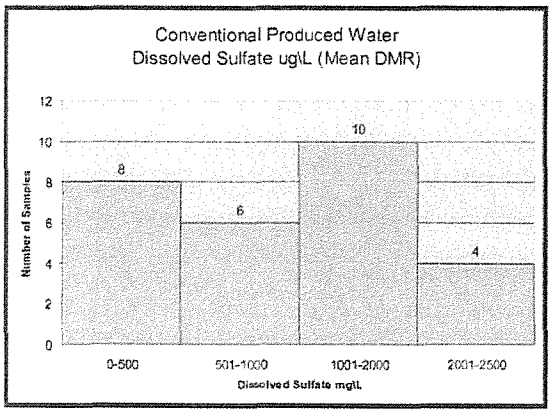


Sulfates: Conventional Oil & Gas Produced Water

Nearly 71% of conventional produced water would not meet the proposed dissolved sulfate limit of 500 mg/l. (WYPDES DMRs indicated 20 out of 28 outfalls would exceed the proposed 500 mg/l limit for SO_4)

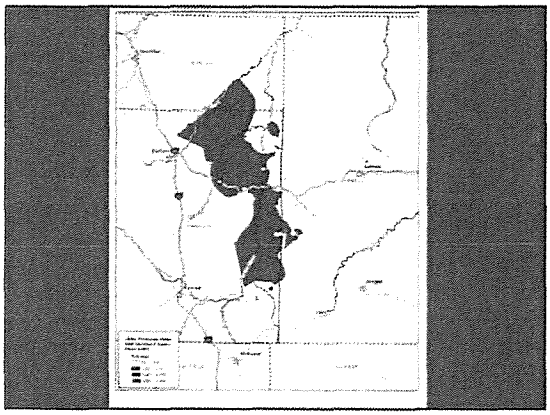
The imposition of the proposed limits would require treatment or reinjection, rendering the majority of the current oil production uneconomic.

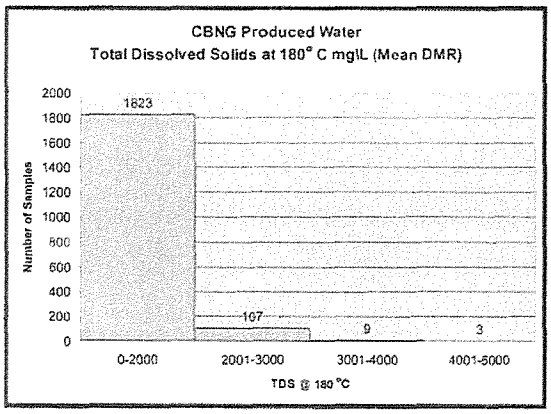




TDS: CBNG Produced Water

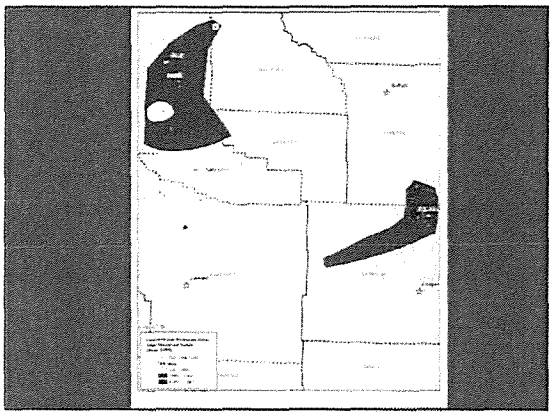
An examination of the CBNG produced water from WYPDES DMRs for 1042 outfalls indicates that 99% of the currently operating outfalls produce effluent with TDS concentrations below the proposed 10,000 mg/L limit.

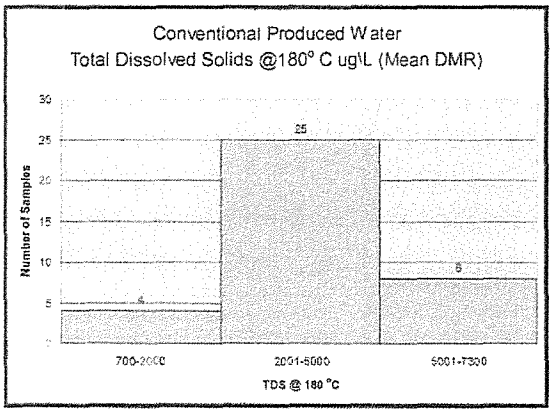




TDS: Conventional Oil & Gas Produced Water

- An examination of the Conventional Oil & Gas produced water from available WYPDES DMRs for 37 outfalls indicates that 89% of the currently operating outfalls would not comply under the proposed TDS limit of 2000 mg/l.





Questions EQC Needs to Answer

What is the risk of harm to livestock and wildlife from produced water under the existing limits?

- Where is *credible* evidence that the existing limits are not protective of livestock or wildlife?

What is the risk of harm to livestock and wildlife if produced water is removed from the State's water supply?

- The EQC needs to determine if there is measurable benefit to livestock or wildlife from a reduction of produced water.
- The loss of the beneficial use of the produced water and the habitat it provides is significant to both ranchers and sportsmen in the State of Wyoming.

Questions EQC Needs to Answer

Where is the credible evidence of measurable benefits to livestock and wildlife from the proposed limits?

Are the losses of produced water to existing livestock and wildlife uses, and the loss of oil and gas reserves, offset and justified by a credible measurable benefit from adopting the new limits?

Recommendations

End of Presentation

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Re: Effluent Limitations Proposed In PRBRC Petition For Rulemaking, Chapter 2, Appendix H

Dear Members of the Environmental Quality Council:

The Petroleum Association of Wyoming (PAW) would like to take this opportunity to submit comments, on behalf of members of the oil and gas Industry, on the proposed Chapter 2, Appendix H rulemaking presented by the Powder River Basin Resource Council ("PRBRC" or "the Petitioners"). Specifically, PAW objects to the Petitioners' proposed effluent limitations for Barium, total dissolved solids (TDS) and sulfates. Petitioners' request that existing effluent limitations be revised purportedly to "more protective" levels simply is not supported by the weight of scientific evidence and on-the-ground practices in Wyoming.

PAW hereby submits these comments and the full report entitled Water Quality Effects and Beneficial Uses of Wyoming Produced Water Surface Discharges prepared by Geomega, Inc, dated July 16, 2007.

I. Background

The PRBRC Petition for rulemaking proposes more stringent effluent limitations for sulfates, total dissolved solids and barium on the grounds that the proposed

limitations are protective of livestock. The proposed limits are not supported by factual and scientific evidence and should be denied. First, there is no support for Petitioners' proposed effluent limitations in *any* peer-reviewed scientific literature and their position is belied by their own sources of information. In fact, a review of the scientific literature demonstrates that the current effluent limitations are protective of livestock and wildlife, will not cause a measurable decrease in livestock production, and that the proposed standards will result in no measurable difference in livestock production. Second, the proposed effluent limitations fail to take into account natural water quality, the fact that existing effluent limitations more accurately reflect ambient surface and ground water quality (which is traditionally used by ranchers for livestock watering) and that the mere existence of produced water contributes to beneficial uses including livestock watering, irrigation and wildlife propagation. Third, the proposed limits would, by themselves, cause a measurable decrease in livestock production due to loss of currently available produced water sources as a supply for livestock watering. Finally, PRBRC objected to the effluent limitations during the Triennial Review process and WDEQ and EQC rejected those objections on the grounds that the existing effluent limitations were protective of livestock and agricultural uses. EQC should not allow the Petitioners a "second bite at the apple", but should require them to proceed through the standard triennial review process.

II. PRBRC's Proposed Effluent Limitations Are Not Supported by Scientific Evidence.

PRBRC alleges that the current effluent limitations are not protective of livestock. When promulgating standards, rules, regulations, or permits, the WDEQ "shall consider all the facts and circumstances bearing upon the reasonableness of the discharge

including... the character and degree of injury to or interference with the health and well being of the people, animals, wildlife, aquatic life and plant life affected." W.S. 35-11-302(a)(vi)(A). In this case, Petitioners have failed to demonstrate any "degree of injury to or interference with" livestock which may result from the use of water meeting the existing effluent limitations. Without this demonstration of harm, the EQA factors weigh against imposition of new effluent limitations.

PRBRC's proposed effluent limitations are not supported by the weight of scientific evidence. In essence, Petitioners' have selected four non-peer reviewed articles to support their position. Strangely, Petitioners fail to inform the Council of the large body of data, many peer reviewed, that fail to support or contradict their position. There are a significant number of peer reviewed sources that can be used to determine appropriately protective levels. In addition, even among the scant few sources Petitioners cite, there is little or no agreement from source-to-source for each of their proposed limitations. Essentially, Petitioners cite an article where it favors their position and disregard the article where it does not. This is not science, and the Council should not be misled into thinking it is. Science requires consideration of all available evidence, assessing its weight and credibility in a rigorous fashion, and reaching a result based on the weight of the evidence. No such process is discernable in Petitioners' selection of quotations.

In contrast, Geomega Inc. has undertaken both an extensive scientific literature review and compiled data from Wyoming ranchers to determine protective levels of barium, TDS and sulfate. Geomega's report analyzed the effects of varying concentrations of barium, TDS and sulfates on reproduction and physiological health of

ruminants (cattle), non-ruminants (rats) and birds. Reproductive effects studied included eggshell thinning (for birds), low birth weights, and reduced litter sizes or number of offspring. Physiological effects studied included weight loss or gain and physiological impairment. *See* Water Quality Effects and Beneficial Uses of Wyoming Coal Bed Natural Gas Produced Water Surface Discharges, Geomega Inc., p. 14 (dated January 16, 2007) (attached hereto as Exhibit A). Geomega computed concentrations of constituents based on levels of the constituents which resulted in no observed adverse effect levels (NOAELS) and lowest observed adverse effect levels (LOAELs) for ruminant mammals, non-ruminant mammals and birds. Geomega carefully evaluated each study to assure methodological soundness, comparability, scientific rigor and applicability. Based on this review, Geomega determined a best weight of the evidence value as a recommended benchmark. All was done in accordance with EPA procedures and protocols. Petitioners have demonstrated no such study and followed no such protocol.

Geomega also interviewed several Wyoming ranchers who use both produced and natural water sources for livestock watering to determine the "real-life" effect of TDS and sulfate constituents in produced and natural water sources on cattle health and reproduction. This is critical because water exists as part of the larger Wyoming environment and the Council is charged with protecting Wyoming's environment and not some laboratory environment. Geomega then compared effects of TDS and sulfates on livestock from produced water and natural water sources in several drainages. Geomega used this empirical data to determine whether Geomega's "recommended benchmarks" were consistent with results from typical livestock operations in Wyoming.

Once again, nowhere do Petitioners undertake any similar rigorous proof testing of their recommended values.

The results of both Geomega's literature review and empirical study demonstrate that, based on the scientific literature and Wyoming practice, WDEQ's existing effluent limits for TDS and sulfate are protective of livestock (and do not result in a measurable decrease in livestock or agricultural production). In addition, Geomega's study demonstrates that an effluent limit for Barium of 13.0 mg/L would be more than adequately protective of livestock and wildlife use of the water. The results are summarized below.

A. Barium

There is currently no effluent limit for produced water containing barium. Petitioners propose a standard of 0.2 mg/L based on two sources, neither of which is peer-reviewed. First, the Colorado State University document (Petitioners' Ex. 23) upon which Petitioners rely in support of their proposed barium limit has been updated since Petitioners proposed the barium effluent limitation. The updated version *does not* propose *any* limit for barium for livestock drinking water. (CSU Cooperative Extension, Livestock Drinking Water Quality, updated July 31, 2006, attached hereto as Exhibit B.)

Second, Geomega reviewed the other non-peer reviewed article relied on by Petitioners (Petitioners' Exhibit 19, Utah State University Analysis of Water Quality for Livestock) and could not identify *any* recommendation that barium in livestock drinking water be limited to less than 0.2 mg/L in the articles cited in the Utah State document. *See*, Ex. A, at p. 29. In fact, Geomega could not locate a *single* study supporting a 0.2 mg/L effluent limit. *Id.* Moreover, WDEQ conducted an extensive study concerning

barium which concluded that a 2 mg/l barium limit (based on the human health drinking water maximum contaminant level) was protective of all other uses, including agriculture. *See* Antidegradation Review, Analysis and Findings – Concentrations of Barium in the Surface Waters in Northeastern Wyoming Related to Discharges of Coal Bed Methane Produced Water (December 1, 2000), p. 8.

While Geomega could not find any support for a 0.2 mg/L limit in the works cited by Petitioners or any other source, it did determine, based on an analysis of eight peer-reviewed scientific sources, that a barium limit of 13 mg/L would be protective of livestock and wildlife. *See* Ex. A, at pp. 28-29. This limit is based on studies conducted on non-ruminant mammals with an uncertainty factor included to provide additional protection for livestock. *See Id.* at 28. In addition, 13 mg/L is consistent with Canada's lowest recommended water quality criteria for livestock and the limit determined by the NRC to be protective for horses, poultry and swine. *Id.* at 29.

In summary, the Geomega report finds no credible scientific support for a barium effluent limitation of 0.2 mg/L. It finds no credible scientific support for WDEQ's general limit of 2.0 mg/L for livestock watering. It finds some scientific support for a limit of 13 mg/L. Accordingly, the Council should either set the barium limit at 13 mg/l or else defer action on barium until the next triennial review, when more data may be available.

B. <u>Total Dissolved Solids</u>

Petitioners have proposed a revision to the TDS effluent limitation from 5,000 mg/L to 2,000 mg/L. Petitioners again rely on two non-peer reviewed documents in support of this position. Petitioners' interpretation of these "sources" is against the weight of the scientific evidence.

First, Petitioners' own materials belie their position. The Utah State University Extension Fact Sheet explicitly states that waters with TDS concentrations from 5,000 – 6,999 ppm (mg/L) "can be used with reasonable safety for dairy and beef cattle." Petitioners' Exhibit 19, at p.2. Also, the Utah State Fact Sheet incorrectly cites a South Dakota State University Extension Services Bulletin in support of a 2,000 mg/L TDS concentration. The South Dakota Bulletin actually provides that 3,000 mg/L *sulfate – dominant* TDS is acceptable for livestock consumption, which speaks more to the sulfate issue (and is consistent with the existing effluent limit for sulfate). Ex. A, at 36. In addition, Petitioners' Exhibit 20 (Wyoming Department of Agriculture Analytical Services Explanation of Standard Potable "Water Supply Series" of Analysis) states that water containing 5,000 mg/L TDS is suitable for consumption. *See* Petitioners' Ex. 20, p. 2.

Second, Geomega reviewed over 39 scientific studies and concluded that there are no observed adverse effects on ruminants (growing cattle) at 7,380 mg/L and, for non-ruminant mammals and birds at 4,750 mg/L. Based on the values determined in the literature, Geomega derived a benchmark at 5,600 mg/L for TDS. This result is consistent with the existing effluent limitation set forth in the regulations.

Finally, the empirical evidence collected from ranchers supports Geomega's recommended benchmark and, hence, the existing effluent limitations, for TDS. Interviews with ranchers documented that water with TDS ranging from 2,310 mg/L to 5,390 mg/L TDS was suitable for livestock drinking. *See* Ex. A, at pp. 22 – 25. Furthermore, no adverse effects were noticed by ranchers to livestock using produced water versus natural water. *Id.* at pp.23 – 24. Thus, under Wyoming conditions, the

existing effluent limits are adequately protective and result in no measurable decrease in livestock production. Based on the peer reviewed literature evaluated in the Geomega risk assessment, further reductions in the TDS effluent limit are not anticipated to cause any measurable difference in cattle production. There is no basis for the Petitioners' request.

C. Sulfate

Petitioners propose that the sulfate effluent limitation for discharges from coal bed natural gas facilities be reduced from 3,000 mg/L to 500 mg/L. Petitioners again rely on two non-peer reviewed articles in support of their position. There is no support for this proposed limit in any peer reviewed literature. Importantly, the materials referenced in Petitioners' Exhibit 19 do not support the proposed sulfate limit. *See* Exhibit A, at p. 32-33. Furthermore, the Wyoming Department of Agricultural Analytic Services document relied on by Petitioners provides no scientific basis for a sulfate limit of 500 mg/L other than merely stating that such water is acceptable. Clearly, any water with sulfate below the no observed adverse effect level is acceptable and such a conclusion adds nothing to the debate on where a limit should be established.

After reviewing over 28 peer reviewed studies, Geomega determined that the average concentration of sulfate that resulted in no observable adverse effects (NOAELs) for growing heifers was 3,660 mg/L. After taking into account water quality concentrations which relate to no observed adverse effect levels (NOAELs) for birds and other mammals, the scientific literature supports a benchmark concentration of 3,010 mg/L sulfate. *See* Ex. A, at p. 31. This recommended benchmark has been

adjusted to take into account the fact that the "upper end of acceptable WQCs for sulfate is much lower for the growing heifer than the adult steer." Ex. A, at p. 31.

The empirical evidence again supports Geomega's recommended benchmark and WDEQ's effluent limitation of 3,000 mg/L for sulfate. Ranchers typically utilized water ranging from 1,180 mg/L to 3,100 mg/L with no adverse health effects noted. Furthermore, there was no difference in health between cattle using produced water or natural water. Once again, in Wyoming, both the peer reviewed literature and field proofing show that the existing standard is protective and will cause no measurable impact on cattle production. Petitioners' proposed effluent limit will make no measurable difference. Hence, there is no basis for adopting the Petition.

D. Conclusion

Petitioners have failed to provide any basis for their proposed effluent limitations. Peer reviewed scientific literature not only does not support Petitioners' proposed limits but, in fact, supports the existing effluent limitations set forth in the regulations. Because there are no valid scientific data supporting Petitioners' proposed limits, those limits should be denied.

In response to prior objections to their proposed effluent limitations on these same grounds, Petitioners have failed to provide any additional documentation in support of their proposed effluent limits. *See generally* Petitioners' Responses to Comments (dated June 26, 2006). In that same response, Petitioners merely urged WDEQ to "impose limits on the more protective, rather than less protective, end of the spectrum." Petitioners' Responses to Comments, p. 12. There is no measurable decrease in livestock production when one compares the existing effluent limitations

with the proposed effluent limitations. *See* Ex. A, at p. ES-1; p. 42. Petitioners' are following the tautology that "lower is better" regardless of the scientific evidence. The EQA requires more to support an effluent limitation.

III. The Proposed Effluent Limitations Fail to Take In to Consideration Ambient Surface and Ground Water Quality

As stated earlier, Petitioners' proposed effluent limitations are more stringent than ambient water quality. Joint Response in Opposition to Petition to Amend Wyoming Water Quality Rule, Chapter 2, Appendix H, pp. 22-24. Ambient water has been used for decades by ranchers in Wyoming for livestock watering. It makes no sense to impose more restrictive effluents solely on oil and gas producers when no net environmental benefit will be achieved and existing users will be harmed by loss of water upon which they rely. Appendix A of the Geomega report gives specific examples of such uses and examples of landowners who will be harmed by adoption of the Petition.

WDEQ has determined that groundwater is acceptable for livestock watering purposes if it meets the standards for Class III groundwater. Significantly, the Chapter 8 Class III groundwater standards for sulfate, TDS and barium are identical to the <u>existing</u> effluent limitations prescribed in Appendix H. *See* WWQRR Chapter 8, Section 5, Table I. Again, ranchers have relied on groundwater for decades to provide water to livestock. Requiring oil and gas operators alone to meet effluent limits more stringent than what is considered by WDEQ to be acceptable for livestock watering is overly burdensome and inconsistent with water quality standards.

IV. The Petition Will Cause a Loss of Livestock Production by Limiting Water Available for Stock Production

The Geomega risk assessment compares produced water quality in a number of Wyoming production basins to the barium, TDS and sulfate proposed standards in the Petition. As the Geomega risk assessment outlines, many of those typical produced water qualities would not meet the standard proposed in the Petition. As such, surface discharge of water from these basins would not be permissible – even where a local landowner or rancher requests the water – unless the water is treated to meet the proposed effluent limitations. The Petitioners have failed to consider the measurable loss of livestock production from the resulting water curtailment at produced water sources that cannot meet the proposed effluent limits. *See* Ex. A, at pp 50-52. As a result, the Petition may, by itself, be inconsistent with the Agricultural Use Protection standard of Section 20 of the Wyoming Water Quality Rules and Regulations.

The importance of this test should not be underestimated. The Geomega risk assessment indicates *no measurable difference* in livestock production would be anticipated if the proposed Petition effluent limitations were met. Because there is no measurable gain in livestock production from adopting the Petition, any corresponding loss in livestock production due to curtailment of water sources will constitute a "measurable decrease in livestock production" that is inconsistent with the spirit, and possibly the letter, of Section 20. As industry representatives have testified and will testify, produced water discharges will be curtailed where treatment is not economical. If even one such produced water discharge is curtailed and a rancher presently using such water suffers a loss in livestock production as a result, then the Council's adoption

of the Petition will violate the spirit of Section 20 and its responsibilities to balance the needs of all Wyoming citizens under W.S. 35-11-302.

V. Petitioners' Proposed Effluent Limitations Have Already Been Rejected by the WDEQ and EQC During the Triennial Review Process

As stated previously, Petitioners sought revisions to the barium and sulfate effluent limitations during the WWQR&R Chapter 1 Triennial Review process in 2005. WDEQ and EQC considered Petitioners' objections and rejected them based on the scientific data available and ranching practices in Wyoming. (Joint Response in Opposition to Petition to Amend Wyoming Water Quality Rule, Chapter 2, Appendix H, pp. 19-22). This recent rule-making effort by Petitioners is nothing more than an attempt to get a "second bite at the apple" with respect to the triennial review process. The Council should direct Petitioners to resubmit their concerns, with scientifically-defensible data, during the next triennial review

VI. Conclusion

The thinly veiled purpose of the Petitioners' proposed effluent limitations is to eliminate <u>all</u> surface discharges of produced water under the guise of livestock protection. In support of such an extreme demand, Petitioners present no scientifically defensible data review, omit peer-reviewed studies that contradict their conclusions, fail to consider the statutory factors or the harms that will result to existing uses. The Council should reject the attempts by Petitioners to get a "second bite at the apple", reject the Petition, and direct the Petitioners to participate in the triennial review process, where this discussion properly belongs.

For the foregoing reasons, PAW requests that PRBRC'S proposed effluent limitations not be adopted by the Council. As always, PAW appreciates this opportunity to provide these comments to the Council.

Sincerely,

John Robitaille

Petroleum Association of Wyoming

no. 4.908

Livestock Drinking Water Quality

by P.N. Soltanpour and W.L. Raley [1]

Quick Facts...

- Test livestock drinking water for salinity and toxic elements if water quality is not known.
- Take a representative water sample for any testing.
- The National Academy of Sciences proposes general guidelines for use of saline waters and for upper limits of toxic ions in water. There are no easy answers or quick fixes for toxic water problems.

Excessive salinity in livestock drinking water can upset the animals' water balance and cause death. High levels of specific ions in water can cause animal health problems and death. The National Academy of Sciences offers upper limits for toxic substances in water (Table 1). It also offers guidelines for use of saline waters for livestock and poultry (Table 2).

Unsafe levels of salts and ions depend on the amount of water consumed each day and the weight of the animal. Test livestock drinking water for salinity and toxic elements if water quality is not known. The general guidelines presented in Tables 1 and 2 include an appropriate margin of safety. For a more specific interpretation of livestock drinking water quality, contact your veterinarian.

To obtain a representative water sample for testing, collect approximately 1-pint samples at random intervals using clean glass or plastic containers. Pour small samples into a large container and mix thoroughly. Take the final sample from the mixed large container. Avoid taking the sample from inactive wells or directly after drilling. Thoroughly pump or bail wells before sampling.

If the test report shows that water contains toxic substances exceeding the upper limit guidelines listed in Tables 1 and 2, treatment may be necessary before livestock drink the water. However, there usually are no simple answers or quick fixes for toxic water problems. In many cases, water treatment may be impractical or too costly. Some circumstances may warrant the use of ion-exchange filters, distillation or dilution to correct the problem. Consultation with a sanitary engineer or water treatment specialist on a case-by-case basis is the best recommendation.

Table 1: Recommendations for levels of toxic substances in drinking water for livestock.

Constituent	Upper limit	Constituent	Upper limit
Aluminum (Al)	5.0 mg/L	Lead (Pb)	0.1 mg/L[1]
Arsenic (As)	0.2 mg/L	Manganese (Mn)	no data
Beryllium (Be)	no data	Mercury (Hg)	0.01 mg/L

Boron (B)	5.0 mg/L	Molybdenum (Mo)	no data
Cadmium (Cd)	0.05 mg/L	Nitrate + nitrite (NO3-N + NO2-N)	100 mg/L
Chromium (Cr)	1.0 mg/L	Nitrite (NO2-N)	10 mg/L
Cobalt (Co)	1.0 mg/L	Selenium (Se)	0.05 mg/L
Copper (Cu)	0.5 mg/L	Vanadium (V)	0.10 mg/L
Fluorine (F)	2.0 mg/L	Zinc (Zn)	24 mg/L
Iron (Fe)	no data	Total dissolved solids (TDS)	10,000 mg/L[2]

[1]Lead is accumulative and problems may begin at threshold value=0.05 mg/L.
[2]See Table 2.

Sources: Environmental Studies Board, Nat. Acad. of Sci., Nat. Acad. of Eng., *Water Quality Criteria*, 1972.
Ayers, R.S. and D.W. Wescot. *Water Quality for Agriculture*. Food and Agriculture Organization of the United Nations, Rome, 1976.

Table 2: Guide to the use of saline waters for livestock and poultry.

Total soluble salts content of waters	**Uses**
Less than 1,000 mg/L (EC < 1.5 mmhhos/cm)	Relatively low level of salinity. Excellent for all classes of livestock and poultry.
1,000-3,000 mg/L (EC = 1.5-5 mmhos/cm)	Very satisfactory for all classes of livestock and poultry. May cause temporary and mild diarrhea in livestock not accustomed to them; may cause watery droppings in poultry.
3,000-5,000 mg/L (EC = 5-8 mmhos/cm)	Satisfactory for livestock, but may cause temporary diarrhea or be refused at first by animals not accustomed to them. Poor waters for poultry, often causing watery feces, increased mortality, and decreased growth, especially in turkeys.
5,000-7,000 mg/L (EC = 8-11 mmhos/cm)	Can be used with reasonable safety for dairy and beef cattle, sheep, swine, and horses. Avoid use for pregnant or lactating animals. **Not acceptable for poultry.**
7,000-10,000 mg/L (EC = 11-16 mmhos/cm)	**Unfit for poultry and probably for swine.** Considerable risk in using for pregnant or lactating cows, horses or sheep, or for the young of these species. In general, use should be avoided although older ruminants, horses, poultry, and swine may subsist on them under certain conditions.
Over 10,000 mg/L (EC > 11-16 mmhos/cm)	Risks with these highly saline waters are so great that they cannot be recommended for use under any condition.

Sources: Environmental Studies Board, Nat. Acad. of Sci., Nat. Acad. of Eng., *Water Quality Criteria*, 1972. Ayers, R.S. and D.W. Westcot. *Water Quality for Agriculture*. Food and Agriculture Organization of the United Nations, Rome, 1976.

[1] P.N. Soltanpour, Colorado State University professor, soil and crop sciences; and W.L. Raley, former Colorado State University Cooperative Extension western district director. 10/93. Reviewed 3/99.

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Updated Monday, July 31, 2006.

FILED

JAN 26 2007

Terri A. Lorenzon, Director
Environmental Quality Council

PRB
ENERGY, INC.

Mr. Mark Gordon, Chairman
Wyoming Environmental Quality Council
122 W. 25th Street
Herschler Bldg., Room 1714
Cheyenne, WY 82002

January 26, 2007

RE: Citizen Petition for Rulemaking – PRBRC et al – WQD Chapter 2

Dear Mr. Gordon,

It is my understanding that the proposed petition filed by the PRBRC, if approved, could reduce or eliminate the ability to discharge CBM produced water discharge at the surface. On July 1, 2006, PRB Energy, Inc. ("PRB") acquired approximately 600 CBM wells with our purchase of leases from Pennaco Energy, Inc. ("Pennaco"). The intent of our Pennaco acquisition was to hopefully be able to develop CBM gas from deeper coal seams (Moyer & Dannar), which are below the depleting WYODAK seam. The depths of these deeper zones vary from 1,000 feet to 1,400 feet below surface and are not in association with the Big George play further to the west.

In late 2005 and early 2006 PRB invested in drilling 40 new CBM wells to the deeper seams on leases we held prior to the Pennaco purchase and these 40 wells are in proximity to Gillette. With the Pennaco purchase, PRB is currently producing or bringing back on-line an additional 40 wells that were drilled to the deeper coals by Pennaco. It is PRB's intent to successfully "de-water" the deeper coals and to establish a "new" pay zone for CBM development in the eastern edge of the Powder River Basin. The quality of our produced water meets all requirements of the present rules & regs of the DEQ and we have been successful, to date, to modify our existing NPDES permits to allow the discharge of water from the deeper coal seams.

If we are successful in producing economical gas from these 80 wells, PRB has a drilling program in place to drill an additional 250-300 CBM wells. Our lease holding is approximately 30,000 acres and no doubt if we are successful, adjoining operators will seriously evaluate their potential for development of the deeper seams. Any new source of CBM gas will greatly benefit the state and will also continue to keep the CBM industry a viable resource to Campbell County and surrounding areas for years to come.

The development of our leases would be seriously affected if the proposed PRBRC petition is successful in rule changes. It is very likely that PRB would not be able to develop our deeper coal seams if stricter rules for CBM water discharge are put in place by the State. Presently, PRB has a great working relationship with surface landowners we operate on and at this time, they are all very thankful for the water that we provide them for livestock and agriculture purposes.

Please feel free to call me anytime if you may have any questions and thank you for your time.

Sincerely,

Larry E. Sare

Larry E. Sare
Senior Landman

812 E. 4th Street • Gillette, Wyoming 82716
P.O. Box 2668 • Gillette, Wyoming 82717
Phone: 307 686 3797 • Fax: 307 686 3743

Effects from the PRBRC's Proposed Effluent Limits for Barium, Sulfate, and TDS

EQC PRBRC Petition Hearing
1/17/07 + added Big George Coal Extents Maps & Histograms

CBM Associates, Inc.

OBJECTIVE

- Contrast the current limits for total recoverable barium (Ba) 2000 ug/l, dissolved sulfate (SO_4) 3,000 mg/l; and, TDS (5,000 mg/l), against those proposed in the PRBRC petition: Ba = 200 ug/l; SO_4 = 500 mg/l; and, TDS = 2,000 mg/l; and
- Evaluate potential effects on oil and gas production and the availability of water due to the more restrictive proposed standards.

Data Sources

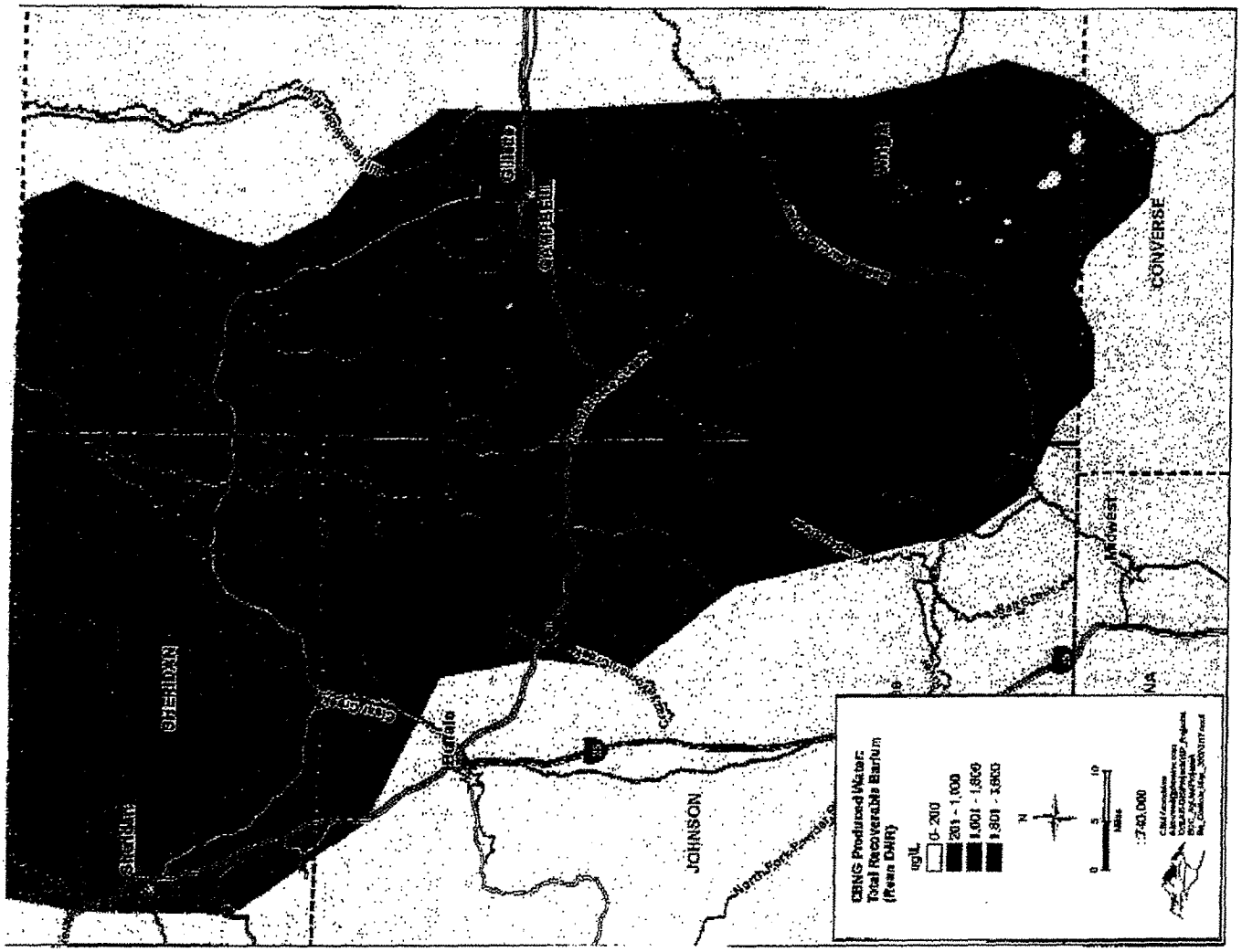
The produced water data used for CBNG production was the average of the reported values for the constituents of concern in Powder River Basin (PRB) WYPDES DMRs for the period of 1999 to 2006.

The Conventional Oil & Gas produced water data was the average of the reported values for the constituents of concern from all WYPDES DMRs for the period of 2001 to 2006 and other studies from 2003 to 2006.

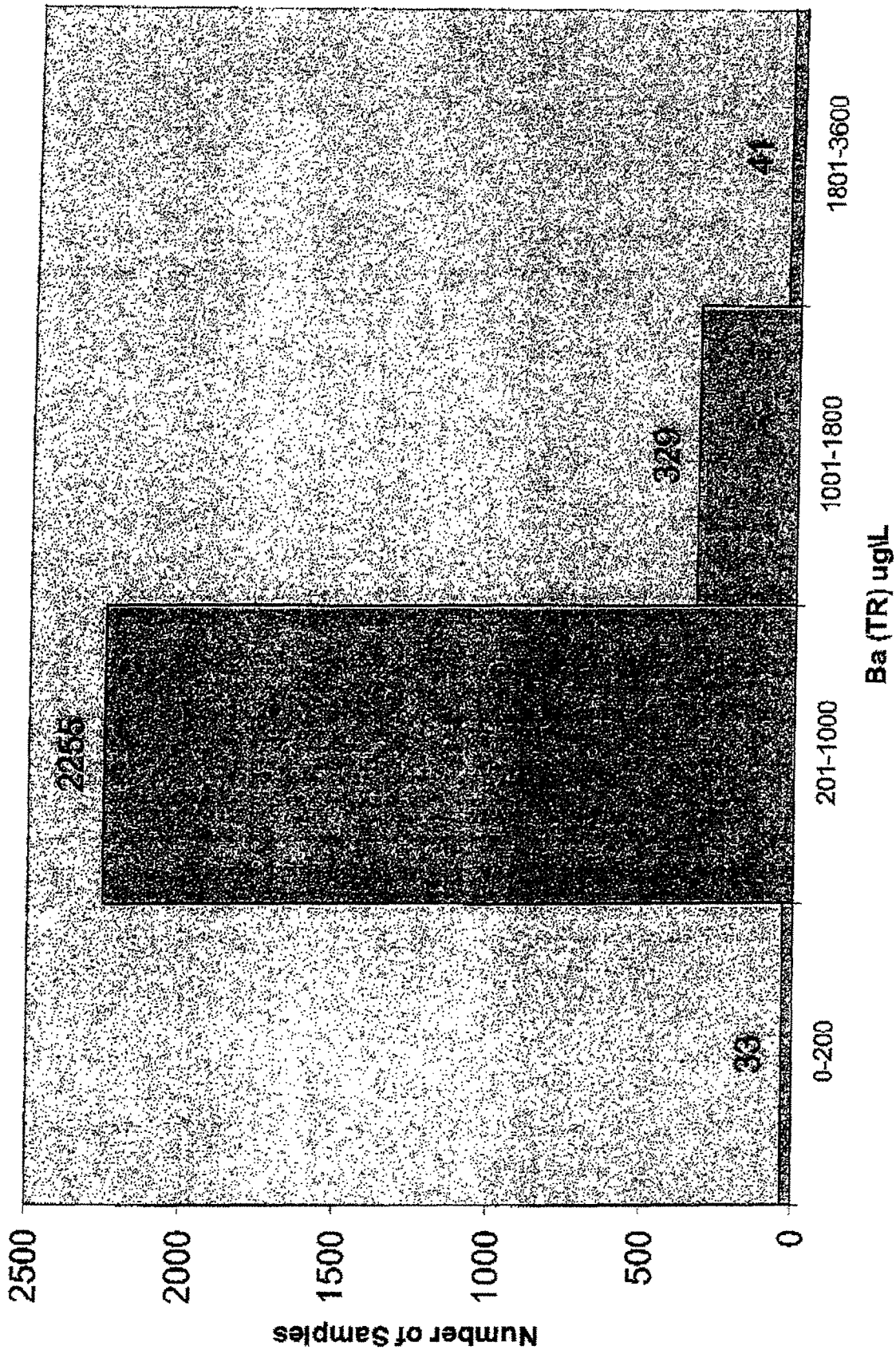
Barium: CBNG Produced Water

An examination of the CBNG produced water from WYPDES DMRs for 2658 individual outfalls indicates that 99% (2625) outfalls had mean concentrations of total recoverable Ba that would exceed the proposed standard of 200 ug/l.

Under the current standard of 2000 ug/l, less than 1% of the outfalls exceed. Therefore, under the proposed effluent limit, virtually all CBNG production in the PRB would require treatment, injection, or shut-in due to barium limits.


SHERIDAN
CAMPBELL
CONVERSE
Buffalo
JOHNSON
MIDWEST
CBNG Produced Water:
Total Recoverable Barium
(Rawa DMR)
ug/L
0 - 200
201 - 1,000
1,001 - 1,800
1,801 - 2,600
N
0
5
10
Miles
1:740,000

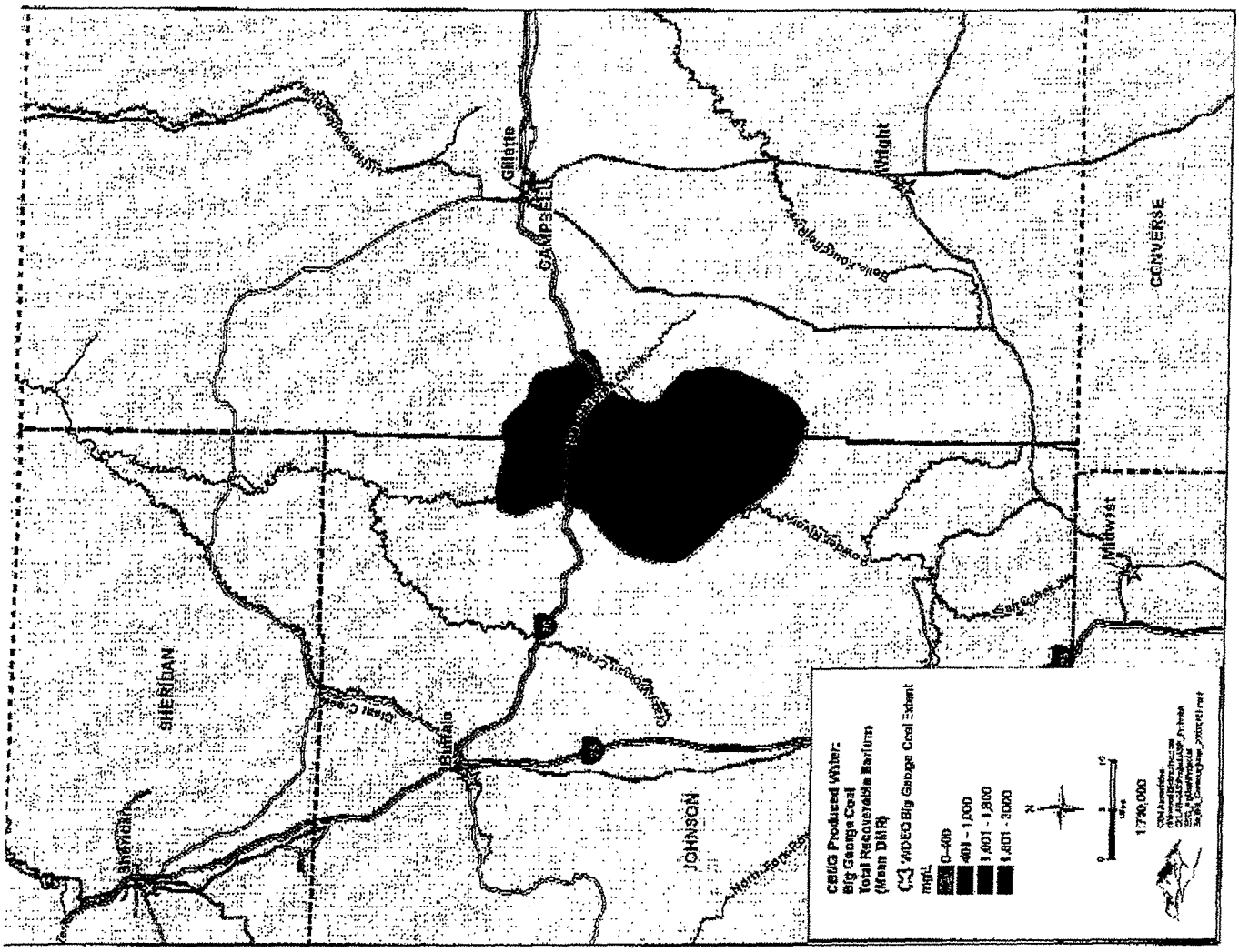
CBNG Produced Water
Total Recoverable Barium ug\L (Mean DMR)



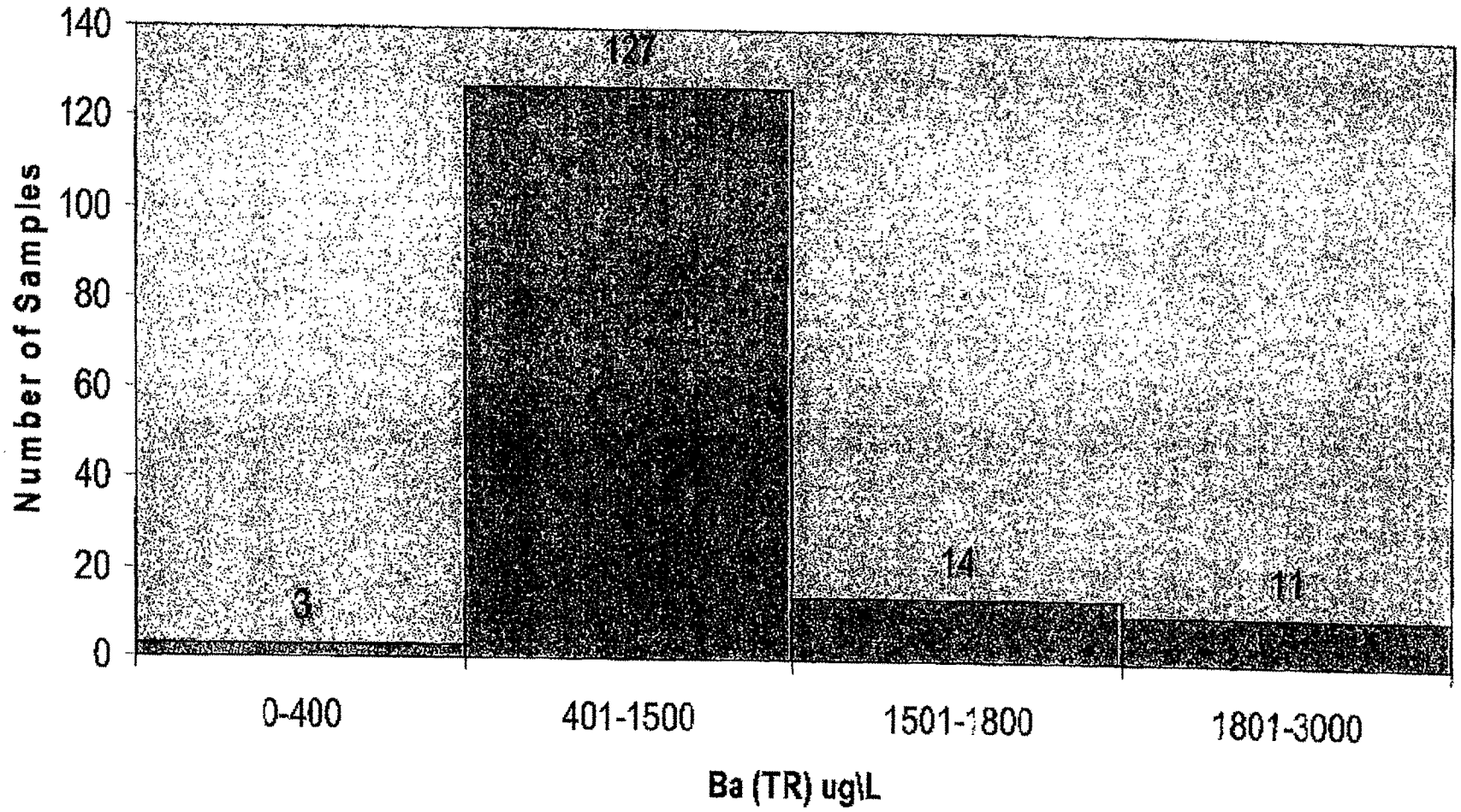
Barium: CBNG Produced Water Big George Coal Extent

An examination of the CBNG produced water from WYPDES DMRs for the 155 outfalls within the WDEQ Big George Coal Extent indicates that 98% (152) outfalls had mean concentrations of total recoverable Ba that would exceed the proposed standard of 200 ug/l.

Under the current standard of 2000 ug/l, less than 7% of the outfalls exceed. Therefore, under the proposed effluent limit, virtually all CBNG production in the PRB would require treatment, injection, or shut-in due to barium limits.


SHERIDAN
Sheridan
Sheridan
JOHNSON
Buffalo
Gillette
CAMPBELL
Wright
Midwest
CONVERSE
CBM/CI Produced Water:
Big Gange Coal
Total Recoverable Barium
(Mean DMR)
WDEQ Big Gange Coal Extent
mg/L
0-400
401 - 1,000
1,001 - 1,800
1,801 - 3,000
N
0
10
miles
1:750,000

CBNG Produced Water
Big George Coal
Total Recoverable Barium ug\L (Mean DMR)



Barium: CBNG Produced Water

Treating barium to the proposed limit at each outfall would require an individual ion exchange system similar to those currently used to treat CBNG. Conservative cost for such treatment currently ranges from $0.35 to $0.60 /BW (WOGCC: 2006 PRB CBNG produced water)

The conservative cumulative cost to treat PRB CBNG produced water for barium alone range from $147 to $252 million/year under the proposed standard.

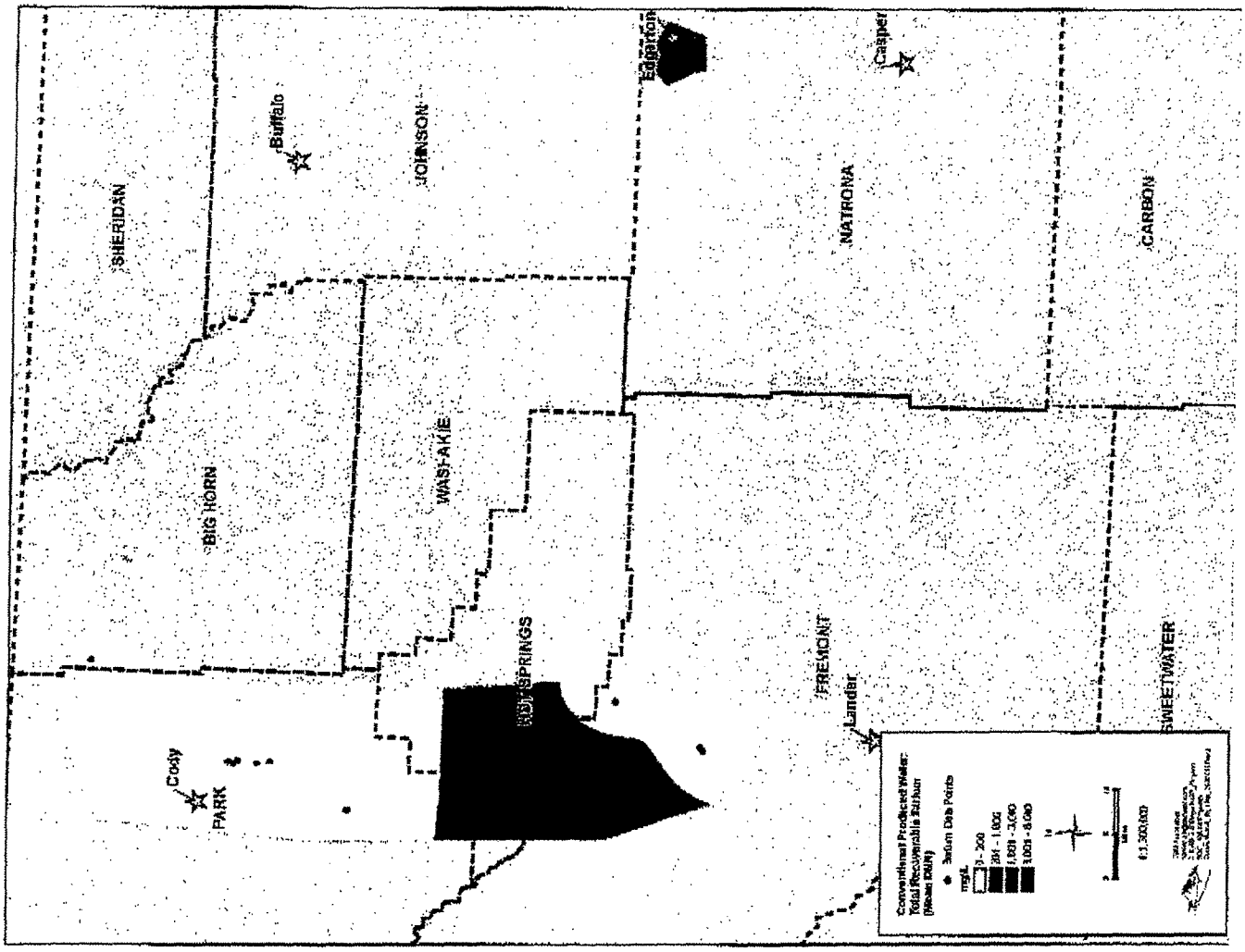
Barium: CBNG Produced Water

Barium treatment alone would result in an estimated cost increase that ranges from $0.63 to $1.08/MCF of CBNG gas produced (WOGCC: 2006 PRB CBNG production).

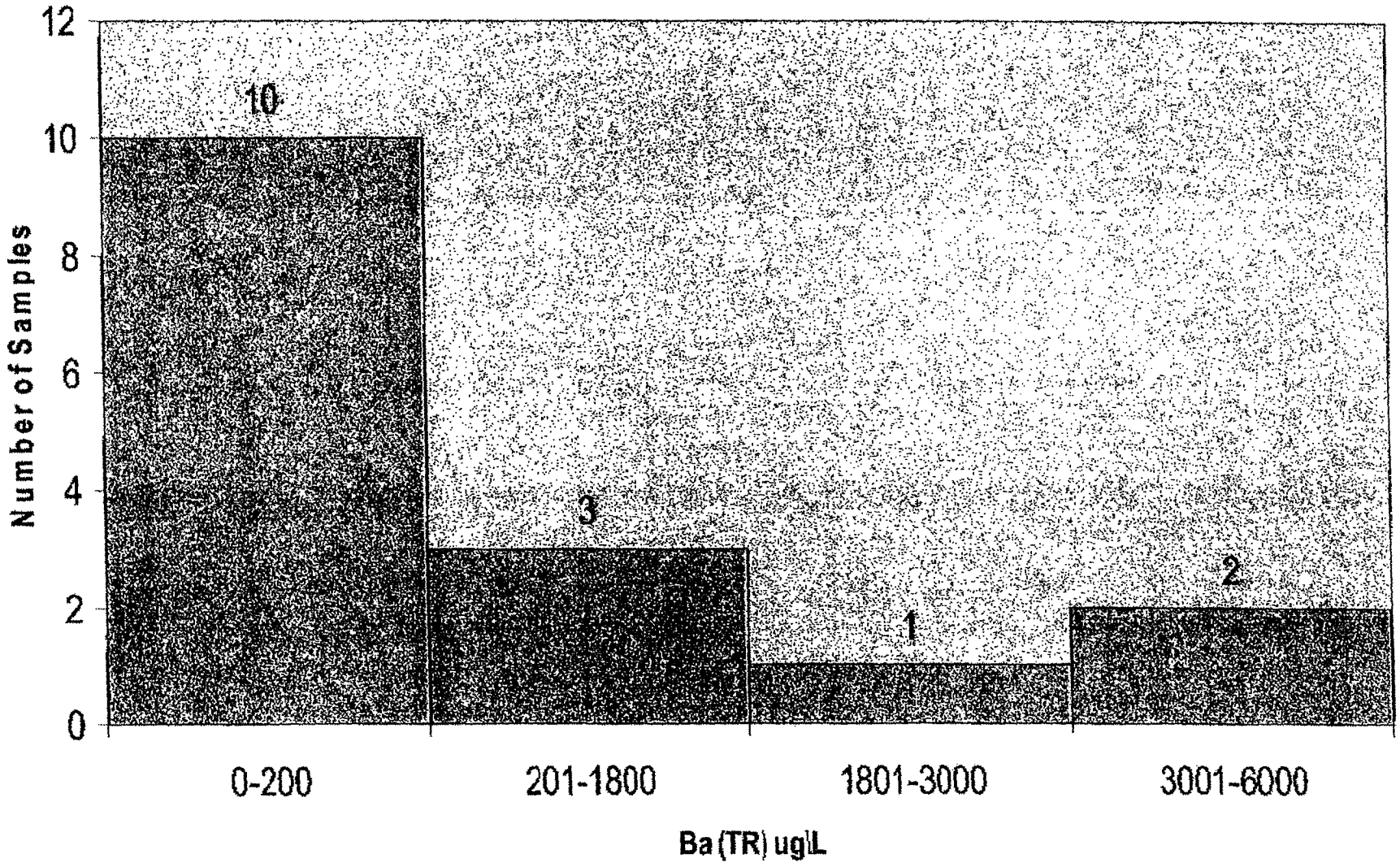
This will make many producing CBNG wells and reserves uneconomic.

Barium: Conventional Oil & Gas Produced Water

An examination of the available Ba sample data from Conventional Oil & Gas produced water from WYPDES DMRs for 16 individual outfalls indicates that 38% (6) of all outfalls examined showed mean concentrations of total recoverable Ba that exceed the proposed limit of 200 ug/l.

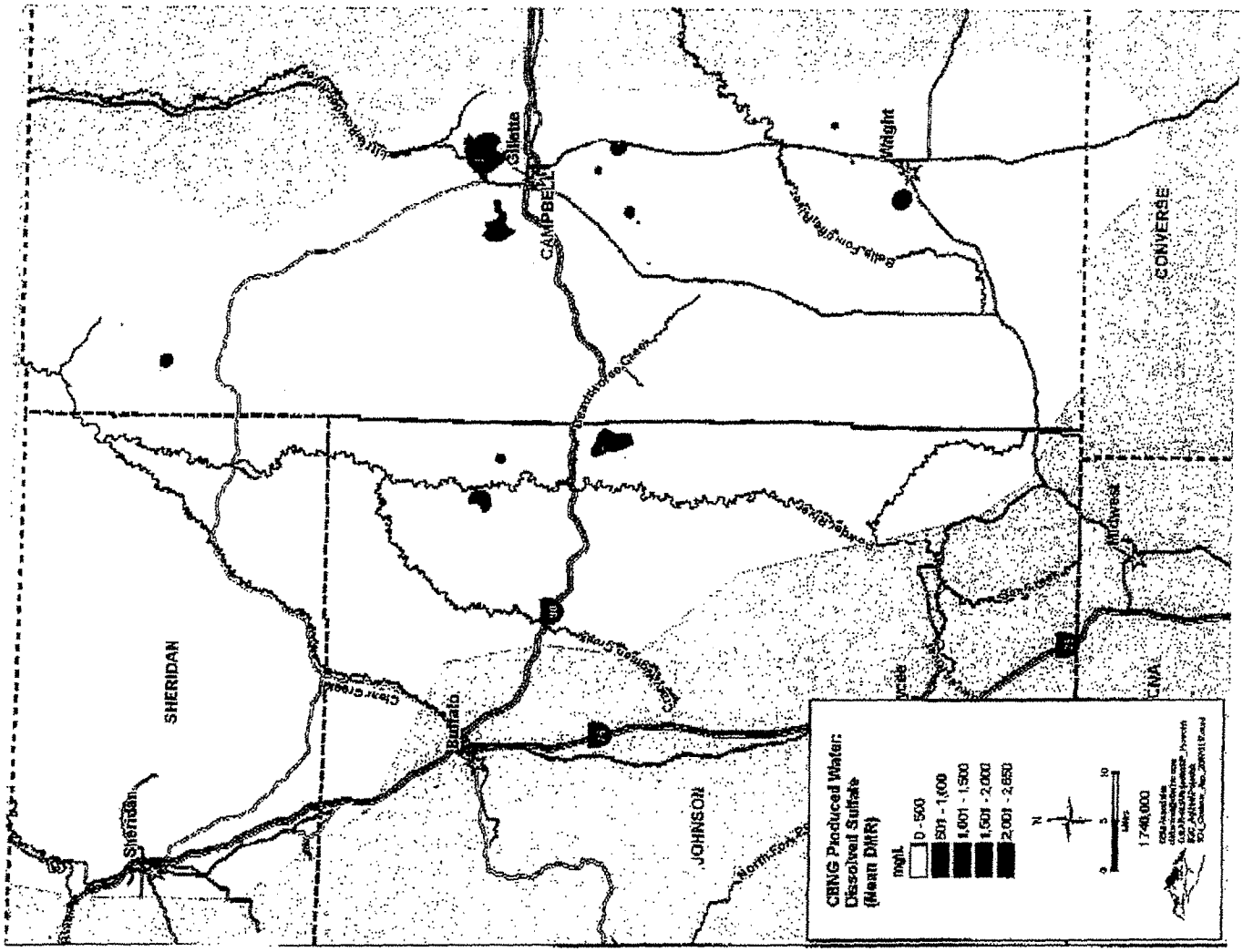

SHERIDAN
Buffalo
JOHNSON
Edgerton
Casper
NATRONA
CARBON
BIG HORN
WASHAKIE
BIG SPRINGS
FREMONT
Lander
SWEETWATER
Cody
PARK
Sodium Data Points
mg/L
3 - 200
201 - 1,000
1,001 - 3,000
3,001 - 8,000
0 15,000

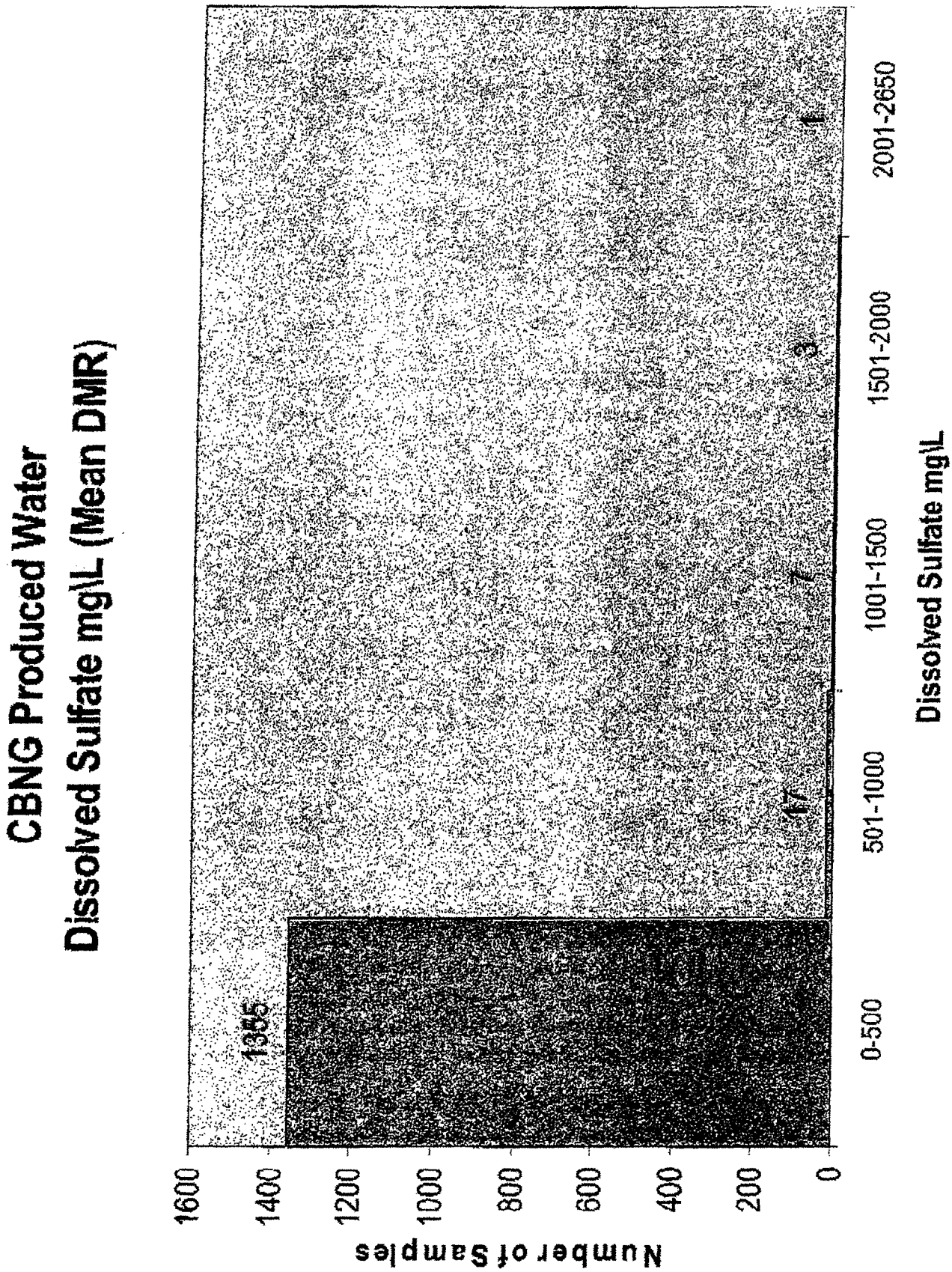
Conventional Produced Water
Total Recoverable Barium ug\L (Mean DMR)



Sulfates: CBNG Produced Water

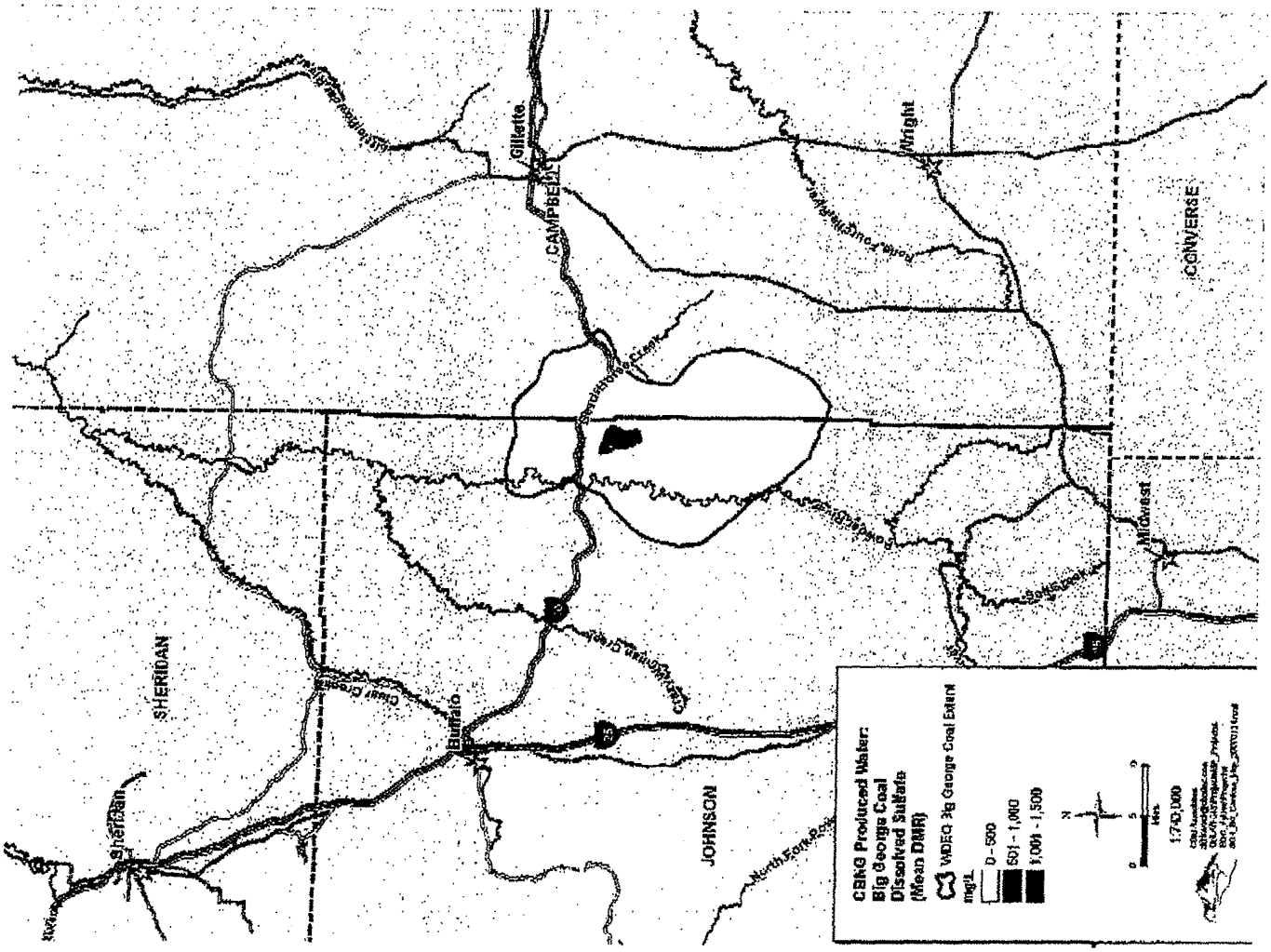
An examination of the CBNG produced water from WYPDES DMRs for 1383 outfalls indicates that 2% (28) of the currently operating outfalls would not comply under the proposed dissolved sulfate limit of 500 mg/l.

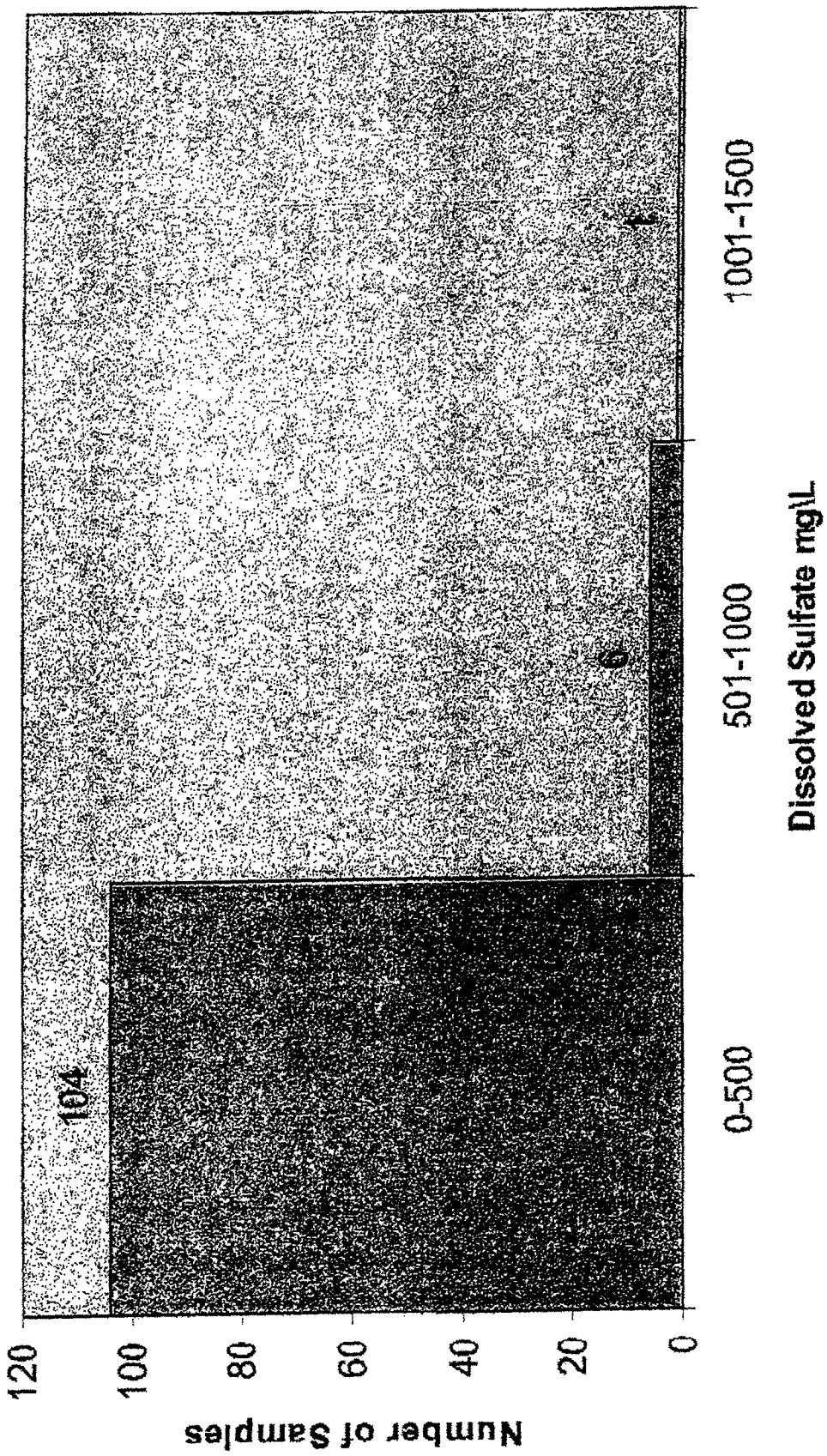

SHERIDAN
Sheridan
Clear Creek
Buffalo
Gillette
CAMPBELL
Wright
Dalton Ponds Branch
Little Thunder Creek
Middle Fork Powder River
Powder River
Salt Creek
JOHNSON
North Fork Powder River
Midwest
CONVERSE
CBNG Produced Water:
Dissolved Sulfate
(Mean DMR)
mg/L
0 - 500
501 - 1,000
1,001 - 1,500
1,501 - 2,000
2,001 - 2,820
N
0
5
10
Miles
1:740,000


CBNG Produced Water
Dissolved Sulfate mg\L (Mean DMR)
Number of Samples
1600
1400
1200
1000
800
600
400
200
0
1355
17
7
3
1
0-500
501-1000
1001-1500
1501-2000
2001-2650
Dissolved Sulfate mg\L

Sulfates: CBNG Produced Water Big George Coal Extent

An examination of the CBNG produced water from WYPDES DMRs for the 111 outfalls within the WDEQ Big George Coal Extent indicates that 6% (7) outfalls would not comply under the proposed dissolved sulfate limit of 500 mg/l.

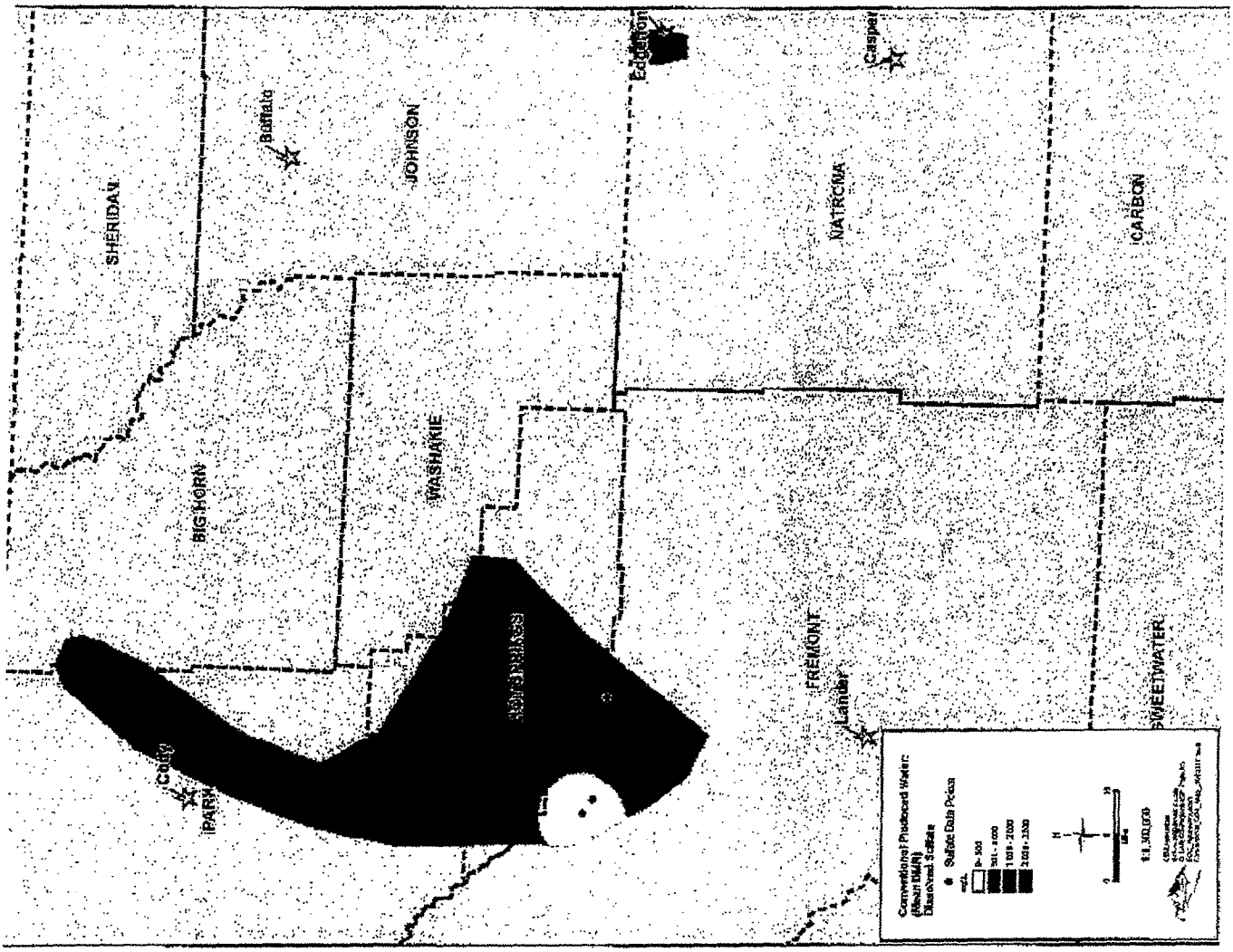

SHERIDAN
Sheridan
Buffalo
Gillette
CAMPBELL
JOHNSON
Wright
Midwest
CONVERSE
CBNG Produced Water:
Big George Coal
Dissolved Sulfate
(Mean DMR)
WDEQ Big George Coal Extent
mg/L
0 - 500
501 - 1,000
1,001 - 1,500
N
0
2
Miles
1:740,000

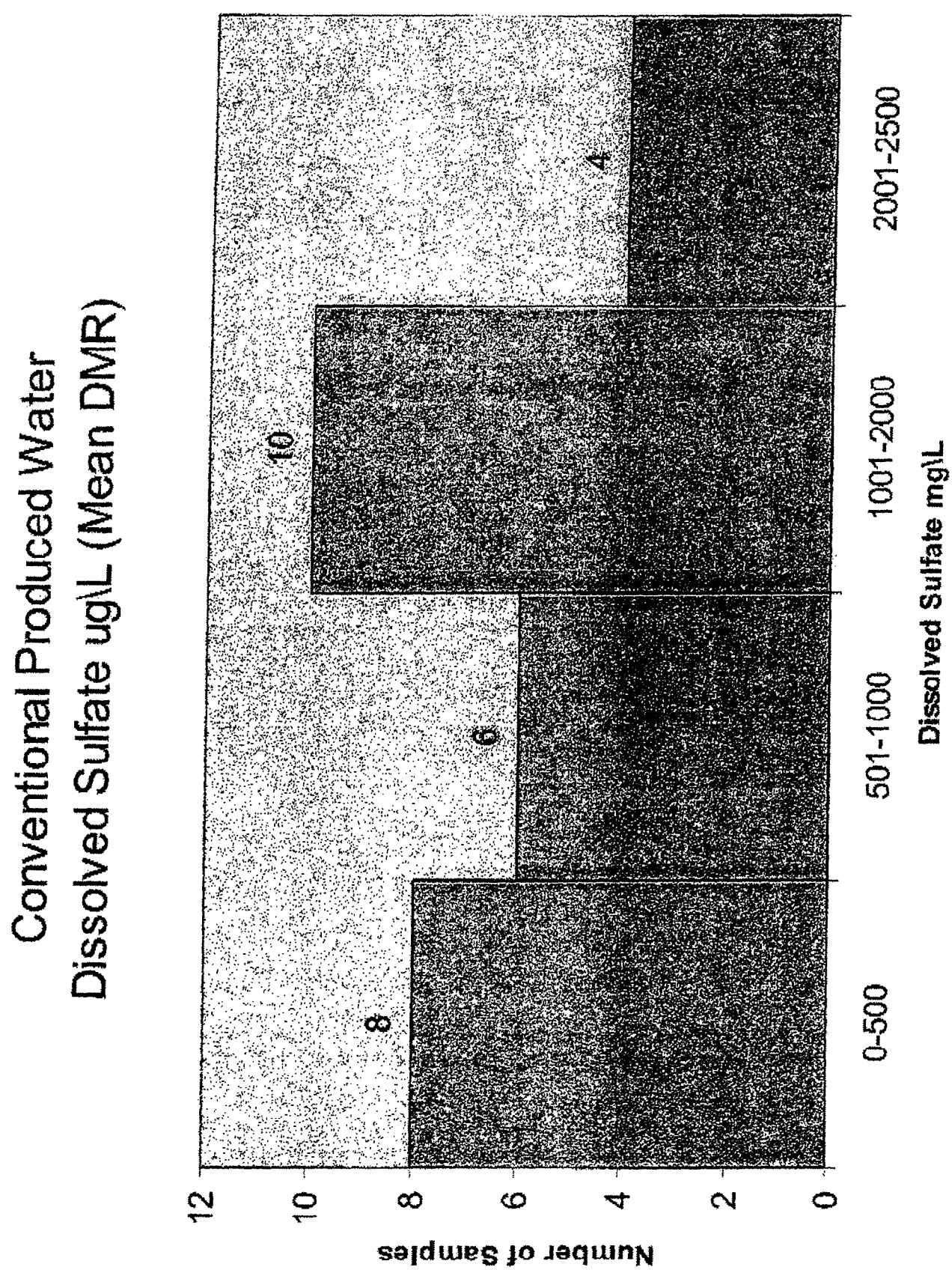

CBNG Produced Water
Big George Coal
Dissolved Sulfate mg\L (Mean DMR)
104
6
1
120
100
80
60
40
20
0
Number of Samples
0-500
501-1000
1001-1500
Dissolved Sulfate mg\L

Sulfates: Conventional Oil & Gas Produced Water

Nearly 71% (20) of the 28 Conventional Oil & Gas outfalls would not meet the proposed dissolved sulfate limit of 500 mg/l. (WYPDES DMRs indicate exceedance of the proposed 500 mg/l limit for SO_4)

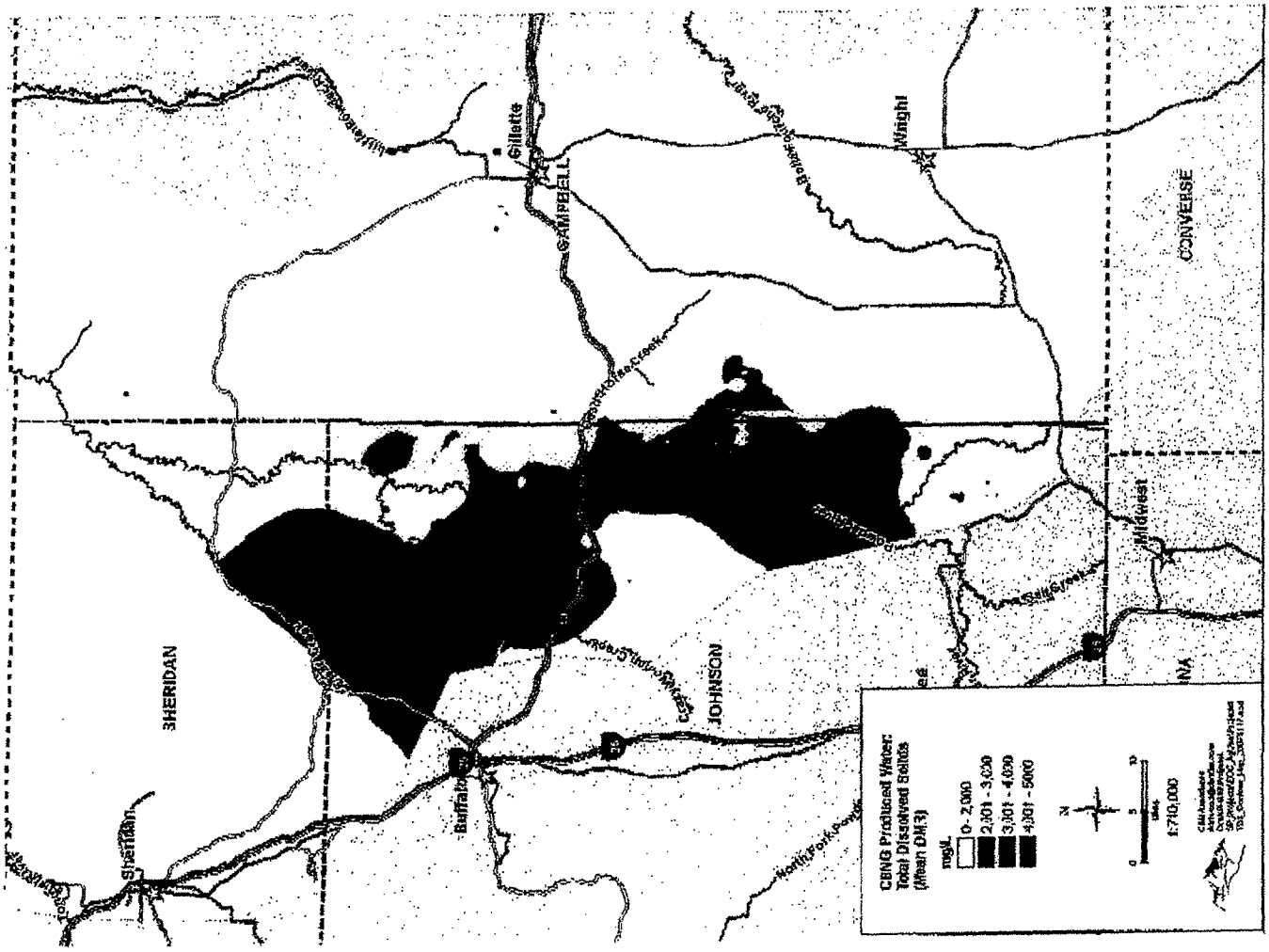
The imposition of the proposed limits would require treatment or reinjection, rendering the majority of the current oil production uneconomic.


SHERIDAN
BIG HORN
Buffalo
JOHNSON
WASHAKIE
Cody
PARK
Edgerton
Casper
NATRONA
CARBON
FREMONT
Lander
SWEETWATER
Conventional Produced Water:
Dissolved Sulfate
Sulfate Data Points
0 - 500
501 - 1000
1001 - 2000
2001 - 3300
0
10
20
Miles
1:1,300,000

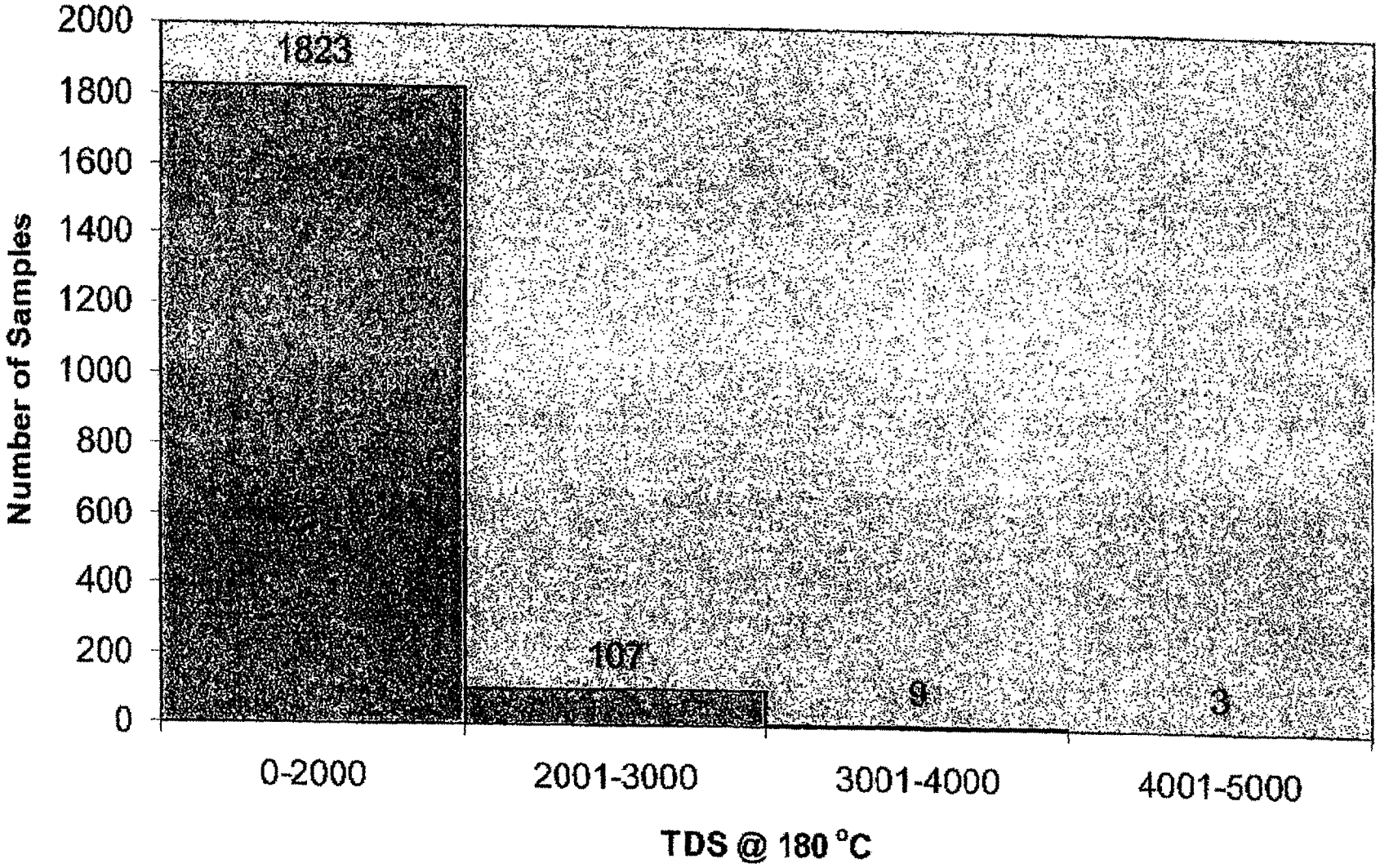

Conventional Produced Water
Dissolved Sulfate ug\L (Mean DMR)
Number of Samples
12
10
8
6
4
2
0
8
6
10
4
0-500
501-1000
1001-2000
2001-2500
Dissolved Sulfate mg\L

TDS: CBNG Produced Water

An examination of the CBNG produced water from WYPDES DMRs for 1942 outfalls indicates that 6% (119) of the outfalls would not comply under the proposed TDS limit of 2000 mg/l.

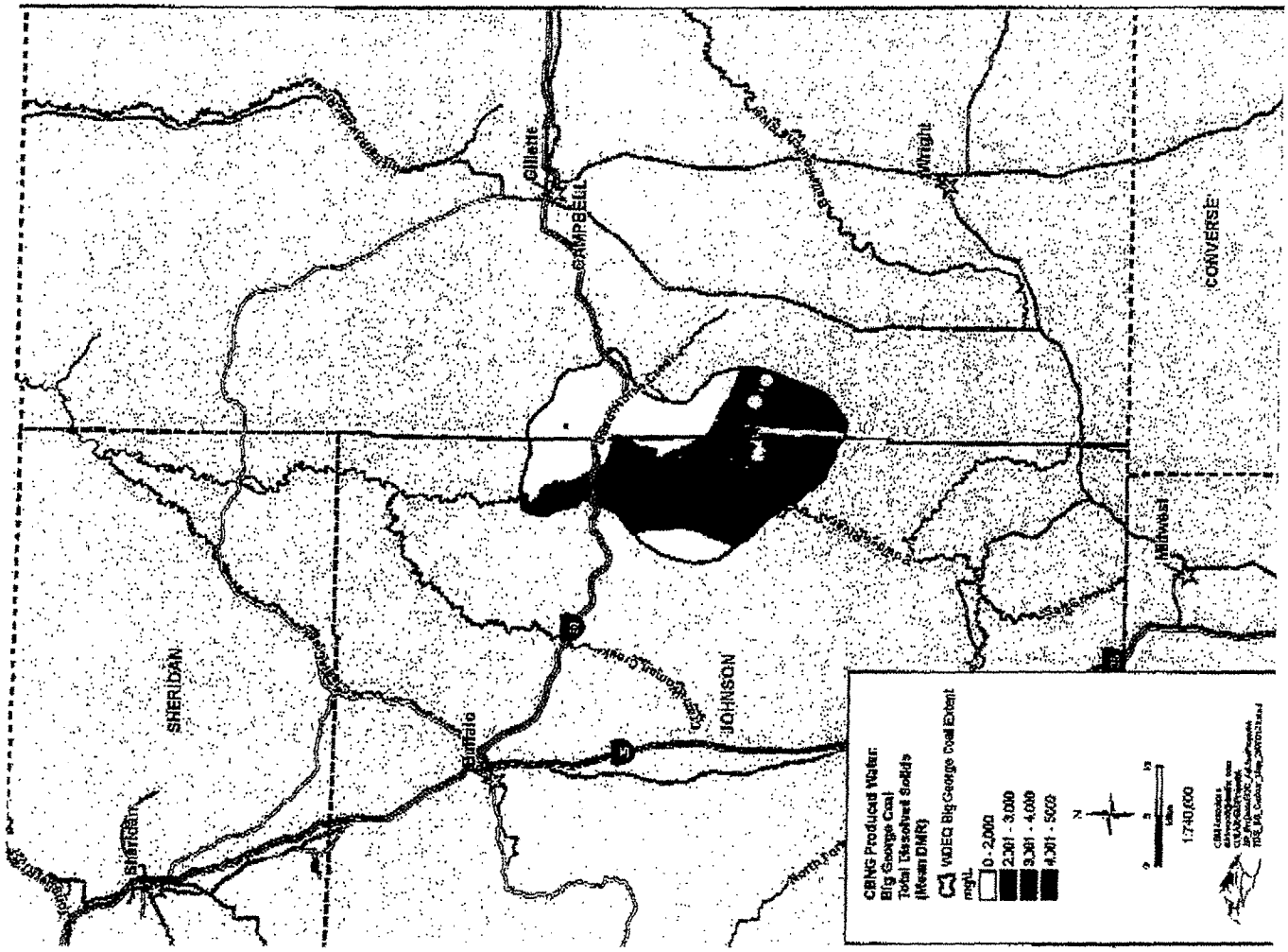

SHERIDAN
JOHNSON
CAMPBELL
CONVERSE
Sheridan
Buffalo
Gillette
Kaycee
Midwest
Wright
Powder River
Clear Creek
Crazy Woman Creek
Salt Creek
North Fork Powder
CBNG Produced Water
Total Dissolved Solids
(Mean DMT)
mg/L
0 - 2,000
2,001 - 3,000
3,001 - 4,000
4,001 - 5000
1:710,000

CBNG Produced Water
Total Dissolved Solids at 180° C mg\L (Mean DMR)

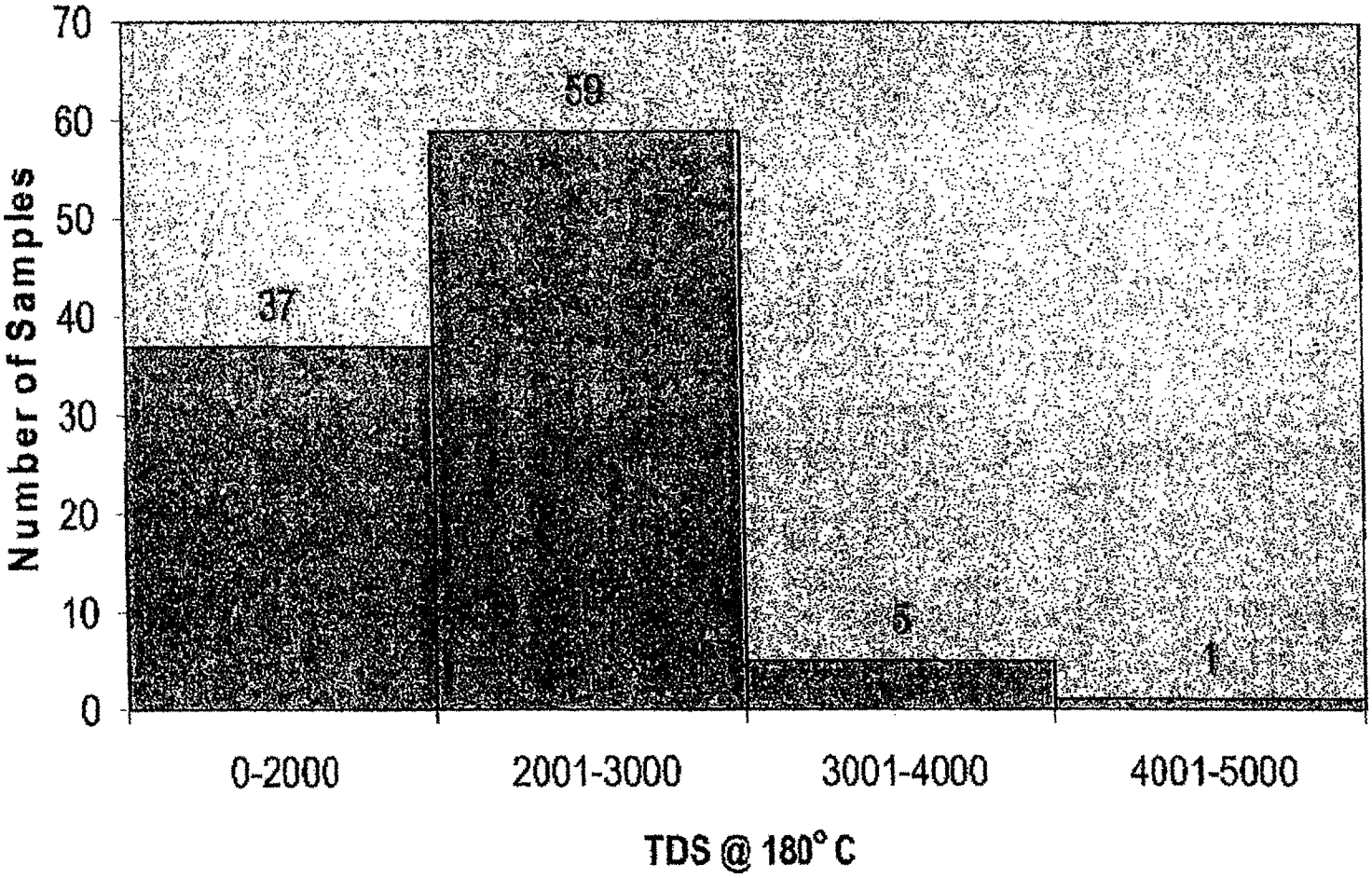


TDS: CBNG Produced Water Big George Coal Extent

An examination of the CBNG produced water from WYPDES DMRs for 102 outfalls within the WDEQ Big George Coal Extent indicates that 36% (37) of the outfalls would not comply under the proposed TDS limit of 2000 mg/l.

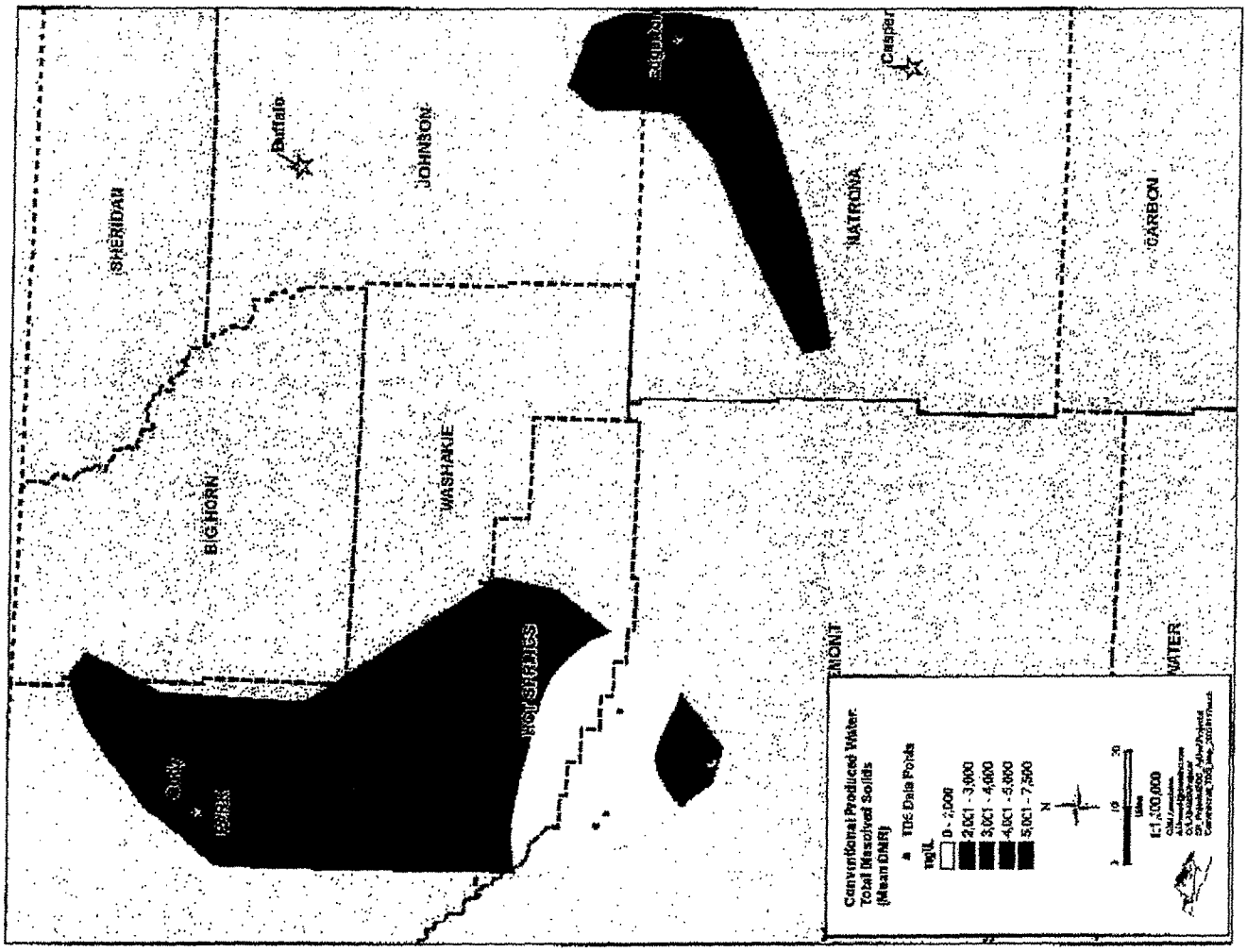

SHERIDAN
Sheridan
Buffalo
JOHNSON
CAMPBELL
Gillette
Wright
CONVERSE
Midwest
CBNG Produced Water:
Big George Coal
Total Dissolved Solids
(Mean DMR)
WDEQ Big George Coal Extent
mg/L
0 - 2,000
2,001 - 3,000
3,001 - 4,000
4,001 - 5000
N
1:740,000

CBNG Produced Water Total Dissolved Solids at 180° C
Big George Coal
mg\L (Mean DMR)

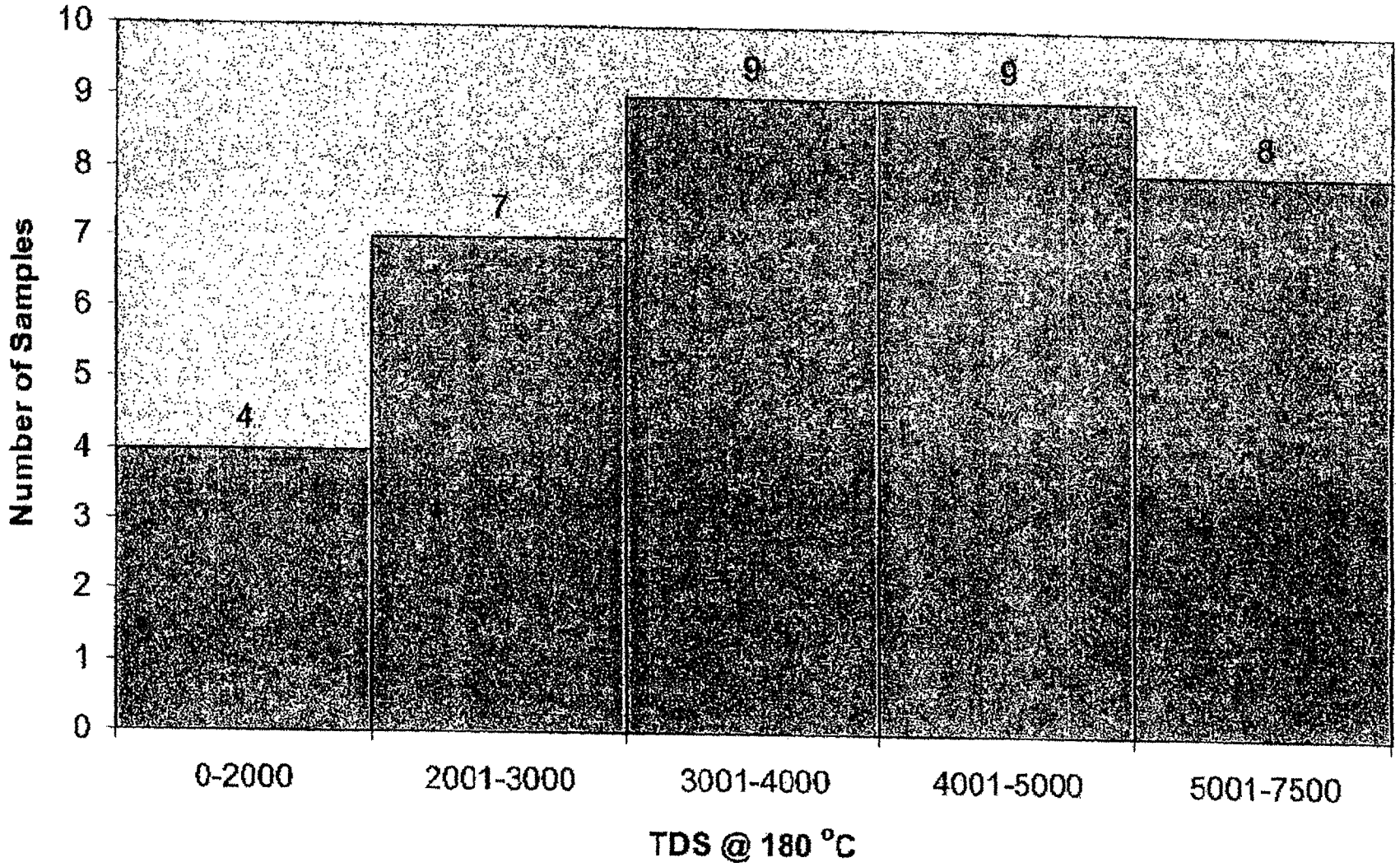


TDS: Conventional Oil & Gas Produced Water

- An examination of the Conventional Oil & Gas produced water from available WYPDES DMRs for 37 outfalls indicates that 89% (33) of the currently operating outfalls would not comply under the proposed TDS limit of 2000 mg/l.


SHERIDAN
Buffalo
JOHNSON
BIGHORN
WASHAKIE
HOT SPRINGS
Cody
NATRONA
Casper
CARBON
Conventional Produced Water
Total Dissolved Solids
(Mean DMR)
TDS Data Points
mg/L
0 - 2,000
2,001 - 3,000
3,001 - 4,000
4,001 - 5,000
5,001 - 7,500
N
1:1,500,000

Conventional Produced Water
Total Dissolved Solids @180° C ug\L (Mean DMR)



Questions EQC Needs to Answer

What is the risk of harm to livestock and wildlife from produced water under the existing limits?

- Where is *credible* evidence that the existing limits are not protective of livestock or wildlife?

What is the risk of harm to livestock and wildlife if produced water is removed from the State's water supply?

- The EQC needs to determine if there is measurable benefit to livestock or wildlife from a reduction of produced water.
- The loss of the beneficial use of the produced water and the habitat it provides is significant to both ranchers and sportsmen in the State of Wyoming.

Questions EQC Needs to Answer

Where is the credible evidence of measurable benefits to livestock and wildlife from the proposed limits?

Are the losses of produced water to existing livestock and wildlife uses, and the loss of oil and gas reserves, offset and justified by a credible measurable benefit from adopting the new limits?

NORWEST
Applied Hydrology

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January 29, 2007

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JAN 29 2007

Terri A. Lorenzon, Director
Environmental Quality Council

Mr. Mark Gordon
Chairman Environmental Quality Commission
Wyoming Division of Environmental Quality
122 W. 25th Street
Herschler Building Room 1714
Cheyenne, WY 82002

Fax 307-777-6134

Subject: December 2005 Powder River Basin Resources Council Petition to Chapter 2 Agricultural Limits for Barium

Dear Mr. Gordon,

Norwest Applied Hydrology (Norwest) has performed work on coal bed methane development in the Powder River Basin since 1998. Petrox Resources (Petrox) requested Norwest's input on the Powder River Basin Resources Council (PRBRC) petition to impose a barium limit of 0.2 mg/L for agricultural uses within Chapter 2. Norwest and Petrox recommend that the EQC disregard this request on the basis of inadequate data to support a reduction in the barium limit of this magnitude for the protection of agriculture.

The National Academy of Science reference does not provide a barium limit and states "Experimental data available are not sufficient to make definite recommendations".

http://www.epa.gov/waterscience/criteria/goldbook.pdf

The Prairie Farm Administration of Agriculture and Agri-Food of Canada recommends that a barium limit of 300 mg/l or less on the basis of depressed weight in chickens.

http://www.agr.gc.ca/pfra/water/livestck_e.htm

This recommendation is more than an order of magnitude higher than the limit proposed by the PRBRC. The PRBRC's proposal is based on recommended water quality criteria from other states that appear to be dated and inconsistent with US recommendations on the protection of agriculture.

This could be derived in part from the fact that simple barium sulfate salt (barite), which is the chemical form found in Wyoming rivers at mid to low elevation, forms rapidly and has very low solubility between the pH range of near 1.0 to 11.6 (Brookins, 1988). This renders barium in its most common natural form as barite essentially non-bioavailable to organisms over the common range of pH's found in natural waters.

Furthermore, the Wyoming Department of Environmental Quality (DEQ) pursued a rigorous anti-degradation review in 2000. In that document, WDEQ determined that a 2 mg/l barium limit (based on the human health drinking water maximum contaminant level) was protective of all other uses, including agriculture.

The Petition's concern about the suitability of CBNG produced water for livestock use fails to recognize the more than 10 years of safe and beneficial use of CBNG produced water for livestock within the Powder River Basin. CBM operators such as Petrox have worked closely with ranchers to design reservoirs and provide an improved water supply for livestock and these ranchers have reported enhanced livestock production form their ranches. Harriet Land and Livestock, a Petrox leasehold landowner, needs the water to support his cattle operation and supports any permitting that promotes the discharge of water on his property for beneficial use. CBM discharges provide water for year-round use of rangeland formerly underutilized due to lack of water. This has helped reduce the overgrazing of vegetation along many of the intermittent and ephemeral streams and reservoirs that have in the past provided much of the water for livestock. The forage plants in these previously underutilized locations provide a better source of feed for cattle than the species located within or adjacent to stream channels. The better distribution of water supply for livestock provides an opportunity to reduce the intensity of livestock use along stream channels and thereby protect stream banks and improve riparian plant communities. Lastly, the beneficial impact of the availability of CBM water permits ranchers to energize stock watering systems. Shutting in shallow water wells, ranchers can conserve that water for future use.

In addition, Norwest and Petrox note that use standards are typically imposed in Chapter 1, which includes narrative protection of agricultural use in Section 20. The utilization of Chapter 2 to impose industry specific limits that are not applied to all water dischargers is inconsistent with the statewide protection of water quality, regardless of source. The use of the appendices in Chapter 2, a chapter devoted to the permitting conditions, processing and administrative procedures, to impose industry specific numeric limits provides a confusing format to users of the regulations.

Norwest and Petrox recommend that the Environmental Quality Council deny the PRBRC's petition to reduce barium limits for oil and gas producers based on the lack of documentation that barium presents a threat to livestock, its low solubility in natural waters, and the support of the agricultural community for this water.

Sincerely,

Cathy Begej
Senior Hydrologist
Norwest Applied Hydrology

Mike Clark
President
Petrox Resources, Inc.

devon

Devon Energy Production Company, L.P.
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FILED

JAN 29 2007

Terri A. Lorenzon, Director
Environmental Quality Council

January 29, 2007

Ms. Sara Flitner
Hearing Officer, Environmental Quality Council
122 West 25th Street
Herschler Bldg., Rm. 1714
Cheyenne, Wyoming 82002

RE: Docket No. 05-3102: Rulemaking, Chapter 2 Appendix H

Dear Ms. Flitner:

Devon Energy Production Company, L.P. ("Devon") appreciates the opportunity to comment on the amendments proposed to the Department of Environmental Quality ("DEQ") Water Quality Rules, Chapter 2, Appendix H. Devon produces oil and natural gas throughout the state of Wyoming, including a significant amount of coal bed natural gas ("CBNG") from the Powder River Basin.

Devon is a participant in the INDUSTRY RESPONDENTS COMMENTS TO PETITIONERS' PROPOSED APPENDICES "H" AND "I" AS PUBLIC NOTICED FOR THE JANUARY 17-18, 2007 RULEMAKING HEARING and the INDUSTRY RESPONDENTS' SUPPLEMENTAL COMMENTS TO RECORD JANUARY 17-18, 2007 RULEMAKING HEARING filed by a group of interested Wyoming oil and gas producers. Devon is also a member of the Petroleum Association of Wyoming ("PAW"). By these comments, we join in the comments and presentations submitted by both groups and wholly incorporate them here, as well as Devon's previous comments in this matter. In addition, Devon asks the Council to consider the following comments and requests that they be made a part of the record in this matter.

I. The proposed rules, as written, ban all discharges

Despite the Petitioners' claims to the contrary, the current version of the proposed rules prohibit CBNG water discharges. This is because the rules prevent DEQ from issuing any permits for the discharge of water from CBNG production unless an applicant can prove that the discharge does not meet the statutory definition of "pollution," which has been inserted in the proposed rules at Appendix I, Section (a)(iii). However, DEQ and the Petitioners contend that water discharges do meet the definition of pollution in all circumstances except where the water is distilled. Consequently, the rules require CBNG producers to prove a regulatory impossibility.

In fact, if the water being discharged was distilled to the point of purity – containing no chemical or chemical compound – a discharge permit would not be necessary. Under Wyoming's Environmental Quality Act ("EQA"), if produced water could meet the standards set out in Appendix I, Section (a)(iii),

CBNG producers could arguably discharge as much water as the waters of the state could carry *without* a permit. This is because the EQA does not prohibits the discharge of *pollution* without a permit, not the discharge of pure water. WYO. STAT. § 35-11-301.

We realize that the EQC has heard hours of testimony and read hundreds of comments from individuals, including landowners and oil and gas company employees, consultants, and attorneys, who are concerned about the devastating impact these rules would have. We also recognize that some members of the council have stated that it is not their intent to shut down the industry. However, DEQ, the agency who would be charged with administering this rule, believes that the language must be read to prohibit all discharges. The Petitioners have provided nothing to alleviate the fears of those who testified at the hearing and submitted written comments.

II. The credible data standard is not appropriate

The EQA specifically defines the term "credible data" to be "scientifically valid chemical, physical and biological monitoring data collected under an accepted sampling and analysis plan, including quality control, quality assurance procedures and available historical data." WYO. STAT. § 35-11-103(c)(xix). The only place where the EQA provides that credible data must be used is in WYO. STAT. § 35-11-302(b). This statute specifically recognizes that obtaining "credible data" in ephemeral or intermittent watercourses is difficult, if not impossible.

> The administrator, after receiving public comment and after consultation with the advisory board, shall recommend to the director rules, regulations and standards to promote the purposes of this act. The rules, regulations and standards shall prescribe:
>
> (i) **A schedule for the use of credible data in designating <u>uses</u> of surface water** consistent with the requirements of the Federal Water Pollution Control Act (33 U.S.C. sections 1251 through 1387). **The use of credible data shall include consideration of soils, geology, hydrology, geomorphology, climate, stream succession and human influence on the environment. <u>The exception to the use of credible data may be in instances of ephemeral or intermittent water bodies where chemical or biological sampling is not practical or feasible</u>;**
>
> (ii) The use of credible data in determining water body's attainment of designated uses. **<u>The exception to the use of credible data may be in instances where numeric standards are exceeded, or in ephemeral or intermittent water bodies where chemical or biological sampling is not practical or feasible.</u>**

The "credible data" standard does not apply in any other context than in stream classification, as DEQ representatives testified on January 18, 2007. Several EQC members also expressed concern. Even Petitioners acknowledge that a full set of data may not be possible, saying "granted they don't have to use a complete set of data. But not using a complete set of data doesn't mean using no data." Unedited Realtime Rough Draft Transcript, EQC Hearing, January 18, 2007. Yet, the petitioners use a term

which again takes the extreme, requiring the a full set of data necessary for *stream classification*, rather than defining the partial set of data that they may be demanding.[1]

Furthermore, not only does this new "credible data" standard apply to determining the amorphous "unacceptable" impacts to water quality, it also requires proof of the water's use in agriculture or wildlife propagation. Here, the petitioners also claim that the rule does not really mean what it says, but that they are just looking for a landowner to say they are using the water. Such a statement, however, does not meet the definition of "credible data." Rather, to meet the "credible data" standard would require a significant intrusion into the privacy of landowners who use the water. We do not believe our landowners would want to disclose the location and quantity of wildlife that are using the water from the streams and reservoirs located on their property.

CONCLUSION

In conclusion, Devon urges the Council to summarily reject the rules proposed by the Petitioners. The rules propose to ban all CBNG water discharges in the state, which is certainly not the appropriate response to the complaints of the Petitioners. Despite the Petitioners latest claims that this is not their intent, they have failed identify language that would actually address their issues without harming the thousands of individuals who benefit from the water discharges and natural gas production. As was stated in testimony at the January 17 and 18 hearing: the Petitioners have a remedy if they or their property have been damaged. However, those that would be hurt by this rule do not have a remedy for the loss of benefits they will experience if this rule is enacted.

Thank you for the opportunity to submit our comments. Please do not hesitate to contact me should you have questions or require additional information.

Sincerely,

Randall W. Maxey

Randall W. Maxey
Senior Regulatory Specialist

[1] In addition, this comment implies that DEQ makes permitting decisions without any data, which is simply not true.

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FILED

JAN 29 2007

Terri A. Lorenzon, Director
Environmental Quality Council

January 30, 2007

Mr. Mark Gordon
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Cheyenne, Wyoming 82002

RE: Docket No. 05-3102
Powder River Basin Resource Council Petition to Amend Water Quality Rules
Chapter 2, Appendix "H" and "I"
Supplemental Comments

Dear Mr. Gordon:

I presented oral testimony to the Environmental Quality Council ("EQC" or "Council") on January 18, 2007 at the rulemaking hearing in Docket No. 05-3102. My comments concerned water law and the impact the proposed rules will have on water rights. Mr. Pat Tyrell, State Engineer, also testified on water law issues. As you know, Wyoming's water law is very complex, and it is difficult to summarize in the very limited time allowed by the Council. I believe the comments Mr. Tyrell and I made are consistent. However, these supplemental comments will clarify water law as it pertains to produced water from coalbed natural gas operations in the Powder River Basin versus produced water from conventional oil and gas operations in the Big Horn Basin, as well as the rights of downstream water right owners.

Water law may apply differently to water produced in association with oil and gas ("produced water") depending on several factors, including:

(1) If the oil and gas company has a ground water right in the well;
(2) If a landowner has a ground water right in the well;
(3) If the produced water is "by-product" water, meaning it has not been put to a prior beneficial use, it remains entirely within the control of the oil and gas company, it is kept separate from all other surface water supplies, and it has retained its identity separate from other surface water supplies in the drainage; and
(4) If the produced water returns to the channel or watercourse and becomes part of the surface water supply and may mix or commingle with other surface water supplies, has

lost its identity as produced water; rather, and thus downstream landowners can call it through the drainage to their appropriated points of diversion or use.

It is my understanding that some of the water produced in association with conventional oil wells in the Big Horn Basin has the following factors:

(1) The oil company is not required to obtain a ground water right from the State Engineer's office. Instead, it must obtain an oil and gas permit.
(2) Landowners don't acquire ground water rights from the State Engineer's office in the well.
(3) The produced water has not been put to a prior beneficial use, remains entirely within the control of the oil company, is kept separate from all other surface water supplies, and is by-product water. In this case, the produced water has retained its identity separate from other surface water supplies in the drainage. The oil company may enter into an agreement to provide the water to a landowner. The landowner acquires a water right for the first beneficial use from the State Engineer, identifying the produced water as the source of supply. Any water that is not consumed by the landowner's first beneficial use and returns to the channel or watercourse is return flow, becomes part of the surface water supply and is available for use by downstream landowners.

In my experience, water produced in association with coalbed natural gas in the Powder River Basin ("CBNG" or "CBM") has the following factors:

(1) Landowners have ground water rights from the State Engineer's office in many wells drilled by CBM companies. Any volume of water not consumed by the landowner's second beneficial use is return flow.
(2) The CBM company is required to obtain a ground water right in the well from the State Engineer. The production of natural gas is the first beneficial use of the ground water. Any volume of water not consumed in that first use is return flow.
(3) Even if the CBM company stores the produced water in an off-channel reservoir from which there are no surface discharges, and the water remains entirely within the control of the CBM company, it is not byproduct water because it has already been put to a beneficial use (producing natural gas). While CBM companies may allow landowners to use the water for stock watering and irrigation, the landowners cannot acquire water rights with the produced water specifically identified as the source of supply.
(4) Any volume of water from a well drilled by a CBM company that is not consumed by the CBM company (the first beneficial use) is return flow. When the return flow reaches the channel or watercourse, then it is in the drainage and becomes part of the state's surface water supply. In fact, the return flow mixes or commingles with surface water from numerous sources, including runoff, inflows to the channel from the water table, surface discharges from landowners' stock wells, irrigation return flows, etc. Landowners who have acquired water rights to the surface water supply in the channel or drainage may divert the commingled water, put it to use, and call it through the drainage to their points of diversion and use.

As a practical matter, return flow from a well drilled by a CBM company that goes into the channel or watercourses is usually mixed with other surface water supplies. I told the Council that downstream landowners have the right to call the produced water through the drainage. Downstream landowners have water rights to the surface water supply in the channel or drainage, and therefore they can call the commingled water through the drainage to their points of diversion and use. I did not mean to suggest water from a well drilled by a CBM company is by-product water, or that landowners can acquire water rights in that water as the specific source of supply. It is only when the return flow from a well drilled by a CBM company has become part of the surface water supply that downstream water right owners can call it through the drainage to their points of diversion or use.

Mr. Tyrell testified that a water right must identify the source of supply. For example, the source of supply for a surface water right would be identified as the name of the creek, such as Dead Horse Creek or Rawhide Creek. Hearing Transcript (Jan. 18, 2007) (Unedited Real Time Rough Draft) Vol. II at p. 120, lines 13-22. Recognizing there are competing demands for limited supplies of water, the State Engineer looks to the source of the water supply in determining which water right owner has the prior right to use it. Hearing Transcript (Jan. 18, 2007) (Unedited Real Time Rough Draft) Vol. II at p. 117, lines 12. The source of supply for water rights that existed prior to CBM development was, more likely than not, the natural flow in the channel. Hearing Transcript (Jan. 18, 2007) (Unedited Real Time Rough Draft) Vol. II at p. 117, lines 24-25.

Mr. Tyrell testified that, under normal situations, he doesn't distinguish between coalbed water or natural flow. Hearing Transcript (Jan. 18, 2007) (Unedited Real Time Rough Draft) Vol. II at p. 121, lines 19-24. However, to ensure the downstream pre-CBM water rights are able to call natural flow volumes through on-channel reservoirs, the State Engineer makes sure the on-channel reservoirs can pass through the volume of natural flow. Where a CBM company may have to store water in a reservoir under another agency's permit requirements, the State Engineer makes sure there is a way to get the volume of natural flows down to senior water rights. Hearing Transcript (Jan. 18, 2007) (Unedited Real Time Rough Draft) Vol. II at p. 118, lines 11-14, p. 121, lines 7-12.

To protect the rights of senior downstream water owners, the State Engineer requires the volume of natural flow to be delivered down the channel. Because return flow from wells drilled by CBM companies is usually commingled with surface water from other sources, the water passed through on-channel reservoirs to senior downstream water rights is a mixture of produced and other water. For example, if snowmelt results in runoff at a flow rate of 20 cubic feet per second, then senior downstream water right owners can call 20 cfs through the drainage—and the water that will flow through the drainage is a mixture of produced water and other surface water.

I contend that, once the return flow from wells drilled by CBM companies becomes part of the surface water supply, downstream senior water right owners can call for their full appropriation of water to be delivered through the drainage to their point of diversion or use. Once it enters the

channel and commingles with other surface waters, CBM produced water loses its identity. If there is a quantity of surface water available, senior downstream water users have the right to call for delivery of the water.

I agree with the State Engineer that appropriators who acquired water rights on the stream prior to CBM development do not have a water right in the CBM wells, or to require a CBM company to continue to produce and discharge ground water from a CBM well. Downstream water right owners cannot call for produced water before it has become part of the surface water supply by being discharged into the drainage, like other return flows.

Mr. Tyrell testified that, once the gas is produced, the water from a well drilled by a CBM company is a return flow. When the return flow gets back to a natural channel—and it is often already in a natural channel—other people are making use of it. The State Engineer does not characterize that as a waste of water. Hearing Transcript (Jan. 18, 2007) (Unedited Real Time Rough Draft) Vol. II at p. 128, lines 9-19. Once the return flow of water from a well drilled by a CBM company gets in the channel other people can make use of it. Landowners can file a permit on the creek channel and divert the water. Hearing Transcript (Jan. 18, 2007) (Unedited Real Time Rough Draft) Vol. II at p. 126, lines 14-15, 17-19.

Mr. Tyrell said that, when the return flow from a well drilled by a CBM company reaches a downstream headgate, intake, spreader dike, or reservoir, the owner of those downstream water rights can make use of it. Anyone that has a water right permit saying that the channel is the source of supply can divert water that is at their headgate and, if coalbed water shows up there, they can certainly divert it. People can put coalbed water to use under the current statutes, and it is being put to use. Hearing Transcript (Jan. 18, 2007) (Unedited Real Time Rough Draft) Vol. II at p. 11, lines 19-21, p. 121 lines 14-18; p. 125, lines 15-18.

The proposed rules would prohibit the return flow from wells drilled by CBM companies from being discharged. For several years, this return flow has become part of the surface water supply and has been beneficially used by downstream water right owners. By prohibiting these return flows, the Council will take the rights of downstream water users to put the water to beneficial use.

As I said, landowners have water rights in over 14,000 wells drilled by CBM companies. They have the right to produce and discharge 25 gallons per minute from wells drilled by CBM companies. Hearing Transcript (Jan. 18, 2007) (Unedited Real Time Rough Draft) Vol. II at p. 55, line 25; p. 56, lines 2-4. The landowners' water rights in these wells are for stock watering, irrigation, and domestic use. Under the proposed rules, the water discharged to the surface by a landowner from a well would be characterized as pollution, and thus would be prohibited. Hearing Transcript (Jan. 18, 2007) (Unedited Real Time Rough Draft) Vol. II at p. 58, lines 6-22. The proposed rules would prohibit the discharge of return flow from the beneficial use of water by landowners.

When natural gas stops being produced from a CBM well, the CBM company's water right in the well will be abandoned. However, the landowners' water rights in these wells are valuable property rights, and the landowners will continue to produce ground water and discharge return flows to the channel or watercourse. These return flows become part of the surface water supply, commingle with other surface waters and are available for use by downstream landowners. If the Council adopts the proposed rules, it will result in a taking of the landowners' water rights in the wells and downstream landowners' water rights to put return flows in the surface water supply to beneficial use.

Therefore, I ask the Council to deny the petition for rulemaking.

Yours truly,

Margo Harlan Sabec

need to see what you're doing there before we grant the first permit, it's not a practice of ours.

So clarifying a little bit further some remarks I heard earlier today about the beneficial use of this water, we certainly encourage and we see the beneficial use of a lot of water produced from wells and out of reservoirs that got there as a result of this industry.

We view it, however, not necessary -- even though it's waters of the state -- because ground water and surface water both constitutionly are the property of the state -- they are from different sources and water that comes out of the ground and is put in reservoirs, etc. is not necessarily callable through a system by an existing senior downstreat water right because it's, for all practical purposes, imported water to the natural drainage.

It wouldn't have been there absentee efforts of the industry. That doesn't mean it doesn't get used. It doesn't mean we don't encourage; and if it's at somebody's headgate or at thier intake or at thier spreaderdike or at their reservoir that that can't make use of it.

The slight distinguishing feature is that if there were to be a call for regulation on one of these ephemeral channels, we would not be, in my opinion, required to send coalbed water down to satisfy that call

because their source of supply, more likely than not, is on the natural flow of that channel, which will only be there after a rain event or a snowmelt event.

These channels are somewhat different than perennial channels where you have a base flow, but we do get those flows in these kind of times. And that's the water, generally speaking, to which those earlier rights are entitled.

We've done quite a bit of work, in my opinion, to try to make sure these systems can get better at functioning to deliver that water down through the system past the reservoirs; and it's because of that recognition of the two different sources that we've done that.

Other than that, as a general introduction, it is a pleasure to be here today; and I would entertain some questions. As I said earlier in announcing that I would be here and be available, I didn't have any printed or written remarks for the council; but I did feel like you may have some questions.

MS. FLITNER: I think you're right about that.

Wendy, go ahead.

MS. HUTCHINSON: Okay. My question pertains -- we've had a lot of testimony on what is our

of the ground and the beneficial use has been established through production of natural glass and flows down a drainage, whether or not a water right can be filed on that flow coming down the drainage -- and we heard testimony earlier today that seemed to -- people are applying for water rights and that by virtue of establishing a water right from the produced water that anything we did that would reduce that flow would impact on the water rights system and water law.

Can you clarify that?

MR. TYRRELL: Well, I can try.

The -- basically, the water right has to establish what is the source of supply. It says right on the application, What is your source of supply?

For example, let's go back to precoalbed days. The source of supply would be dead horse creek or the bellfuce river or raw hide creek or -- pick it -- you pick a name. And that would be, then, a water right that falls in the priority system along that creek. And if it's an ephemeral channel, they would get water when that channel is flowing and hopefully -- well, they would need to make beneficial use of it.

But in a setting like that, it's very difficult if not impossible to actually go out and administer or

regulate if we ever got called because of the ephemeral nature of the water being there. You get out in muddy conditions, you try and see who's first, second, third in prior and by then the storms over and floods.

So we do encourage and work to try to make these systems that we've put in. We've done quite a bit of work to make sure reservoirs in areas where, for example, they may have to store water under other permits or other requirements can have a way to get the natural drainage or leave parts of it unbanned so that we can get water down to those senior rights. It's not easy, but we do work in that direction.

But I think that anybody, then, that has a permit on the channel, with that channel that's the source of supply, can divert water that's at thier headgate. That is different; and if coalbed water shows up there, they can certainly divert it.

We don't distinguish between water that's necessarily coalbed or natural flow under normal situations, unless there's, like I said, a call for regulation, in which case, that call from people's whose source of supply is that creek, it's going to be on the natural water, not on coalbed water, in my view.

So to say that they're filing on that water is

back to this question that we would look at it as -- once it gets into the surface system, it's more of a -- an imported water source should we get asked to regulate on its behalf as opposed to the natural flow of the channel.

MR. GORDON: Okay. Well, I found a -- and I just wanted -- I don't know if this is still in effect. It's a April 26, 2004 memo, and it stays, Unless specified in the groundwater permit, water produced in the production of coalbed methane gas has no other implied use and is considered to be unappropriated waters of the state of Wyoming.

MR. TYRRELL: That would be correct, because once they lose control of that, it's in the channel and other people can make use of it.

MR. GORDON: Okay.

MR. TYRRELL: If they're there, they can file a permit on that creek channel and they can certainly divert it.

MR. GORDON: Okay. And then it goes on under groundwater, which is next. It says, If CBM produced water will be discharged and not used for any other beneficial purposes no further groundwater permiting is required.

MR. TYRRELL: That's correct.

surface water side of things -- that if you are irrigating and your return flows are -- or even your active irrigating is going into a swamp and -- somebody -- a barrow ditch along the highway where it's not going to beneficial use on your property, we can come in and stay, Stop that. Get it back on your ravine, get it back on your alfalfa, because this going into the barrow ditch stuff is a waste of water.

The question, of course, we've had put to us, is the production of the water after it's produced -- that's in the act of using the water. In the coalbed natural gas field, once the gas is produced, what you essentially have is a return flow. And where -- if we can get that back to a natural channel -- and often it already is in a natural channel -- we, at that point, because other people have been making use of the water -- and certainly the question here is have they been making use of all of it -- we have not characterized that as a waste of water, because the beneficial use hasn't been made.

Now it's a problem of dealing with the return flow. We do have a statute also that allows -- it's under the authorities of our superintendents to allow the -- or to require the construction or the returning of the curve flows back to a drain or stream channel if they are causing problems.

BEFORE THE ENVIRONMENTAL QUALITY COUNCIL
STATE OF WYOMING

IN THE MATTER OF THE PETITION TO AMEND THE WYOMING WATER QUALITY RULES AND REGULATIONS, CHAPTER 2, APPENDIX H	))))	Docket No. 05-3102

INDUSTRY RESPONDENTS' SUPPLEMENTAL COMMENTS TO RECORD OF JANUARY 17-18, 2007 RULEMAKING HEARING

Introduction and Summary

In accordance with the Council's January 18, 2007 order that the record of this rulemaking remain open for ten (10) days thereafter, the undersigned Respondents[1] submit these comments for the record. Respondents urge the Council to reject the proposed rule because key provisions of the rule are so ambiguous as to be impossible for DEQ to implement and are bound to breed uncertainty and litigation. Specifically, it is more apparent than ever that section (a)(iii) of Appendix I is subject to at least two radically different interpretations. Under one interpretation, the language of section (a)(iii) includes a complete ban on discharges of CBNG produced water that would cause change, in any respect to, water quality in receiving waters. This was DEQ's interpretation of the rule prior to and at the hearing, and one of the interpretations shared by industry and other commenters. Under another interpretation, section (a)(iii) only bans discharges that create a nuisance, render receiving waters harmful or injurious, degrade water quality for its intended

[1] The following Respondents join in these comments: Bill Barrett Corporation; Devon Energy Production, L.P.; Fidelity Exploration & Production Company; Marathon Oil Company, Merit Energy Company; Petro-Canada Resources (USA) Inc.; Yates Petroleum Corporation; Williams Production (RMT) Company.

use, or cause other adverse environmental effects. PRBRC's counsel first advanced this interpretation at the eleventh hour, in her closing remarks concluding the two-day hearing.

In light of the great uncertainty that now exists about what section (a)(iii) means, the Council should reject the petition and terminate this proceeding. Petitioners have not met their responsibility to provide the Council with clear regulatory language. Should Petitioners wish to pursue rulemaking, it is their burden to submit clear and workable regulatory language. It would be arbitrary and capricious for the Council to proceed to adopt a rule that does not mean what it says, or as to the meaning of which no one can be sure.

If the Council does not reject the Petition, Respondents object to any further action by the Council to adopt the current petition unless the Council provides the public notice of and an opportunity to comment on the new interpretation advanced by PRBRC's counsel, which differs fundamentally from what the public assumed to be the meaning of the rule that that the Council noticed for hearing on December 1, 2006. The public has never had an opportunity to comment on Appendix I with clear notice of what Petitioners now say is its intended meaning. For the reasons set forth below, should the Council decide to proceed with this rulemaking, it must republish the proposal, with an explanation of the "true" meaning of section (a)(iii), and give the public an opportunity to comment on *that* rule.

Discussion

1. The Public and DEQ Reasonably Believed Before and During the Hearing That Appendix I As Noticed For Hearing Bans All "Pollution" From CBNG Discharges.

Proposed section (a)(iii) of Appendix I, as noticed for hearing, provides:

> (a) Applications for produced water discharges from coal bed methane gas production facilities . . . shall include . . . credible data establishing each of the following: . . .
>
> > (iii) *That the produced water shall not cause contamination or other alteration of the physical, chemical or biological properties of any waters of the state, including*

> *change in temperature, taste, color, turbidity or odor of the waters*; or shall not cause the discharge of any acid or toxic material, chemical or chemical compound, whether it be liquid, gaseous, solid, radioactive or other substance, including wastes, into any waters of the state which:
>
> > (a) creates a nuisance, or
> > (b) renders any waters harmful, detrimental or injurious to public health, safety or welfare, to domestic, commercial, industrial, agricultural, recreational or other legitimate beneficial uses, or to livestock, wildlife or aquatic life, or
> > (c) degrades the water for its intended use, or
> > (d) adversely affects the environment

Prior to the hearing, the public had been led to believe that the italicized first clause of subsection (a)(iii) must be read to flatly ban any discharge that "cause[s] contamination or other alteration of the physical, chemical, or biological properties of any waters of the state" – without regard to the rest of the text in subsection (a)(iii), including the four factors in paragraphs (a) through (d). Even DEQ, the agency that is charged with interpreting the Environmental Quality Act believed that the italicized language stands alone and would operate as a ban on all discharges, and for that reason recommended that the Council not adopt the rule. Letter from John Wagner to Mark Gordon (Jan. 5, 2007).

DEQ and other commenters had good reason to interpret the first clause of section (a)(iii) as stand-alone language that is independent of the language that follows that clause and, therefore, as a ban on permitting any discharge of CBNG produced water. The drafters' punctuation dictates DEQ's interpretation.[2]

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[2] On its face, the semi-colon that appears at the end of the first clause serves in lieu of a comma, presumably because there are commas in the second clause from which the semicolon separates the first clause. In other words, this punctuation denotes two separate clauses. *See* Columbia University Press, The Columbia Guide to Standard American English (1993) at http://www.bartleby.com/68/73/5373.html:

> This punctuation mark (;) has two important uses in written English. (1) It coordinates (separates yet connects evenhandedly) two independent clauses not joined by a coordinating conjunction: *I ran to the door; no one was there. . . .* (2) The

At the hearing before the EQC on November 13, 2006, counsel for PRBRC also appeared to concede that, unless modified, section (a)(iii) broadly covered any discharge that fell within the first clause of PRBRC's proposed rule:

> MS FOX: A couple of things; one, I do agree – this is the language of the AG's opinion, which is taken from the Environmental Quality Act. The A(3) is the definition of pollution, and I do understand that it is – covers so much as to perhaps not be – so I have a suggestion, which is simply to go right to B so that it would read under A(3), "that the produced water shall not render" – are you with me – "or have a potential to render . . ." I think we should use that language, because, again, it is the AG's language; and then go on with what's there, "water's harmful, detrimental," et cetera.

Transcript (Nov. 13, 2006), p. 53, lines 24-25; p. 54, lines 1-10. Chairman Gordon restated Ms. Fox's proposal as follows:

> CHAIRMAN GORDON: Well, just so I understand what Kate's suggestion was, you're suggesting strike from "cause contamination" down to "renders"?
>
> MS. FOX: Yes.

Id., p. 55, lines 17-20. The Council ultimately determined, however, that it would not make any changes to the language of the rule, and that the rule would go forward as proposed by

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> *semicolon* also serves to separate clauses or phrases in series constructions when these already contain commas (*He had a tall, black horse; a wagon, which someone had given him after the battle; and a threadbare, tattered carpetbag*) and elsewhere where there are already other commas.

Moreover, in the second clause, the absence of a comma or semicolon after "state" and before "which" indicates that the language following "which" – the four paragraphs (a) through (d) – is a part of the second clause, but not of the separate first clause. (Interestingly, the semicolon in question, which determines the meaning of the first clause in Petitioners' language, does not appear in the definition of 'pollution" in the Environmental Quality Act. *See* Wyo. Stat. § 35-11-103(c)(i).)

PRBRC on May 11, 2006, and as accepted for rulemaking on July 17, 2006.[3]

Thus the proposed language of (a)(iii), which Petitioners' counsel admitted "covers so much," was unchanged when noticed for public comment and hearing. Understandably, in light of counsel's efforts to eliminate the first clause of (a)(iii), DEQ and Respondents believed that the clause, if adopted, would be read in accordance with its plain meaning and, therefore, would ban any discharge that would cause "contamination or other alteration" of the properties of receiving water.

Consistent with everyone's interpretation of section (a)(iii) as noticed for hearing, counsel for PRBRC, in her opening presentation on January 17, 2007, again tried to revise the petition to cut out the first clause of section (a)(iii).[4] She acknowledged that "(A)(3) is too long and it is too repetitive of the statutory language" and suggested that the Council look back at her proposals for amending section (a)(iii) at the November 13, 2006 hearing and "work this language" (without, however, attempting to articulate or restate those changes for the benefit of those in attendance at this hearing). Hearing Transcript (Jan. 17, 2007) (Unedited Rough Real Time Rough Draft) at p. 61, lines 17-25; p. 62, lines 1-3.

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[3] As Councilmember Hutchinson stated: "I would leave – this was the language we adopted at the meeting in Casper, so I would suggest that we make no changes, except [where there is] a typographical issue." *Id.*, p. 65, lines 7-10.

Counsel for the EQC confirmed at that hearing that Ms. Fox's proposed revision of (a)(iii) could not be entertained:

> MS. HILL: If you read the APA on citizens' petitions, it says you decide whether you accept or deny it. Once you accept it, you initiate rule-making on what the citizen has presented you with. . . . [Y]ou move forward with rule-making on the petition.

Id., p. 69, lines 7-10; p. 70, lines 1-2. Ultimately, the Council rejected all changes to the original language, save one typographical correction (see *id.*, p. 71-72), and published notice that the Council would consider the original rule with that correction at its January 17-18, 2007 hearing.

[4] Respondents have not yet received a copy of the final transcript of the January 17-18, 2007, hearing from EQC's court reporter. When the transcript is received, Respondents will supplement these comments with transcript citations, if the citations from the draft transcript are no longer accurate.

2. PRBRC Offered a Radically Different Interpretation of the Rule At the End of the Hearing.

During the remaining two days of hearing, DEQ and many other members of the public presented testimony premised on everyone's understanding of the language of the first clause of (a)(iii) as barring WYPDES permits for any CBNG discharge that would cause *any* alteration of receiving waters. Counsel for Petitioners heard all this testimony, then in the final hour of the hearing, after all members of the public had testified (and after many had to leave), abruptly reversed field and stated, contrary to her earlier statements, that no changes to the language of section (a)(iii) are necessary because the first clause of (a)(iii) really should be read to allow DEQ to issue a permit for some "contamination or other alteration" of receiving waters, provided the applicant demonstrates that none of four factors in paragraphs (a) through (d) is associated with the discharge. Counsel asserted that:

> Appendix I says that the produced water shall not cause contamination or other alteration and then goes on, and then – and then that is exactly qualified by the word, "which" with a colon, and then is says "creates a nuisance or renders any waters harmful, detrimental or injurious to public," etc.

Hearing Transcript (Jan. 18, 2007) (Unedited Rough Real Time Rough Draft) at p. 274, lines 15-20. She acknowledged that "nobody who has commented in the last day and a half has recognized the existence of the second part which defines that alteration that should be prohibited as an alteration which creates a nuisance or renders waters harmful." *Id.*, p. 274, lines 23-25; p. 275, lines 1-2. Explaining further, she noted:

> [If] it's not a nuisance or harmful or injurious [to a specific landowner] . . ., that gives the DEQ the regulatory leeway to allow the discharge of this water . . . . Nobody who's commented against this rule has recognized the existence of this language . . . .

Id., p. 275, lines 12-16.

In effect, Counsel for PRBRC said, DEQ and numerous witnesses had completely misread that language, and clause (a)(iii) does not, after all, mean what it clearly says.

3. The Council Must Reject Appendix I Because Its Text is Fundamentally Flawed and Unclear.

Although the text of the rule on which the EQC sought public comment and on which it held the hearing on January 17-18 is facially the same text that PRBRC advanced in May 2006, the meaning of a key portion of that text – section (a)(iii) – changed dramatically as a result of the hearing, at least as interpreted by its proponents. As a result of PRBRC's revisionist interpretation of section (a)(iii), no one can be sure about what section (a)(iii) means. At this juncture, if the Council were to adopt this rule, DEQ would have no way to know whether it should follow Petitioners' eleventh hour interpretation or its own interpretation. Adoption of the rule now would spawn a host of legal questions: Is a petitioner entitled to determine how an ambiguous rule should be interpreted? Would a reviewing court defer to a petitioner's interpretation of a rule or instead reject this as a usurpation of an executive branch function? If DEQ were to issue WYPDES permits allowing some "contamination," as PRBRC now says would be proper, who is to say that any such permit would not be challenged by other interest groups as contrary to the plain meaning of the first clause of section (a)(iii)?

The amorphous language in PRBRC's petition raises the same concerns as the language at issue in *Matter of Bessemer Mt.*, 856 P.2d 450 (Wyo. 1993). In *Bessemer*, the statute directed the EQC to "[d]esignate . . . those areas of the state which are very rare or uncommon and have particular historical, archaeological, wildlife, surface geological, botanical, or scenic value." *Id.* at 452 (quoting Wyo. Stat. § 35-11-112(a)(v) (Supp. 1992) (internal quotation marks omitted). Pursuant to that directive, the EQC designated certain

sections of land as "rare and uncommon." *Id.* at 451. The EQC, however, did not establish any regulatory "criteria and factors [that would] set the standard for that classification." *Id.* at 453. Without such criteria and factors, the court found that the phrase "rare and uncommon" was "too amorphous to permit judicial review of the action of the EQC." *Id.* at 453. Consequently, the EQC's adoption of this language, which simply repeated the statute, was "inherently arbitrary and capricious." *Id.*

As in *Bessemer*, the Council's adoption of the "no nuisance" standard for WYPDES permitting would require DEQ to "develop standards on a case by case basis, which is time-consuming; may lead to inconsistent results; and severely inhibits judicial review." *Id.* Without criteria and factors for determining "nuisance" – which, as discussed below, is a fact-intensive inquiry – the regulated community and other interested public have no notice of how the agency will determine nuisance. The EQC's adoption of this amorphous "no nuisance" standard therefore would be arbitrary and capricious and contrary to law, in violation of the Wyoming Administrative Procedure Act ("WAPA"). *See* Wyo. Stat. § 16-3-114(c)(ii)(A).

It is Petitioners' responsibility to provide clear regulatory language, and they have failed to do so. It is not the Council's job to rewrite Petitioners' rule or to provide some "legislative history" as to why otherwise plain regulatory language should be disregarded. Petitioners have demonstrated great creativity in crafting and interpreting their proposed regulatory language, both in writing and "on the fly" during hearings. This "moving target" approach, however, does not comport with rulemaking requirements and does not provide the clear and workable regulatory language required for the Council's consideration.

4. At A Minimum, the Council Should Re-Notice the "New" Appendix I for Public Comment and a Hearing.

If the Council does not reject the Petition, Respondents object to any further action by the Council on the current petition unless and until the Council has given the public notice of and an opportunity to comment on the text of the proposed rule in light of what PRBRC now says is the true meaning of section (a)(iii). Clearly, as of January 17-18, commenters were not adequately apprised of what Petitioners apparently contend is the "true" meaning of the rule. Although the text of the rule has not changed from its proposal, its meaning has fundamentally changed. Notice of the proposed rule, as now interpreted by Petitioners, did not satisfy the requirements of the Administrative Procedure Act. Under the WAPA, Wyo. Stat. § 16-3-106, any rulemaking that an agency undertakes in response to a petition from a citizen must conform to the procedures for rulemaking in Wyo. Stat. § 16-3-103, under which:

> (a) Prior to an agency's adoption, amendment or repeal of all rules other than interpretative rules or statements of general policy, the agency shall:
>
> (i) Give at least forty-five (45) days notice of its intended action. . . . The notice shall include:
>
> (A) The time when, the place where and the manner in which interested persons may present their views on the intended action;
>
> (B) A statement of the terms and substance of the proposed rule or a description of the subjects and issues involved . . . .
>
> (ii) Afford all interested persons reasonable opportunity to submit data, views or arguments, orally or in writing, provided this period shall consist of at least forty-five (45) days from the latter of the dates specified under subparagraph (A) of this paragraph . . . .

The agency is further required to "consider fully all written and oral submissions respecting the proposed rule" and to "either prior to adoption or within thirty (30) days thereafter, . . .

issue a concise statement of the principal reasons for overruling the consideration urged against its adoption." Wyo. Stat. § 16-3-103(a)(ii)(B),(D).

The Legislature enacted these requirements as quality-control measures in rulemaking and to ensure due process for those who may be affected by new or amended rules. As the Supreme Court explained in *Laughter v. Board of County Com'rs for Sweetwater County*, 110 P.3d 875 (Wyo. 2005), proper notice of a rule entails notice that is "reasonably calculated, under all the circumstances, to apprise interested parties of the pendency of the action and afford them an opportunity to present their objections." 110 P.3d at 882 (citing *Pfeil v. Amax Coal West, Inc.*, 908 P.2d 956, 960-61 (Wyo. 1995)). Procedural due process is satisfied only "if a person is afforded adequate notice and an opportunity to be heard at a meaningful time and in a meaningful manner." 110 P.3d at 882. (citing *Pfeil*., 908 P.2d at 960-61 , *Amoco Production Co. v. Wyoming State Bd. of Equalization,* 882 P.2d 866, 872 (Wyo. 1994)).

In light of the vague and ambiguous construction of Appendix I, and PRBRC's evolving interpretation of section (a)(iii), EQC cannot meet these requirements unless Appendix I is noticed for public comment. Were EQC to adopt Appendix I, and PRBRC's interpretation of section (a)(iii), without further notice-and-comment, the public will not have had an opportunity to "be heard at a meaningful time and in a meaningful manner" on the "new" rule and, potentially, to urge "considerations against its adoption." Nor will the Council have gone through the beneficial process, required by the statute, of fully considering those comments. For the Council to adopt the proposed rule without affording the public a full 45-day period in which to comment on the implications of a fundamentally changed Appendix I would be contrary to the Legislature's desire for careful adoption of

high-quality rules and would be arbitrary and capricious as well as a denial of constitutional guarantees of due process.

Comment on the proposed rule as now interpreted by PRBRC would not be an academic exercise. In at least one respect, public comment is vitally necessary to inform the Council's decision whether to adopt Appendix I. That is whether it would be sound policy to subject DEQ's decision whether to issue a WYPDES permit for a discharge of CBNG produced water to some or all of the four factors enumerated in section (a)(iii)(a), (b), (c), and (d). Respondents did not address these factors in their January 17, 2007 joint comments because the factors were superfluous under DEQ's interpretation of section (a)(iii) as a complete ban on discharges of CBNG produced water. Additional time for public comment on the new interpretation, under which these factors would now become *determinative* of DEQ's permitting decisions, would be warranted. Preliminarily, of particular concern to the CBNG industry is that, under this reading, paragraph (a)(iii)(d) of Appendix I establishes "shall not create a nuisance" as a separate and distinct factor that DEQ must consider on an ad hoc basis in deciding whether to issue a permit for a proposed CBNG produced water discharge.

Apparently DEQ would be compelled to apply a broad and ambiguous "no nuisance" standard in evaluating permit applications. Under Appendix I, almost every DEQ permitting decision – whether the Department grants or denies a permit – could be challenged either by the applicant or its opponents on the ground that DEQ did not correctly apply a free-floating "no nuisance" standard. DEQ would find itself in the role of arbiter of the common law of "nuisance," a role for which DEQ is not well suited nor authorized to fill.

Generally, a nuisance is a wrong that "arises from an unreasonable, unwarranted, or unlawful use by a person of his own property," and which works an obstruction or injury to the right of another. *Bowers Welding & Hotshot, Inc. v. Bromley*, 699 P.2d 299, 306 (Wyo.1985). If the PRBRC petition is adopted, DEQ would be directed to apply an ambiguous "no nuisance" test to permitting decisions, perhaps including private nuisances,[5] requiring DEQ to determine whether a nuisance might arise from a particular discharge. "Whether a thing is a nuisance or not is a question to be determined not merely by an abstract consideration of the thing itself, but in reference to circumstances." *Erickson v. Hudson*, 70 Wyo. 317, 335 (1952). "Nuisance" is an inherently broad standard unsuited for administrative agency determinations, and all too prone to yield inconsistent determinations.

This "nuisance" standard contrasts markedly with the objective and clear criteria that DEQ applies in making WYPDES permitting decisions under the current rules. DEQ currently sets effluent limits in WYPDES permits at levels necessary to meet state water quality standards. Moreover, Appendix I implies that a discharge could be prohibited as a "nuisance" even though the discharge meets all applicable effluent limits in section (b)(vii)[6] and neither "renders any waters harmful, detrimental or injurious to public health, safety or welfare, to domestic, commercial, industrial, agricultural, recreational or other legitimate beneficial uses, or to livestock, wildlife or aquatic life," nor "degrades the water for its intended use," nor "adversely affects the environment." Essentially, requiring DEQ to make

[5] A private nuisance affects one or a limited number of individuals and is based on the unreasonable and substantial interference with the person or persons' interest in the use and enjoyment of land or property. 58 Am. Jur. 2d, "Nuisances" §§ 31, 42, 48, 64, 256.

[6] The Council voted on January 18, 2007 to defer consideration of revised effluent limits for CBNG produced water in section (b)(vii) until Dr. Raisbeck completes the University of Wyoming's study of safe levels for sulfates and barium in water for stock and wildlife. We assume that if the Council adopts Appendix I, the rule would include the "old" limits set forth in section (b)(vii). If not, the absence of any numerical limits for these parameters would make DEQ's application of the "no nuisance" requirement even more difficult and, potentially, arbitrary.

ambiguous "no nuisance" determinations will expose the Department to legal challenges in connection with every permitting decision, as DEQ struggles to make rational determinations that do not fall within its ambit of statutory or regulatory authority.[7]

Additional comment on this aspect of the proposed rule is further warranted in light of the fact that PRBRC's counsel, in proposing revisions to section (a)(iii) at the November 13, 2006 hearing, would have excluded the "creates a nuisance" factor in section (a)(iii)(a):

> CHAIRMAN GORDON: Well, just so I understand what Kate's suggestion was, you're suggesting strike from "cause contamination" down to "renders"?
>
> MS. FOX: Yes.

Transcript, p. 55, lines 17-20. The word "renders" is the first word in (a)(iii)(b), so under this proposal (a)(iii)(a) – the "nuisance" language – would have been excluded. On January 18, 2007, however, counsel for PRBRC asserted that no change should be made to any of the language of section (a)(iii), so now the nuisance language would remain in the rule.

The uncertainty, even on the part of Petitioners, as to the proper construction of Appendix I illustrates why it is an unworkable and improvident proposed regulation. If the Council is intent upon proceeding with some form of a rule along the lines of what Petitioners have proposed, or *intended* to propose, new language must be crafted and published for comment. Only in this way could EQC both afford the public due process and ensure that any rule finally adopted has a rational basis and will allow for workable DEQ decisions in issuing WYPDES permits.

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[7] The "no nuisance" standard, and the other "prove the negative" factors in section (a)(iii)(a-d) also are unconstitutional. As described in the Respondents' joint comments submitted on January 17, 2007, the proposed regulatory language, including application of the "credible data" burden of proof and the "no nuisance" standard *only* to dischargers of CBNG produced water and to no other type of discharge in Wyoming, violates the Equal Protection clause in Article 1, Section 2 of the Wyoming Constitution and the Fourteenth Amendment of the U.S. Constitution.

Conclusion

For the foregoing reasons, Respondents respectfully requests that the EQC reject the proposed rules submitted by Petitioners and terminate this rulemaking proceeding or, alternatively, republish notice of the proposed Appendix I for further public comment.

RESPECTFULLY SUBMITTED, this 29th day of January, 2007.

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BEFORE THE ENVIRONMENTAL QUALITY COUNCIL
STATE OF WYOMING

IN THE MATTER OF THE PETITION TO AMEND THE WYOMING WATER QUALITY RULES AND REGULATIONS, CHAPTER 2, APPENDIX H	))))	Docket No. 05-3102

INDUSTRY RESPONDENTS' COMMENTS ON PETITIONERS' PROPOSED STATEMENT OF PRINCIPAL REASONS

Introduction and Summary

On February 16, 2007, the Council voted to adopt the proposed new Appendix I to Chapter 2 establishing effluent limits for discharges of produced water from coalbed methane operations, with certain amendments. Petitioners have submitted a proposed Statement of Principal Reasons to be adopted by the Council in accordance with W.S. § 16-3-103(a)(ii)(D). *See* Attachment 1 hereto ("Proposed Statement"). Industry Respondents respectfully object to six mischaracterizations or ambiguities in the Proposed Statement, all of which should be corrected and clarified in any final statement adopted by the Council.[1]

First, nothing in the record of this rulemaking supports the statement that "The proposed Appendix I . . . will maintain Wyoming's primacy for delegated programs under the federal Clean Water Act." Proposed Statement at 2. This is a red herring, as there is not a shred of evidence in the record to suggest that Wyoming's primacy would be in jeopardy if CBM discharges continued to be regulated under existing Appendix H.

Second, contrary to Petitioners' assertion, the Environmental Quality Act, W.S. § 35-11-112(c)(i), expressly requires that the Council act on a petition for rulemaking only after the

[1] The following Respondents join in these comments: Marathon Oil Company; Devon Energy Production, L.P.; Merit Energy; Petro-Canada Resources (USA) Inc.; Yates Petroleum Corporation; Williams Production (RMT) Company; Fidelity Exploration and Production Company.

proposed rule has been recommended by DEQ following consultation with the Water and Waste Advisory Board. It is incorrect to state that the adopted rule went through several years of Advisory Board proceedings. On the contrary, the rule was never presented to the Advisory Board in any of its several versions.

Third, it is not true that a hearing was held on January 17-18, 2007, on Appendix I as adopted. Before adopting Petitioners' proposed rule, the Council made drastic changes to it on February 16, 2007, by deleting section (c)(i), under which wildlife and livestock uses were presumed to occur for discharges that meet livestock drinking water standards. In fact, the Council's amendment went far beyond the scope of permissible amendments to a proposed rule and, under the Wyoming Administrative Procedure Act ("WAPA") and the Environmental Quality Act, the public must be afforded an opportunity to comment on this fundamental change in the rule.

Fourth, the Proposed Statement erroneously asserts that the rule is authorized under the EQA. On the contrary, to the extent that section (a)(i) of the rule still purports to authorize DEQ to regulate the quantity of water discharged, without regard to the quality of the discharge, by requiring actual use thereof, the rule is contrary to the EQA.

Fifth, the Proposed Statement overreaches in asserting that DEQ can promulgate an effluent limitation guideline (ELG) for the CBM industry that requires consideration of the fate of every affected produced water discharge as it flows downstream. While ELGs may be supplemented by water quality-based limits in a given permit, ELGs promulgated under the federal Clean Water Act and the EQA are uniform standards that apply to all permits in a given industry category and, by definition, do not involve case-by-case analysis of the fate of discharged water.

Sixth, Petitioners assert that "evidence in the record demonstrates that too often permit applications are based on shoddy science and DEQ issues permits based on shoddy science." Proposed Statement at 12. The draft statement does not cite a single item of specific information to support this gratuitous statement, and no such evidence was ever presented to EQC.[2]

Discussion

1. Wyoming's Primacy Was Not At Risk Under Appendix H.

Respondents' Draft Statement says that "the WYPDES program must, at all times, be in accordance with § 401 of the [federal Clean Water] Act, all guidelines promulgated pursuant to § 304(h)(2) of the Act, and the Memorandum of Agreement between the EPA Regional Administrator and the Director of the Wyoming DEQ." Proposed Statement at 2. Respondents would have the Council assert, as justification for the new rule, that Appendix I "addresses shortcomings" and thereby "maintain[s] Wyoming's primacy" for issuing discharge permits under the Clean Water Act. *Id.*

Since 1975, Wyoming has been authorized under Section 402(b) of the federal Clean Water Act ("CWA") to administer the NPDES permit program in lieu of EPA. *See* 33 U.S.C. § 1342(b); 40 C.F.R. Part 123 (requirements for State programs). As an authorized State, Wyoming must satisfy certain federal statutory and regulatory requirements to maintain authorization of its Wyoming NPDES ("WYPDES") program. *See* 33 U.S.C. § 1342(b); 40 C.F.R. Part 123.

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[2] Additionally, the discussion at pages 9-11 of the proposed Statement, which apparently predates the February 16, 2007 proceedings, in which Petitioners seek to qualify the reach of section (a)(iii) as something less than a prohibition on discharges of CBM water, is irrelevant in light of the Council's deletion of section (a)(iii) from the adopted rule and should be removed from the Statement.

EPA can withdraw authorization of the State program, but *only* if EPA provides notice to the State and then holds a public hearing consistent with certain statutory and regulatory criteria and procedures. *See* 40 C.F.R. § 123.63(a) (specifying criteria for determining whether State program complies with applicable requirements); *id.* § 123.64 (procedures for notice and public hearing); *id.* §§ 123.64(b)(8)(iii), (vi) (allowing EPA to withdraw State authorization only after EPA gives the State up to 90 days to take corrective action and the State fails to do so); 33 U.S.C. § 1342(c)(3) (same). Congress intended that EPA would not exercise its withdrawal "except upon a clear showing of failure on the part of the State to follow the guidelines or otherwise to comply with the law." 118 Cong. Reg. 33750 (1972); *see id.* at 33761 (Congress "expect[s] the Administrator to use this authority judiciously; it is their intent that the Act be administered in such a manner that the abilities of the States to control their own permit programs will be developed and strengthened"); *see also Save the Bay, Inc. v. EPA*, 556 F.2d 1282, 1287 (5th Cir. 1977) (citing legislative history to support "the theme of restraint in the EPA's exercise of its supervisory role").

There has been no indication by either EPA or any other interested person that Wyoming is failing to meet the applicable requirements for administering its WYPDES program *at all*, let alone with respect to the State's enforcement of discharges from CBNG production. Even if there were, EPA would be expected to exercise its restraint in determining whether to withdraw Wyoming's WYPDES program and would be required to follow the detailed statutory and regulatory procedures. Thus, there is no basis for claiming that the new Appendix I to Chapter 2 is necessary to "maintain Wyoming's primacy for delegated programs of the federal Clean Water Act," Proposed Statement at 2, and the unsupported risk of losing State CWA

authorization should *not* provide *any* basis for adopting Appendix I. This assertion therefore should be deleted from the Statement of Principal Reasons.

At none of the hearings on the rule have Petitioners ever asserted that Wyoming's primacy was at risk if the State did not create a separate Appendix I with effluent limits specific to discharges of CBM produced water, let alone evidence to support that assertion. Indeed, EPA only recently published notice of its intent to consider whether it is appropriate to develop effluent limitation guidelines for CBM discharges. *See* 71 Fed. Reg. 76644 (Dec. 21, 2006). EPA's stated intent is to develop more information about CBM discharges "in order to determine whether it would be appropriate to conduct a rulemaking to potentially revise the effluent guidelines for the Oil and Gas Extraction category to include limits for [CBM]." *Id.* at 76656. Clearly, the Agency would not find fault with Wyoming's continued use of Appendix H, which reflects the technology-based effluent limitations for oil and gas producers in 40 C.F.R. Part 435, in WYPDES permitting for CBM discharges. That is the applicable effluent limitation guideline for all oil and gas produced water discharges under the Clean Water Act, and will remain so unless and until EPA determines, based on record evidence, that a separate ELG is needed for CBM discharges.

If the Council nevertheless believes that adoption of Appendix I was required by federal law, then, at a minimum the Statement of Principal Reasons must include those items required under section 103 (a)(i)(F) of the WAPA, which were not included in the public notice for the proposed rules. Furthermore, pursuant to W.S. § 16-3-103(a)(ii)(C), Industry Respondents hereby request that the Council provide them with "a written response explaining and substantiating the agency's position by reference to federal law or regulations." The Council

must also provide "to the governor and legislative service office a concise statement of [this] objection and the agency's response."

2. The Rule Was Never Presented to the Advisory Board And Could Not Be Lawfully Adopted Without A Recommendation From DEQ Following a Hearing Before the Advisory Board.

Petitioners would have the Council state that "this rule has gone through several years of the Advisory Board and Administrator process." Proposed Statement at 4. This is simply not true. Notwithstanding that Industry Respondents urged the Council to refer the PRBRC petition to the Advisory Board as long ago as June 2006[3], this rule has never been considered by the Advisory Board, the Board has never received public comment on the rule, and DEQ has never recommended that this rule be adopted.

Despite contending erroneously that Appendix I has gone through the Advisory Board and DEQ review process, Petitioners also would have the Council erroneously find that it is empowered to promulgate rules without regard to the EQA's requirements that rules be adopted only upon a recommendation from the Director following consultation with the Water and Waste Advisory Board. The language of W.S. § 35-11-112(a)(i) is unmistakably clear. The Council's enumerated powers include the power to "[p]romulgate rules and regulations necessary for the administration of this act, *after recommendation from the director of the department, the administrators of the various divisions and their respective advisory boards*." (Emphasis added.) This prohibition of unilateral rulemaking is confirmed in W.S. § 35-11-112(a)(ii), under which the Council is empowered to "[c]onduct hearings as required by the Wyoming Administrative Procedure Act [W.S. §§ 16-3-101 through 16-3-115] for the adoption, amendment or repeal of

[3] See Joint Response to Petitioners' First Status Report, filed June 16, 2006, at 16.

rules, regulations, standards or orders recommended by the advisory boards through the administrators and the director." (Emphasis added.)

Petitioners contend that this limitation on the Council's power to promulgate rules does not apply where a member of the public petitions EQC to adopt a rule, citing W.S. § 35-11-112(c)(1), which provides: "Subject to any applicable state or federal law, and subject to the right to appeal, the council may: (i) Approve, disapprove, repeal, modify or suspend any rule, regulation, standard or order of the director or any division administrator;. . . ." However, this language does not say the Council is authorized to "approve, disapprove, repeal, modify or suspend" rules only when it engages in rulemaking in response to citizen petitions. Thus, W.S. § 35-11-112(c)(1) could not be read to negate W.S. §§ 25-11-112(a)(i) and (ii) *only* with respect to citizen petitions. If read as an independent grant of authority to EQC, W.S. § 35-11-112(c)(i) would have to be operative in all rulemakings and, thus, would also negate W.S. §§ 35-11-112(a)(i) and (ii) for DEQ-proposed rules as well. To avoid that absurd result, and to harmonize these provisions and give meaning to both, W.S. § 35-11-112(c)(i) must be read as being subject to the "applicable state law" in the preceding W.S. § 35-11-112(a)(1).

Therefore, even citizens' petitions must be submitted to the Director, the Administrator of the appropriate division and the respective advisory board so that the Council will have the requisite professional advice on whether a proposed rule meets EQA's criteria and is in the best interests of Wyoming. By neglecting this duty, the Council compromised the quality control and consultation procedures the Legislature established for rulemaking on highly technical subjects under the EQA. As a result the Council struggled, and the State will suffer, with rule language that not even Petitioners' counsel could adequately explain at the January 17-18 hearing, as she said the Council would have to "work this language" to make the rule clear. Hearing Transcript

(Jan. 17, 2007) at p. 61, lines 17-25; p. 62, lines 1-3. "Working" the language of environmental regulations is the function of DEQ and the Advisory Board, and should have occurred before Appendix I was presented to the Council for final approval.

3. EQC Failed to Hold an Effective Hearing on Appendix I, As Amended.

Petitioners would have the Council find that "a hearing was held [on the adopted rule] January 17 & 18, 2007." It is true that EQC held a hearing on Petitioners' proposed rule, which included section (c)(i). However, EQC has never held a hearing on the fundamentally different rule it adopted on February 16.

Any rulemaking that an agency undertakes in response to a petition from a citizen must conform to the procedures for rulemaking in W.S. § 16-3-103, under which:

> (a) Prior to an agency's adoption, amendment or repeal of all rules other than interpretative rules or statements of general policy, the agency shall:
>
> (i) Give at least forty-five (45) days notice of its intended action. . . . The notice shall include:
>
> (A) The time when, the place where and the manner in which interested persons may present their views on the intended action;
>
> (B) A statement of the terms and substance of the proposed rule or a description of the subjects and issues involved . . . .
>
> (ii) Afford all interested persons reasonable opportunity to submit data, views or arguments, orally or in writing, provided this period shall consist of at least forty-five (45) days from the latter of the dates specified under subparagraph (A) of this paragraph . . . .

The agency is further required to "consider fully all written and oral submissions respecting the proposed rule." W.S. § 16-3-103(a)(ii)(B),(D).

The Legislature enacted these requirements as quality-control measures in rulemaking and to ensure due process for those who may be affected by new or amended rules. As the Supreme Court explained in *Laughter v Board of County Com'rs for Sweetwater County*, 110 P.3d 875

(Wyo. 2005), proper notice of a rule entails notice that is "reasonably calculated, under all the circumstances, to apprise interested parties of the pendency of the action and afford them an opportunity to present their objections." *Laughter*, 110 P.3d at 882 (citing *Pfeil v Amax Coal West, Inc.*, 908 P.2d 956, 960-61 (Wyo. 1995)). Procedural due process is satisfied only "if a person is afforded adequate notice and an opportunity to be heard at a meaningful time and in a meaningful manner." 110 P.3d at 882 (citing *Pfeil*, 908 P.2d at 960-61, *Amoco Production Co. v Wyoming State Bd. of Equalization*, 882 P.2d 866, 872 (Wyo. 1994)).

EQC amended the proposed Appendix I in a very significant and material way, by deleting section (c)(i) of the proposed rule. Section (c)(i) provided that any discharge that meets that livestock water quality limits would be presumed to be beneficially used by livestock or wildlife if discharged to the surface and, thus, the permit applicant would not have the burden of demonstrating beneficial use. As a result of the EQC's *sua sponte* deletion of the language in section (c)(i), however, a permit applicant now has the burden to "establish" that the discharge will actually be put to a beneficial use. As explained below in the next section of these comments, this amendment – depending how it is interpreted – may impose requirements on applicants for WYPDES permits that go well beyond what Petitioners sought in the rule.

Looked at another way, the extent of the Council's action – and why it cannot be reconciled with the EQA and the WAPA – becomes even clearer. At the time the Council took up the Petition, section (c)(i) was the applicable standard for CBM discharges under Appendix H. The Petition proposed various changes to Appendix H, which took the form of a new Appendix I, but *did not* propose any changes to section (c)(i). As a result the Petition proposed *no change* to section (c)(i). When the Council struck section (c)(i) on February 16, 2007, it repealed a section of the governing regulations with no advance notice whatsoever.

It is a basic principle of administrative law that agencies may make changes to a proposed rule after the comment period has closed *only* if the changes are "in character with the original scheme and [are] foreshadowed in proposals and comments advanced during the rulemaking." *Beirne v Sec'y of Dep't of Agric*, 645 F.2d 862, 865 (10th Cir. 1981) (citation and internal quotation marks omitted). In *Beirne*, the court found that although the proposed and final regulations differed, the final regulation was "only another, perhaps clearer, way of saying what was explicit in the proposed regulation." *Id.* at 864. The "bare words of the proposal were adequate to alert those interested" and the final rule did not change "either the effect of or the intent behind the proposed rule." *Id.* at 865.

EQC's deletion of the language in section (c)(i) regarding the presumption of beneficial use of CBM produced water discharges is *not* in character with the original proposal and was *not* foreshadowed during the rulemaking so as to alert interested parties that this presumption could be removed. In fact, Petitioners' attorney stated the intent of their revised proposed Appendix I was not to change the standard for agricultural use, but only to change the type of data required by the rule. Hearing Transcript (Jan. 18, 2007) at 254-256. EQC nevertheless *repealed* an existing regulation when this action was not requested by the Petition. This drastic change goes well beyond simply the kind of "mere change in wording" that was at issue in *Beirne*. *Id.* The public were mere spectators at the February 16 EQC meeting and had no notice or opportunity to comment on this amendment when it was offered, let alone an opportunity to "be heard at a meaningful time and in a meaningful manner" and to urge "considerations against its adoption." *See Laughter, supra*, 110 P.3d at 882. The Council's radical rewrite of the proposed rule's provisions on beneficial use without the benefit of any public comment was contrary to the

Legislature's desire for careful adoption of high-quality rules and was arbitrary and capricious as well as a denial of constitutional guarantees of due process.

4. Contrary to the Proposed Statement, Appendix I, As Amended, Appears to Unlawfully Regulate Quantity of Water Discharges Contrary to the Environmental Quality Act.

Section (a)(i) of the rule requires a WYPDES permit applicant to "establish," *inter alia*, "that the produced water discharged into surface waters of the state . . . shall be of good enough quality to be used for wildlife or livestock watering or other agricultural uses and *actually be put to such use during periods of discharge*." (Emphasis added.) This language was carried over unchanged from Appendix H. Section (c)(i) of the proposed rule, also carried over from Appendix H, created a presumption of such "actual use" where the proposed discharge "is accessible to livestock and/or wildlife, meets the effluent limitations specified in this appendix, and meets the criteria of the protection of livestock and wildlife as specified in Chapter 1." With the Council's decision to delete section (c)(i), the final rule – if interpreted to require a showing of "actual use" of all or some particular quantity of discharged CBM water – if runs afoul of the Attorney General's formal opinion of April 12, 2006.

In that opinion, the Attorney General addressed the issue of whether the EQA "grant[s] authority to regulate water quantity to ensure that all produced water from coalbed natural gas (CBNG) production is at all times actually used for wildlife or livestock watering or other agricultural uses." Formal Opinion No. 2006-001 at 1. His answer was "no," because "the EQA allows regulation of the quantity of water [only] if the quantity has an unacceptable effect on the quality of the water." *Id.* Petitioners' original petition, the Attorney General noted, "wants the EQC to dictate to DEQ that it must consider 'how much the cows or antelope will actually drink.'" *Id.* at 2. "The EQA does not authorize such an action." *Id.* "Petitioners want

the regulation of water quantity for agricultural use, regardless of the quality of the water. There is no such authority under the EQA . . . . There is no express authority, nor is there any implied authority, in the EQA for regulation of water quantity in the absence of a *direct tie* to water quality." *Id.* at 5-6 (emphasis added). Thus, the EQA does not authorize a rule "to ensure that all produced water from oil and gas production is at all times actually used for wildlife or livestock watering or other agricultural uses." *Id.* at 8.

Council Member Boal pointed out repeatedly that deletion of section (c)(i) would render the rule unlawful under the EQA: "See, you got to remember this the original Powder River petition was essentially to undue [sic] (c)(i), and that provoked the AG's opinion that we didn't have authority to do it." Draft Transcript, Feb. 16, 2007, at 89, lines 17-20. Elaborating, he observed:

> [T]he first petition was aimed at, you know, doing the assumption which is contained in subsection (c)(i). That was – that was the whole idea, and you know, you'll recall that we went forward on – we wanted to go forward on considering taking out that assumption. Next thing we know, we get a formal AG's opinion saying we don't have authority to do that, because we're regulating quantity.

Draft Transcript at 90, lines 19-25. He cautioned against the amendment because it would go beyond what even the Petitioners sought under section (a)(i) and render the rule unlawful:

> Powder River reads the same petition, they read the same opinion, their revised language takes that out. I mean, we shouldn't enact something that we know has a high degree of probability that it will not withstand scrutiny from the AG. We're waisting (sic) everybody's time to do that.

Draft Transcript at 96, lines 23-25; 97, lines 1-2.

The Council went ahead and deleted section (c)(i)'s presumption that water of adequate quality will be used, leaving an ambiguous but potentially Draconian "actually used" test. The Statement of Principal Reasons must make it clear that section (a)(i) requires, at most, a showing

that discharged water that meets applicable quality standards will be available to "actually be put to such use [for livestock or wildlife watering or other agricultural uses] during periods of discharge." Otherwise, as Council Member Boal explained, the rule is an unlawful attempt to regulate the quantity of water discharged even though the discharge meets applicable effluent quality standards, i.e., to limit quantity without regard to quality.

5. Appendix I Could Not Lawfully Be Applied to Impose Effluent Limits on CBM Discharges Based on the Downstream Fate of Their Constituents.

Under section (a)(ii) of the rule, a permit applicant must establish that the "quantity of produced water shall not cause, or have the potential to cause, unacceptable water quality." Petitioners' draft Statement of Reasons would have the Council graft an entirely new concept onto this requirement, namely that DEQ must "require applicants to establish more than just acceptable water quality at the end of pipe." Petitioners would have the Council find that DEQ has "failed to look to the fate of discharged water as it travels downstream." Proposed Statement at 11.

However, Appendix I is an effluent limitation guideline, to be established in accordance with section 304(b) of the Clean Water Act, 33 U.S.C. § 1314(b).[4] ELGs are, by definition, generally applicable, technology-based limitations that apply at the end-of-pipe, and which incorporate considerations of availability, feasibility, and cost. *See* 33 U.S.C. § 1314(b).[5] ELGs

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[4] Under the EQA, DEQ establishes "standards for the issuance of permits as authorized pursuant to section 402(b) of the Federal Water Pollution Control Act [33 U.S.C. 1342(b)]." W.S. § 35-11-302(a)(iv). Section 402(b) incorporates, inter alia, section 311 of the Clean Water Act, which requires application of effluent limitations promulgated under the Act to all point source discharges. See 33 U.S.C. §§ 1342(b); 1311(e).

[5] Effluent limitations in CWA permits fall into two categories: technology-based effluent limits and water-quality-based effluent limits. *Catskill Chapter, Trout Unlimited v NYC*, 451 F.3d 77, 85 (2nd Cir. 2006). Technology-based limits require installation of various forms of technology that will reduce the discharge of pollutants. *See Texas Oil & Gas Ass'n v EPA*, 161 F.3d 923, 927 (5th Cir. 1998); *see also Maier v EPA*, 114 F.3d 1032, 1034 (10th Cir. 1997) ("The CWA mandates varying standards of technology-

are inherently not tailored to site-specific or local situations; rather they represent generic limitations for industrial categories that typically must be incorporated in an NPDES permit. The fate of CBM discharges after discharge and mixing is by definition not relevant to ELGs, which apply to all discharges within a given industry.

6. No Evidence of "Shoddy Science" on DEQ's Part Was Presented In This Proceeding.

Apparently in an effort to fabricate a rationale for this rule, Petitioners would have the Council state that "evidence in the record demonstrates that too often permit applications are based on shoddy science and DEQ issues permits based on shoddy science." Proposed Statement at 12. Petitioners do not, and could not, cite to any specific evidence of "shoddy science" because none was presented. Petitioners presented no evidence from any expert in the course of this proceeding. Even Professors Munn and Paige, offered as "resources," at no point suggested that either permit applicants or DEQ permitting staff have ever asserted or relied on technical or scientific findings that they knew were wrong or unreliable in the process of issuing WYPDES permits. This proposed finding is a gratuitous insult to DEQ technical staff and to the engineers and consultants who represent CBM producers in WYPDES permitting, and should be deleted.

Conclusion

For the foregoing reasons, the Industry Respondents urge the Council to adopt a Statement of Principal Reasons that does not include the erroneous statements identified in

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based treatment as the minimum requirement for different categories of point sources.") (citing 33 U.S.C. §§ 1311, 1314). In setting technology-based limits, the agency "will consider the available technologies, costs in relation to effluent reduction benefits, engineering aspects of various control techniques, available best management practices, and non-water-quality environmental impacts." *Catskill Chapter*, 451 F.3d at 85 (citing 40 C.F.R. §§ 125.3(c), (d)). This is inherently an industry-wide, not a site-specific, rulemaking exercise.

Points 1, 2, 3, 4, 5, and 6 above and which clarifies that the rule does not seek to regulate the quantity of produced water discharges without regard to the quality of such discharges.

Dated: February 22, 2007.

Respectfully submitted,

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ATTACHMENT 1

BEFORE THE ENVIRONMENTAL QUALITY COUNCIL

PETITION TO AMEND WYOMING WATER QUALITY RULE, CHAPTER 2, APPENDIX H	)))	05-3102

STATEMENT OF PRINCIPAL REASONS

The Environmental Quality Council, pursuant to its authority under the Environmental Quality Act, W.S. § 35-11-112, and the Wyoming Administrative Procedure Act, W.S. § 16-3-103, proposes rulemaking to amend Chapter 2 of the Wyoming Water Quality Rules. The proposed rule change leaves the Appendix H unchanged as to traditional oil and gas production facilities, removes the Appendix H provisions specific to Coal Bed Natural Gas, and revises the standards applicable to produced water discharged from Coal Bed Natural Gas Facilities in a new Appendix I.

Background

The Federal Water Pollution Control Act (the Act) of 1972, as amended by the Clean Water Act (CWA) of 1977 and the Water Quality Act of 1987, give the Environmental Protection Agency (EPA) the authority to regulate the discharge of pollutants to waters of the United States. The Act provides broadly defined authority to establish the National Pollutant Discharge Elimination System (NPDES) Permit Program, define pollution control technologies, establish effluent limitations, obtain information through reporting and compliance inspections, and take enforcement actions when violations occur.

The Code of Federal Regulations, Chapter 40 Part 123, provides procedures for States to assume responsibility for implementing the NPDES Permit Program. On

November 1, 1974, Wyoming Governor Stan Hathaway submitted a request to the EPA for Wyoming to conduct a state permit program pursuant to the provisions of the NPDES under Section 402 of the Act. On January 30, 1975, pursuant to § 402(c) of the Act, the EPA approved the Wyoming Department of Environmental Quality (WDEQ) NPDES program and suspended the issuance of NPDES permits by EPA, with a few exceptions. The Wyoming NPDES program authority was amended September 24, 1991 to include state authority for issuance of general permits. The program has been renamed Wyoming Pollutant Discharge Elimination System (WYPDES).

The WYPDES program must, at all times, be in accordance with § 401 of the Act, all guidelines promulgated pursuant to § 304(h)(2) of the Act, and the Memorandum of Agreement between the EPA Regional Administrator and the Director of the Wyoming DEQ.

Principal Reason for Revision of the Rule

The principal reason for the proposed rule revisions is: The existing Appendix H, although apparently effective to regulate water discharged in traditional oil and gas operations, has been demonstrated to be inadequate to protect water quality and prevent pollution resulting from the discharge of water from coal bed natural gas (a/k/a coalbed methane, "CBM"). The proposed Appendix I, specifically applicable to water discharged from CBM facilities, addresses those shortcomings, brings the rules in compliance with the Wyoming Environmental Quality Act, and will maintain Wyoming's primacy for delegated programs of the federal Clean Water Act.

Rulemaking Process

A group of 19 landowners and the Powder River Basin Resource Council filed a Petition to Amend Chapter 2, Appendix H December 7, 2005. The Environmental Quality Council held two public hearings on the Petition (February 16, 2006 in Cheyenne and July 17, 2006 in Casper), received and reviewed voluminous written comments, and determined that environmental concerns existed sufficient to consider a rule revision in formal rulemaking proceedings. The documents are available for review on the EQC website, http://deq.state.wy.us/eqc/index.asp, Docket No. 05-3102. The rulemaking hearing was noticed pursuant to the Wyoming Administrative Procedures Act, W.S. 16-3-103(a)(i), and a hearing was held January 17 & 18, 2007 in Cheyenne, Wyoming. The record was left open until January 29, 2007. The members of the Council have carefully reviewed the entire record, including the public comments at the rulemaking hearing as well as the entire documentary record. It is the judgment of the Environmental Quality Council that Wyoming Water Quality Rules and Regulations Chapter 2 should be amended for the reasons set forth below.

Summary of the Proposed Revisions

Appendix H is unchanged as to water quality standards applicable to traditional oil and gas production facilities. A new Appendix I would include new standards applicable strictly to water produced from CBM facilities. The Appendix I language is derived from the definition of "pollution" at W.S. § 35-11-103(c)(i) and the Wyoming Attorney General Formal Opinion No. 2006-001. It requires applicants for CBM-WYPDES permits to establish that the quantity of produced water would not cause or

have the potential cause unacceptable water quality and would not cause pollution; and it would require permit applicants to submit scientifically valid data to establish those requirements will be met.

1. EQC rulemaking authority

The Wyoming Administrative Procedures Act provides an avenue for citizens to "petition an agency requesting the promulgation, amendment or repeal of a rule." W. S. 16-3-106. The EQA also gives the EQC authority to "approve, disapprove, repeal, modify or suspend any rule [or] regulation. . ." W. S. 35-11-112(c)(i). That provision, unlike W.S. 35-11-112(a)(i), does not require recommendation from the director, administrator and advisory boards. In accordance with the WAPA, the EQC over the years has regularly considered citizen rulemaking petitions (*e.g.* the recent smoke rules, hog farm rules, and numerous petitions brought by industry itself under Chapter 1 for reclassification) without advisory board input. Citizens should be able to petition for rulemaking in exactly this sort of situation, in which the agency itself has been unable or unwilling to address a very significant environmental issue. This historic practice is authorized by the WAPA and the EQA and should not be stopped now. The suggestion that the EQC should accept the Petition and then refer it to the Advisory Board and Administrator would defeat the purpose of the citizen Petition. This rule has gone through several years of the Advisory Board and Administrator process. A referral now would only serve to delay.

The Council applauds the efforts of the CBM Task Force, the voluntary Produced Water Initiative, and the Wyoming legislature to address some of the issues arising from

CBM development, and it is hoped they each will find some success within their spheres. Similarly, the Council encourages any cooperative efforts to resolve differences between industry and landowners. The Council agrees such efforts may often bring the best solution. However, the Council notes the playing field is not level, and hearing testimony made it clear significant problems persist. The possibilities for other approaches to solutions do not alter this Council's authority, jurisdiction, or obligation to proceed with rulemaking.

2. Regulating traditional oil and gas separately from CBM

There was extensive public comment regarding the fear that the rule change would impact water users who use water discharged from traditional oil and gas operations, and there were (somewhat contradictory) comments questioning the basis for issuing a different regulation for CBM. The Council finds the distinction between water produced from traditional oil and gas is evident in the unqualified support in the record for continued discharge of such water, in contrast to the very strong opposition expressed by some to the water produced from CBM.

The Wyoming Attorney General has opined that, "if the Council desires to promulgate a separate and distinct section related to CBNG, it may do so." July 12, 2006 letter from AG to EQC Chair Gordon at 8. The distinction is supported by the degree of environmental impact caused by the overwhelming volume of CBM water (cumulative water production from CBM in the Powder River Basin estimated at 1,495,153 acre-feet (11.6 billion barrels). Water production is expected to peak between 2011 and 2014 at

154,671 acre-feet (1.2 billion barrels) annually, or double the current rate. Oil production is long-term as opposed to CBM, and therefore there is a historical reliance on the oil-field water (and they are grandfathered), the SEO requires a permit for CBM water and not oil-produced water, the existing Appendix H (d) language is targeted specifically to CBM, and EPA is drafting guidance specific to CBM. All of these considerations provide a separate and distinct basis for regulating CBM water separately from traditional oil and gas-produced water.

3. Regulation of pollution

The Wyoming Environmental Quality Act charges the DEQ to "prevent, reduce and eliminate pollution." W.S. 35-11-102. There are two distinct questions: First, does the DEQ have the authority to regulate CBM water's impacts as "pollution?" Second, how should DEQ regulate CBM water as "pollution?"

(a) CBM discharge water is "pollution"

"Pollution" is defined for purposes of water quality as:

> . . . contamination or alteration of the physical, chemical, or biological properties of any waters of the state, including change in temperature, taste, color, turbidity or odor of the waters or any discharge of any acid, or toxic material, chemical or chemical compound, whether it be liquid, gaseous, solid, radioactive or other substance, including wastes, into any waters of the state which creates a nuisance or renders any waters harmful, detrimental or injurious to public health, safety or welfare, to domestic commercial, industrial, agricultural, recreational or other legitimate beneficial uses, or to livestock, wildlife or aquatic life, or which degrades the water for its intended use, or adversely affects the environment.

W.S. 35-11-103(c)(i).

CBM water alters the physical properties of the waters of the state. CBM water is "industrial waste." Northern Plains Resource Council v. Fidelity Exploration and

Development Co., 325 F.3d 1155, 1161 (9th Cir. 2003), *cert. denied*, 540 U.S. 967 (2003) ("Because Fidelity is engaged in production of methane gas for commercial sale and because CBM water is an unwanted byproduct of the extraction process, CBM water falls squarely within the ordinary meaning of 'industrial waste.'"); Sierra Club v. Cedar Point Oil Co., 73 F.3d 546, 568 (5th Cir. 1996)(concluding "produced water" is encompassed as "industrial waste"). In addition, CBM water falls under the catchall definition of "waste" by virtue of it being both an "industrial waste" and a "liquid" or "other substance which may pollute any waters of the state."[1]

(b) DEQ has the authority to regulate CBM water's pollution effects

There is no basis for the DEQ position that it is only authorized to regulate water quality. To the contrary, the EQA specifically recognizes that quantity of water has important environmental impacts that can and should be regulated. That is why, for example, the EQA contains the following language:

> No person, except when authorized by a permit issued pursuant to the provisions of this act, shall:
>
> . . .
>
> (iv) Increase the quantity or strength of any discharge. . .

W.S. 35-11-301(a).

The Wyoming Attorney General has also recognized that authority. In answer to the question posed by the EQC, the Wyoming Attorney General has opined that the Council has "the authority to regulate the quantity of water produced" from CBM, if the Council determines that the produced water is a "nuisance" under the statutory definition of "pollution."

[1] "Waste" is defined as "sewage, industrial waste and all other liquid, gaseous, solid, radioactive, or other substances which may pollute any waters of the state." WYO. STAT. § 35-11-103(c)(ii). CBM water is a substance which may pollute waters of the state.

> When considering "nuisance" in context, it is clear that it must be a discharge of any "acid or toxic material, chemical or chemical compound, whether it be liquid, gaseous, solid, radioactive or other substance, including waste into any water of the state" that creates the nuisance. The Council is granted the authority to regulate the discharge of substances into the waters of the state that create a "nuisance" in that sense.

July 12, 2006 AG letter at 6 (emphasis added). The AG recognized that "nuisance" includes "waste." "Waste" includes CBM water. When the waste causes harm or injury, it is the DEQ's charge to control the environmental degradation through effective rules that are effectively implemented.

CBM water quality (including its quantity and timing) is creating a nuisance that renders the waters harmful to agricultural and other beneficial uses, and to livestock, wildlife or aquatic life. (W.S. 35-11-103(c)(i)). The EQC and the DEQ have the authority, as well as the obligation, to regulate "pollution" – including the quantity and timing, as well as the quality, of water that creates that nuisance.

(c) The rule does not infringe on the State Engineer's authority or affect irrigation return flows

This approach is consistent with the EQA, and does not run afoul of the limitation on interference with the State Engineer jurisdiction, duties or authorities. W.S. 35-11-1104. (The State Engineer specifically stated at the hearing that he did not believe the proposed rule infringed upon his authority). DEQ will not mandate water rights administration, but would leave it as usual to the SEO and Board of Control. DEQ will require permittees to reduce or eliminate pollution; the mechanism for doing so is up to the permittee, who would need to obtain necessary permits from the other agencies as applicable. This is no different than the current structure: many DEQ-issued permits are

dependent upon reservoirs in order to meet WYPDES permit terms. Reservoir permits are then obtained from the SEO, and that structure does not interfere with SEO jurisdiction. The Council rejects the attempts of some commenters to style the issue as one of Constitutional law or "waters of the state" as unfounded. The Council is aware of the limits of its jurisdiction and will not exceed them.

The Council also notes that 40 CFR § 131.10(a) requires that:

> Each State must specify appropriate water uses to be achieved and protected. The classification of the waters of the State must take into consideration the use and value of water for public water supplies, protection and propagation of fish, shellfish and wildlife, recreation in and on the water, agricultural, industrial, and other purposes including navigation. In no case shall a State adopt waste transport or waste assimilation as a designated use for any waters of the United States

Finally, "return flows from irrigated agriculture," are specifically excluded from discharges requiring a WYPDES permit, which should allay the fears of some commenters that this rule would have any impact on irrigation return flows. (Water Quality Rules, Chapter 2, §2(b)(v).

(d) The rule would not prohibit discharges of CBM water

Pollution is allowed within "clear and defined boundaries." The Council finds nothing in the record to support the contention that the proposed rule would require DEQ to prohibit CBM water discharge. The rule would require DEQ to regulate its impacts, in accordance with the Environmental Quality Act.

Appendix I(a)(iii) has two parts: First, it defines when discharged water should be regulated by the DEQ – when it is "pollution." "Pollution," in the context of CBM water, includes discharges that alter the physical, chemical or biological properties of

water, including industrial waste. The Environmental Quality Act authorizes DEQ to regulate pollution. "Pollution" is a function of chemical concentrations as well as turbidity, temperature, alterations to the hydrograph, timing and flows. The first paragraph of Appendix I(a)(iii) directs DEQ to regulate CBM water that causes pollution in all its forms.

Second, Appendix I(a)(iii) limits the scope of CBM water that should be regulated by DEQ to water "which:" creates a nuisance or causes injury. The rule's opponents have ignored the qualifications following the word "which" that are set forth in (a), (b), (c) and (d). Not all pollution would be regulated or prohibited under this language; only pollution that causes injury.

The contention that the language would require all discharges to cease is unsupported in the record. The Council rejects some commenters' attempts to create an ambiguity by their determination to interpret the rule in a distorted fashion, saying it would prevent all discharges. That is not the case.

The Council does recognize the validity of some of the criticism regarding the rule language, and has edited portions that are superfluous and may cause confusion. This is not a "new" rule. The nuisance standard that some commenters protested was sprung upon them at the January hearing has in fact been in the language of the proposed rule since May 8, 2006 (Petitioner's First Status Report, Exhibit 24), and is in the language of the proposed rule that was sent to public notice pursuant to the APA. Appendix I(a)(iii)(a) "creates a nuisance")

The rule requires that discharges that cause damage such as the damage to Marge West's alfalfa meadows would have to be handled by one of the several alternatives to

surface discharge (or better water management). For those people who say they like the water, it is not a nuisance and does not cause injury. Its discharge would continue to be permitted under this rule language (and the permit applicant may have to pipe around the West Ranch). This is not an "all-or-nothing" solution; rather it is a solution that requires DEQ to regulate the effect of pollution when they cause harm.

The Council expects that the DEQ will continue to exercise its discretion in applying this rule, as it does any other rule. For example, DEQ has regulated water quality, not by prohibiting discharges that result in degradation of quality by elevating EC and SAR, but by allowing that degradation to a level that DEQ considers to be protective. DEQ has the ability to implement rule language in a reasonable and not an absolute manner. For example, it interprets the Chapter 1, Section 20 "no measurable decrease in crop or livestock production" language by allowing an "acceptable" level of decrease in production. It could and should apply the same sort of implementation approach to the proposed Appendix I language. Appendix I (a)(iii) instructs DEQ to regulate pollution within defined boundaries.

4. Regulation of water quantity that impacts water quality

Section (a)(ii) of Appendix I conforms with Wyoming Attorney General Formal Opinion 2006-001 by requiring permit applicants to show that the "quantity of produced water shall not cause, or have the potential to cause, unacceptable water quality." The reason for this language is to instruct the DEQ that it must require applicants to establish more than just acceptable water quality at the end of pipe. The record shows that DEQ has historically failed to look to the fate of discharged water as it travels downstream.

The SA Creek example in Petitioner's Rulemaking Hearing Brief and related exhibits demonstrate the need for this provision (as do portions of the *Maycock* transcript designated in this record). Water quality in SA Creek exceeded the 7500 µmhos/cm limit for EC that DEQ set as being protective of livestock and wildlife. Livestock and wildlife do not consume water solely at the end of pipe. Yet when presented with evidence the EC downstream exceeded 7500 µmhos/cm, DEQ said it could take no action. DEQ must issue permits that authorize it to require a quantity and quality of discharge that protects downstream water quality.

The Council understands that DEQ may have valid reasons for *enforcing* effluent limits at the end of pipe; however, it must set those limits based upon a scientifically valid modeling of what the water quality will be at relevant points downstream.

5. Requirement of scientifically defensible data

The Council finds that the Petitioner's proposed requirement of "credible data" is not justified. Instead, the Council's Appendix I(a) requires applicants to submit "scientifically defensible site specific data establishing each of the following:" (This is the term proposed by the Advisory Board in the proposed Agricultural Use Policy – Tier 3 – No harm analysis.) The reason this language is necessary is that the evidence in the record demonstrates that too often permit applications are based on shoddy science, and DEQ issues permits based on shoddy science. The "scientifically defensible site specific data" requirement is a specific instruction to DEQ to raise its standards so that the data submitted by permit applicants is adequate to justify permit issuance and so that DEQ issues permits with meaningful and enforceable terms.

Conclusion

The Council has determined that amendment of Chapter 2, Appendix H and addition of Appendix I are necessary to address the demonstrated failures of the current rule in regulating the pollution caused by CBM discharges, to provide the department with adequate authority to operate the WYPDES program and to maintain primacy under the requirements of the Clean Water Act and the requirements of W.S. 35-11-301(a)(i), (ii) and (iv) and 35-11-302(a)(ii) and (v) and to provide improved protection to public health and the safety for public water supplies.

EXECUTED THIS _____ DAY OF _____, 2007.

FOR THE ENVIRONMENTAL QUALITY COUNCIL

_____

Chairperson

Water Quality Effects and Beneficial Uses of Wyoming Produced Water Surface Discharges

January 16, 2007

Prepared for:

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Executive Summary

In addition, associated social and economic impacts of reduced water discharges and/or reduced exploration and development would be harmful to Wyoming residents.

Geomega reviewed literature-based toxicity studies and published guidelines for each of the constituents of interest, and gathered empirical data from several Wyoming ranchers who use produced water sources for their livestock. The ecological risk assessment followed US Environmental Protection Agency guidelines (US EPA 1998).

Ranchers' experiences indicate that water containing sulfates up to 3,100 mg/L and TDS up to 5,390 mg/L do not pose adverse risk to livestock in Wyoming. The ranchers' experiences were evaluated in conjunction with published literature; as a result, the following water quality benchmarks were recommended for each constituent as an alternative to the petitioner's proposed limits:

Benchmark/Limit	Barium	Sulfate	TDS
Recommended benchmark:	13	3,010	5,600
Current effluent limit:	None	3,000	5,000
Petition proposed limit:	0.2	500	2,000

Table E-1. Summary table of recommended water quality benchmarks for barium, sulfate and TDS that are protective of livestock and wildlife receptors, compared to the current WDEQ effluent limits and the petition's proposed effluent limits. All results in mg/L.

These recommended water quality benchmarks are consistent with current WDEQ effluent limits, other published local and national established benchmarks, and ranchers' experiences. They are not, however, consistent with the proposed limits in the petition. The recommended benchmarks are protective of wildlife and livestock such that ingestion of surface water with TDS concentrations up to 5,600 mg/L, sulfate concentrations up to 3,010 mg/L, and barium concentrations up to 13 mg/L will not result in injury to the animals. Thus, reducing effluent limits of sulfate and TDS to the petitioners' proposed limits will not result in any incremental reduction in risk to wildlife or livestock.

In the larger picture, however, CBNG and conventional oil extraction industries that surface-discharge produced water have additional social and economic value to residents in

Wyoming. Reductions in exploration/development and produced water surface discharge, due to unnecessarily stringent effluent limits, could result in substantial injury to the social and economic well-being of many Wyoming residents.

Numerous landowners in the Powder River and Bighorn basins benefit from produced water surface discharges through irrigation and/or livestock watering. This statement is supported by the many letters of beneficial use, rancher interviews, and other literature sources. Produced water surface discharges also support wildlife populations that may not otherwise be viable, including wild horse populations in the Bighorn basin, and migratory and waterfowl bird species at the Loch Katrine wetland complex. In addition, produced water discharges in certain circumstances improve water quality of natural drainages, as evidenced by the increased livestock capacities cited by several ranchers in the Salt Creek area of the Powder River basin.

To analyze the social and economic impacts of produced water surface-discharge in Wyoming, Geomega gathered US Census Bureau and US Department of Agriculture information on livestock use and economic indices in the Bighorn, Powder River and Platte River basins, and reviewed use attainability analyses and economic analyses authored by Gene R. George and Associates (2005), RETEC (2004), SWWRC et al. (2002), Taylor (1999). Economic effects of reduced exploration and development include lost revenue from oil and gas extraction facilities in the form of jobs and associated earnings, and basic oil and gas export revenue. Case studies include the following:

- Elimination of the South Casper Creek field in the Platte River basin would result in annual losses of $3 million (in 2002 dollars) to the basic exports of Natrona County, with additional losses of associated jobs with annual earnings that totaled $487,142 in 2002.

- Elimination of the Hamilton Dome oil field in the Bighorn basin would result in losses of $28.7 million (in 1997 dollars) in state total annual economic output, with associated losses of 136 jobs in Hot Springs county alone with earnings totaling $4.1 million in annual labor.

- Elimination of operations in the Salt Creek area in the Powder River basin would result in losses of jobs directly and indirectly related to oil and gas production, that result in an estimated $4.6 million in annual earnings for Natrona and Johnson Counties (in 1997 dollars).

Social impacts of reduced exploration/development include loss of financial contributions that go toward the improvement of local communities. County income from these operations supports various public facilities including schools, hospitals, libraries, fire departments, environmental programs, and the county general fund. Examples include the following:

- Elimination of the South Casper Creek field would result in reduced social contributions to Natrona County such as:
  - county property tax income by 2.5%,
  - severance taxes of 0.04%,
  - sales and use taxes of 0.16%, and
  - 2.5% of federal royalties for the county (on average, between 1997 and 2002).
  - State severance taxes; in 1997, severance taxes from the Salt Creek fields were estimated at $2.4 million. 2.6% ($62,257) of the total severance tax was received by Natrona County, and 0.2% ($4,789) was received by Johnson County.
- Elimination of the Hamilton Dome oil field would reduce social contributions to Hot Springs County (in terms of fiscal contributions) totaling:
  - 29% of total property taxes
  - 9% of total general fund revenues,
  - 27% of the library system's total revenues,
  - 2% of county hospital revenues,
  - 9% of county weed and pest management program,
  - 29% of the rural fire district budget, and
  - additional funds for school districts, averaging $1.4 million annually.

- Elimination of operations in the Salt Creek area in the Powder River basin would reduce social contributions to Natrona and Johnson Counties totaling (in 1997 dollars):
    - School funding of $2 million annually;
    - County government funding of $500,000 annually;
    - Community college funding of $300,000 annually.

Even with continued industry presence, lost opportunity to surface-discharge water would have a negative impact on Wyoming landowners and ranchers in many counties in the form of lost jobs and income from livestock and farming businesses. Additional negative impacts would result for the State general fund and federal mineral revenues. The following are examples of estimated economic losses from lost opportunity to surface-discharge water:

- In the Bighorn basin:
    - 15 to 20% loss of cattle in the Cottonwood Creek area, corresponding to an estimated $2 million in lost annual livestock sales for the Bighorn basin;
    - economic losses of 1.7% ($3.3 million) of total annual economic output in Hot Springs County, plus job losses totaling $645,000 in annual labor income;
    - an 8% loss of irrigated pastureland in the Cottonwood Creek area, corresponding to a loss of 1,600 acres of irrigated cropland and 4,000 tons of annual hay production;
    - livestock losses estimated between 30 and 50% by some ranchers in the Bighorn basin, resulting in estimated losses $387,000 to $645,000 in annual livestock sales;
    - lost access to federal funding and associated employment at the Loch Katrine wetland complex, which was created from produced water sources.

- In the Powder River basin:
    - livestock losses estimated between 20 and 40% in the Salt Creek area, corresponding to estimated losses of $590,175 to $1.1 million in annual livestock sales;
- All counties affected by loss of opportunity to surface discharge produced water would face:
    - Estimated herd losses between 15% and 50%, corresponding to lost annual livestock sales between $57 million and $192 million.
    - additional costs to ranchers to develop alternative water sources such as wells, water hauling and breaking ice;
    - associated job losses related to ranching and farming; and
    - lost revenue from hunting, fishing and tourism due to declining wildlife populations.

Economic and social injury of reduced exploration/development and loss of opportunity to surface-discharge produced water would not be limited to the case studies provided in this report. State-wide, the oil and gas industry supported 2,995 employees in 2002, with a total annual payroll of $162 million (US Bureau of the Census 2002). In addition, support activities for oil and gas operations, including drilling of oil and gas wells, employed an additional 9,200 employees with earnings totaling $332.6 million in 2002. The value of shipments, sales and receipts for oil and natural gas industries in Wyoming totaled $3.9 billion (in 2002), representing ~14% of the total sales, shipments and receipts for the state. At least a portion of the jobs, earnings and state revenue is expected to be negatively impacted by unnecessarily stringent effluent limits across Wyoming. A state-wide analysis of economic and social benefits and injury upon loss of produced water surface discharge, exploration and development is recommended to evaluate the total impact of the petitioners' proposed water quality amendments.

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Appendices

A **Interviews with Local Ranchers in the Bighorn and Powder River Basins**

B **Letters of Beneficial Use**

1 Ecological Risk Assessment of TDS, Sulfate and Barium Water Quality in Wyoming Surface Water Bodies

1.1 Introduction

The Wyoming Department of Environmental Quality (WDEQ) is reviewing a petition to change current effluent limits of total dissolved solids (TDS) and sulfate, and to add a barium limit for coal bed natural gas (CBNG) produced water. The petitioners argue that the current effluent limits are not "protective of stock and wildlife."

To analyze the adequacy of the current effluent limits and the validity of the proposed limits to protect wildlife and livestock, Geomega performed an analysis of livestock and wildlife chemical risk from TDS, sulfate and barium constituents in surface water bodies created or impacted by produced water surface discharge in Wyoming. This was accomplished by investigation along two lines of evidence. The first line included peer-reviewed scientific literature on water quality effects on animal species; the investigation sought to determine the water quality attribute (TDS, sulfate, barium) levels that are protective of animal species of interest, including livestock (heifers, steers and sheep), and wildlife (mammals and birds).

The second line of evidence included data compiled from Wyoming ranchers who use produced and natural water sources for their livestock. In-person and telephone interviews were conducted with a handful of ranchers in the Bighorn and Powder River structural basins in Wyoming to gather information on the nature and extent of produced or natural water usage and effects noted from that use. Where available, data was obtained from these ranchers to quantitatively evaluate the effects of produced water usage.

1.1.1 Ecological risk assessment procedure

A quantitative evaluation of risks to livestock and avian and mammalian wildlife from exposure to surface water in produced water bodies was undertaken to determine if the water chemistry could cause unacceptable adverse effects.

This ecological risk assessment (ERA) follows the US Environmental Protection Agency's (EPA) Guidelines for Ecological Risk Assessment (US EPA 1998), as well as other supplementary guidance documents, including:

- Guidelines for Exposure Assessment (US EPA 1992a),
- Wildlife Exposure Factors Handbook (US EPA 1993),
- Generic Assessment Endpoints for Ecological Risk Assessments (Draft) (US EPA 2002),
- other relevant federal and state regulations and guidance, and
- the general literature.

With the goal of improving the quality and consistency of its own risk assessments, the US EPA published a set of guidelines to describe the assessment process of ecological risk assessment. The guidelines incorporate the elements needed to assess the likelihood that adverse ecological effects could occur as a result of exposure to one or more stressors. As outlined in the guidance, the basic steps in an ecological risk assessment include problem formulation, analysis, and risk characterization. This report addresses each of these steps.

The problem formulation stage of this ERA includes background information on the availability and quality of water bodies in Wyoming, both from natural and produced water sources. Subsequently, wildlife and livestock uses of produced water bodies are described and an ecological conceptual model is presented that describes the relationships between the stressors (produced water bodies) and biological components. Finally, a set of endpoints is identified to ensure that the risk assessment goals are consistent with the petitioners' statements regarding WDEQ water quality regulations.

The analysis phase of the risk assessment examines the two primary components of risk: exposure and effects. The objective of the analysis phase is "to provide the ingredients necessary for determining or predicting ecological responses to stressors under exposure conditions of interest" (US EPA 1998). The products of the analysis phase are summary profiles that describe exposure and the relationship between the stressors and response. These profiles provide the basis for estimating risks.

The analysis phase was divided into three sections: exposure analysis (Section 1.3 of this report), effects analyses using literature-based studies (Section 1.4) and effects analysis using field-based data (Section 1.5). Two methods to evaluate effects were undertaken, because

during literature review and toxicity reference value (TRV) derivation (method 1), it was recognized that there are gaps between the constituent concentration clearly identified not to result in any effect, and the concentration found to result in a significant adverse effect. Concentrations in between these extremes have not yet been evaluated and hence the potential for risk is unknown. In addition, there are many differences between literature-based toxicity studies and environmental conditions of the open range in Wyoming. These differences have important impacts on animal tolerance to constituent exposure.

To reconcile the gaps in data and differences in study conditions from the Wyoming environment, a second method to evaluate effects was undertaken which involved a compilation of field-based data of water body users in Wyoming. Interviews with ranchers and other users of water bodies in Wyoming were undertaken to identify anecdotal as well as quantitative measures of effects. The field-based data served to support toxicity study results and fill in data gaps in the literature-based studies.

In the risk characterization step of the ERA, water quality concentrations were derived from the reviewed literature sources that would not result in any adverse effect on livestock or wildlife. Selected no observed adverse effects levels (NOAELs) and low observed adverse effects levels (LOAELs) were converted to water quality concentrations (WQCs). Subsequently, an uncertainty analysis was conducted and the ranges of WQCs were also compared to empirical data gathered from the Wyoming ranchers. Based on the WQCs, uncertainty analysis and empirical Wyoming studies, a recommended water quality benchmark was identified for each constituent at which risk to wildlife and livestock in Wyoming would be unlikely.

1.2 Problem Formulation

The problem formulation stage of the ERA integrates information about site characteristics, exposure opportunities, and chemical and biological information to generate a set of assessment endpoints (explicit statements of an environmental value that is to be protected) and an ecological conceptual model. Designed to establish the framework to evaluate hypotheses about what ecological effects can occur from the environmental conditions at the site, the problem formulation process is the foundation of the ecological risk assessment.

1.2.1 General description of areas containing produced water

There are more than 64,000 (WOGCC pers. Com. 2007) currently active CBNG and conventional oil and gas industry wells in Wyoming. The most active development is currently in the Wyoming portion of the Powder River structural basin, with ~25,000 currently active wells (Figure 1-1). The Bighorn and Platte River (also known as Wind River) basins also host conventional oil and gas production facilities. These basins are characterized as semiarid environments, with average annual precipitation in the Bighorn basin ranging from six to nine inches annually. To characterize produced water quality and exposure conditions, data was collected for the Powder River, Bighorn and Platte River basins. These three basins represent the majority of areas in Wyoming that receive produced water discharges from oil and gas extraction.

Some of the water produced as a result of oil and gas extraction is discharged into reservoirs or naturally occurring drainages. Drainages in these basins receiving produced water inputs include (but are not limited to) Dry Creek and Cottonwood Creek in the Bighorn basin; Powder River, Salt Creek, and tributaries in the Powder River basin; and Poison Spider Creek in the Platte River basin. Portions of all of these drainages are naturally ephemeral or intermittent creeks that have become perennial streams as a result of CBNG and conventional oil and gas industry discharges. Livestock, farmers and wildlife use the water in these drainages.

In addition, a number of reservoirs also regularly receive oil and gas produced water, including the Loch Katrine in the Bighorn basin, a playa lake enhanced and maintained by oil and gas produced water from the Oregon Basin oil field in Park County, Wyoming. Due to

its large size and rich habitat structure relative to natural water bodies in Wyoming, the Loch Katrine has become an attractive nesting and breeding ground for a number of migratory birds and other wildlife. Smaller reservoirs created by oil and gas discharge water in the various basins primarily support livestock, but are utilized by wildlife species as well.

1.2.2 Water quality of natural and produced water bodies in Wyoming

Natural background water quality is an important consideration in determining potential effects of produced water on animals, since not only will natural background give some indication of incremental risk, but animals often adapt to suboptimal environmental conditions without any long-term effect on their health. Incremental risk is defined as the added risk of exposure to a new mass of a constituent compared to the baseline risk of the natural environment.

The surface water quality of both natural and produced water bodies in Wyoming is highly variable. The Powder River basin has been extensively characterized in a recent use attainability analysis reported by RETEC (2004). Natural water quality in Salt Creek and its tributaries (measured in 2003 and 2004) is characterized as having average TDS concentrations of ~6,400 mg/L and sulfate concentrations averaging ~3,800 mg/L, with maximums as high as 22,000 mg/L TDS and 12,000 mg/L sulfate (measured in Castle Creek).

Produced water discharges into Salt Creek have the effect of lowering TDS and sulfate levels to means of ~4,000 (max 4,580) and 1,130 (max 1,680) mg/L, respectively, at discharge points. These concentrations remain approximately the same downstream; concentrations were measured at 3,880 mg/L TDS and 1,240 mg/L sulfate. TDS measured in Salt Creek and its tributaries are dominated by sodium sulfate in background waters. With the addition of produced water, the TDS composition changes to a sodium chloride type.

Total salinity in the Powder River upstream of Salt Creek ranges from 670 to 2,840 mg/L (measured in the 2003-2004 period), with a mean of 1,650 mg/L. Sulfate averaged 930 mg/L. Downstream of Salt Creek and discharge points, the corresponding TDS ranged from 900 to 3,640 mg/L, with a mean of 2,200 mg/L, and sulfate averaged 920 mg/L. There is a moderate increase in Powder River salinity due to Salt Creek. Upstream of Salt Creek, the

Powder River is characterized as a calcium and sodium sulfate type. Downstream of discharge points and flows from Salt Creek, the signature changes to more sulfate- and chloride-dominated waters.

In the Bighorn basin, Dry Creek upstream of discharge points contains a TDS concentration as high as 2,310 mg/L and sulfates up to 1,180 mg/L, as measured in a residual stream flow during summer months (M. Blakesley, personal communication). The water is characterized as a sodium sulfate type. Downstream of discharges, TDS increases to an average 4,100 mg/L with average sulfate of 2,025 mg/L, although concentrations can be as high as 5,390 mg/L TDS and 3,100 mg/L sulfate (measured between 2002 and 2006). TDS contain an increasing amount of sodium and carbonates relative to upstream samples.

In Cottonwood Creek in the Bighorn basin, TDS and sulfate average 355 mg/L and 164 mg/L, respectively, upstream of discharges, while downstream of discharges water quality averages 3,320 mg/L TDS and 1,380 mg/L sulfate (SWWRC et al. 2002). Other tributaries in the Bighorn basin downstream of produced water inputs, characterized in 1997 (Ramirez 2002), contain average TDS of 3,700 mg/L and sulfates of 1,400 mg/L. Finally, the Loch Katrine wetland complex contains 1,370 mg/L TDS and 790 mg/L sulfate (Ramirez 2002).

In the Platte River basin, natural water quality in Poison Spider Creek was reported at 3,150 mg/L TDS and 1,700 mg/L sulfates (Gene R. George & Associates et al. 2005). Downstream of discharges, TDS averages 2,630 mg/L, with 1,130 mg/L sulfates.

A summary of several produced water effluent concentrations from the Powder River, Platte and Bighorn basins are shown in Table 1-1.

Natural background concentration of barium measured in eight different watersheds ranged between 0.1 and 0.3 mg/L (WDEQ 2000). Produced water typically discharges 1 mg/L barium or less (RETEC 2004, SWWRC et al. 2002).

1.2.3 Wildlife and livestock use of produced water bodies in Wyoming

In Wyoming, livestock and a variety of wildlife species utilize both natural and produced surface water bodies for food, shelter, breeding ground and water resources. In the Powder

River basin, the Salt Creek corridor is an important habitat to both upland and riparian plant and animal species. Local topography is varied, with a number of small canyons, outcrops, cliffs and rocky hills, which provide habitat for big game, carnivores, small mammals, upland game birds, raptors, waterfowl, a variety of migratory birds, and some semiaquatic species (RETEC 2004).

In the Bighorn basin, a variety of wildlife species inhabit the Cottonwood Creek area (Table 1-2). Produced water sources in this area have created additional forage and shelter grounds for big game species including pronghorn antelope, mule deer, and white-tailed deer, and for small game birds including chukar, ring-tailed pheasants, and sage grouse; foraging grounds for a variety of large and small mammals and, subsequently, important prey resources for raptors; stopover resting and foraging grounds for migratory birds and waterfowl species; habitat for threatened and endangered species; and critical habitat for water-dependent species such as beaver and muskrat (SWWRC et al. 2002).

The Loch Katrine, also in the Bighorn basin, is a nesting and feeding ground for many species of waterfowl and shorebirds (Table 1-3), including two threatened and endangered species (peregrine falcon and bald eagle) and three candidate species (long-billed curlew, white-faced ibis and ferruginous hawk) (Ramirez 1993, T. Enright 1989). Wild horse populations also frequent the Dry Creek area (G. Flitner, personal communication), and letters of beneficial use describe wild horse dependence on produced water sources in the Bighorn basin area (Appendix B).

Finally, 97 species of birds and mammals (Table 1-4) were surveyed in the area near Poison Spider Creek (Gene R. George & Associates et al. 2005).

Agricultural uses of the creeks and reservoirs are primarily for livestock ranching. Livestock species reported by Wyoming ranchers and the US Department of Agriculture (USDA) are predominately beef cattle, and some sheep and horses. Most beef cattle in Wyoming are raised on the open range, with typically <1% feedlotted (NASS 2005). Livestock use of surface water bodies tends to be year-round, sometimes with little variation among water bodies. Wildlife, on the other hand, often use water sources on a seasonal basis. Migratory birds, for example, may use Wyoming water bodies on a transient basis between summer and

winter destinations, and mule deer and antelope migrate to different elevations depending on the time of year.

1.2.4 Conceptual model

An ecological conceptual model describes the relationship between stressors and ecological components of an environment. A conceptual model was developed based on life history characteristics of ecological receptors, environmental fate and transport properties of stressors, and ecological conditions of the Wyoming environment. The major ecological groups of wildlife in Wyoming include waterfowl, passerine birds and ruminant and nonruminant mammals (Figure 1-2). Livestock using produced water sources may include cattle, sheep and horses.

1.2.5 Endpoint selection

Assessment endpoints are explicit statements of an environmental value that is to be protected (US EPA 1998). Consistent with WDEQ water quality regulations, the assessment endpoint identified in this risk analysis is the protection of the health and well-being of populations of Wyoming livestock and wildlife species from adverse effects of consuming surface water. For this analysis, well-being is defined as the physiological condition of an animal insomuch as it impacts the social or economic welfare of the animal's owner.

From this broad assessment endpoint, more specific measurement endpoints can be identified. Measurement endpoints are defined as measurable environmental characteristics that are related to the values (i.e., assessment endpoints) that are to be protected (US EPA 1992b). Measurement endpoints to protect animal health in this analysis include developmental, behavioral, reproductive and longevity effects. Growth effects are usually considered less desirable in risk assessments for evaluation of health endpoints, because growth effects can be short-term or reversed, depending on the exposure program, and the relationship between growth and other adverse effects is uncertain. However, for livestock species, measurement endpoints that include growth rate or weight gain were considered in this risk analysis because these parameters relate to the well-being of the animal, as defined above. Feed or water intake rates and digestibility were not considered adequate endpoints in themselves to evaluate the well-being of livestock species, because research has shown that

there is considerable individual variation in feed intake above and below that expected or predicted on the basis of size and growth. Individuals of the same body weight often require widely different amounts of feed for the same level of production (NRC 2000). Thus, in the risk analysis, only those studies that measured growth rates in addition to intake rates or other performance parameters such as digestibility were considered for water concentration derivation.

1.3 Exposure Analysis

In the exposure analysis, general fate and transport properties of constituents of interest in the aquatic environment and in biological organisms are described, and exposure profiles for indicator species are identified.

The fate and transport of constituents of interest in the environment play a significant role in determining toxicity to receptors. In general, constituents in water are available from solution as free ions for uptake into organisms, or are sometimes transported over biological membranes as inorganic complexes. The chemical composition of the water, e.g., pH, hardness, dissolved organic carbon content, etc., strongly influences the speciation of constituents and the degree of uptake by biological organisms. Specific fate and transport properties of barium, sulfate and TDS are described below.

1.3.1 Barium

In water, barium will form compounds in the +2 oxidation state. Barium compounds such as barium nitrate and barium chloride are soluble in water (ASTDR 2001). However, the solubility of barium is often limited by the presence of sulfate and carbonate, which bind the barium in sparingly soluble forms, including barium sulfate and barium carbonate compounds (McCauley and Washington 1983). These forms of barium are relatively nonbioavailable. Bioavailability is defined in this document as that fraction of the constituent that is available for absorption into biological receptors. Barium does not bioconcentrate through food chains (Moore 1991, Hope et al. 1996), for example, soil-to-mammal bioaccumulation factors are <0.05 (Sample et al. 1997). In biological organisms, barium competes with and replaces calcium in processes normally mediated by calcium, particularly those relating to the release of adrenal catecholamines and neurotransmitters, such as acetylcholine and noradrenaline (US EPA 2005).

1.3.2 Sulfate

Sulfate (SO_4^{-2}) is an inorganic, ionic form of aqueous sulfur that has a -2 valence. Aqueous sulfate reacts with and forms chemical complexes with nearly all constituents, from metals to salts to organic matter. In animals, inorganic sulfur is converted into organic sulfur, an essential component of proteins and numerous other organic compounds (NRC 1980, Henry

1995). Thus, sulfur is considered by many to be an essential nutrient. Most sulfur compounds are synthesized in animals in vivo from methionine and cystine, two amino acids. Monogastrics cannot manufacture organic sulfur compounds in vivo, and therefore must obtain the amino acids from outside sources. Methionine and cystine are routinely supplemented in poultry diets, for example. Although ruminants contain gut bacteria capable of synthesizing sulfur-containing amino acids and vitamins from inorganic sulfur sources, nutritional supplements for sulfate are sometimes recommended for these species as well.

1.3.3 TDS

Total dissolved solids (TDS) is a measure of all constituents dissolved in water. In natural and produced water bodies, the most abundant of these constituents are typically chlorides, carbonates, bicarbonates, sulfates (collectively referred to as 'anions'), and calcium, magnesium, potassium, and sodium (collectively referred to as 'cations'). Iron and manganese may also be present sporadically at minor to moderate concentrations in Wyoming water bodies. Thus, the components of TDS in natural and produced water bodies are variable.

Most compounds must be solubilized in water to be absorbed from the digestive tract. Solubility will affect the mass absorbed and rate of absorption (Church 1979). Solubility is also affected by the relative ratios of different constituents; availability of magnesium, for example, is ~60% when consumed on its own, but it can be reduced by high potassium intake. Sodium is almost completely absorbed as is chloride.

1.3.4 Receptor identification

In ecological risk assessments, the quantitative evaluation of point-of-contact-type stressor response requires that specific numerical information about the livestock or wildlife be measured, such as food and water intake rates and body weights. Because not all individual trophic components of an ecological system can be evaluated for risk, several representative indicator species were chosen in association with the assessment endpoints. Selection of the indicator species used in this analysis was based on consideration of various functional groups, their potential for exposure and regulatory concerns.

The receptors chosen for the risk analysis included a developing ruminant (growing heifer), a nonruminant small mammal (rodent), and waterfowl (mallard duck). These receptors are representative of the types of livestock and wildlife species in Wyoming that are exposed to surface water bodies, including locations where produced water effluent might be deposited. The growing heifer and small mammal represent two particularly sensitive animal types, since small body size and young, developing animals are generally at a greater risk for adverse effects at lower doses than are larger, adult animals. As an example, a sulfate water quality concentration was derived for an adult steer to compare with the concentration derived for a growing heifer (Section 1.6.2). It was assumed that the receptors are exposed year-round to the same water body, thus maximizing potential water ingestion rates.

Sheep were also considered in the initial risk analysis, however the tolerance of sheep for these constituents is much higher than cattle (as described in the analyses below), and hence specific water quality ranges were not derived for this species. Little information is available on horses, and therefore this receptor was not specifically evaluated; however, effects on other ruminants and mammals were selected to represent this species.

Water ingestion rates of wildlife receptors were calculated using empirically based ingestion models from Nagy (1987) or Calder and Braun (1983). Representative body weights of each receptor were obtained from either standard EPA information on laboratory animals or from the general literature. For the livestock receptor, average body weights and ingestion rates were obtained from NRC (2000). Exposure parameters for each indicator receptor are summarized in Table 1-5.

1.4 Effects Analysis I: Literature-Based Analysis

In this section, general toxicity characteristics of each constituent of interest are described and a quantitative evaluation of effects is undertaken using two different methods. The first method consists of a review and synthesis of published toxicity studies, from which no-effects and low-effects concentrations were derived in the risk characterization section. A description of the toxicity reference value (TRV) derivation process is included, followed by general effect profiles of each constituent. Discussion of toxicity studies selected for final TRV derivation is provided in the risk characterization step (Section 1.6).

1.4.1 Methods used to derive TRVs

TRVs are estimates of exposure levels below which unacceptable adverse effects are not expected to occur. TRVs were derived for each individual receptor and chemical combination, and are used as ecotoxicity screening values against which receptor-specific exposure estimates are compared.

To derive TRVs based on phylogenically similar species exposed via similar routes of exposure (i.e., through the diet) and that measured toxicological endpoints comparable to the assessment endpoints, several steps were taken:

Step 1. Assemble toxicological databases. Literature databases were assembled that contained all available chronic and subchronic studies on livestock, birds and mammals. Acute studies were excluded from the database since these studies do not assess long-term effects on animals and therefore do not accurately represent potential adverse risks associated with growth, reproduction and development of species. TRV information was obtained by review of several secondary sources, including NRC 1980, Sample et al. 1996, Eisler 2000, the Cal/EPA toxicity database, EPA IRIS, TerreTox/EcoTox databases, and the general literature.

Step 2. Select appropriate studies from the databases. As the databases show, the availability of toxicity studies varies widely by constituent and by species. Therefore, selection of the appropriate studies from these databases necessarily involves a detailed

assessment of the differences from one study to the next, with an objective selection process required to make decisions.

Selection of appropriate studies was based primarily on five principal decision factors, including:

- biological effects,
- technical quality of study,
- method of administration,
- duration of study / identification of a toxicological endpoint, and
- biological parameters.

Biological effects describe the effects that were measured in each study. They can be broadly classified into effects on reproduction, growth, development, or mortality. Effects on reproduction include eggshell thinning, low birth weights, reduced litter sizes or number of offspring, and decreased hatchability. Reproductive effects are considered one of the most sensitive measurement endpoints of species, and therefore a key response in assessing long-term chronic impacts on animals. Growth effects include weight loss or gain, and physiological impairment.

Feed or water intake rates and digestibility were not considered adequate endpoints in themselves to evaluate the well-being of livestock species, because research has shown that there is considerable individual animal variation in feed intake above and below that expected or predicted on the basis of size and growth. Individuals of the same body weight often require widely different amounts of feed for the same level of production (NRC 2000). Thus, in the risk analysis, only those studies that measured growth rates in addition to intake rates or other performance parameters such as digestibility were considered for water concentration derivation.

Developmental effects include decreased feed consumption and other individual responses such as biochemical effects, histopathological changes and behavioral effects. Developmental effects are sometimes not obvious and are difficult to quantify at times.

Mortality is not a preferred endpoint for study selection because its effects are final and usually is the cumulative result of other sublethal effects that are also detected at lower exposures, however in some instances mortality was the only endpoint identified in the study.

Technical quality of study includes assessment of critical parameters such as whether the chemical is isolated or in combination with other chemicals, and whether a normal nutritional level was maintained during the exposure period. It is important in this assessment to derive TRVs from studies involving exposure to isolated chemicals because many effects of one chemical can be masked by the addition of another chemical. Further, while it is recognized that exposure to a combination of constituents may sometimes reflect conditions in the field, the long term additive effects of multiple constituents are not known.

Normal nutritional levels are a second critical parameter for each study selected because malnourishment can interfere with chemical assimilation and metabolic functions, which can result in exacerbated or subdued effects from exposure (Newman 1998). Finally, the number of test organisms is an important consideration in the selection of studies because individual effects of chemicals can vary; statistically significant numbers of test individuals are important in order to assess population-level effects of constituents on receptors.

Method of Administration describes the route of exposure. Because wildlife populations are assumed to be exposed to chemicals in the environment primarily through their diets, studies that administered chemicals orally in the diet were considered more desirable than administration by capsule or gavage. Injection of chemicals directly was not considered acceptable because the route of exposure is significantly different.

Duration of Study and Identification of a Toxicological Endpoint identifies the exposure time of the test group to the constituent, and whether a no effects level or low effects level was identified in the study. Chronic exposure is defined for mammals as more than one year, and/or over a critical life stage, and greater than 10 weeks for birds (Sample et al. 1996). Acute studies were not considered appropriate for TRV derivation.

Biological Parameters are receptor-specific and consider the similarity in phylogeny between the test organism (ROC_t) and the wildlife receptor (ROC_w). Although it was considered most

desirable to match the test species to the wildlife receptor, toxicological studies are typically limited to a few species. If the test organism had the same phylogenic characteristics of the wildlife receptor, this aspect of the study was preferred over a study for which the test organism had only a similar diet or physical traits as the wildlife receptor.

Step 3. Derivation of NOAELs and LOAELs. Once appropriate studies were selected, study NOAELs and LOAELs were derived. NOAELs and LOAELs are expressed as mg constituent/kg body weight per day.

If not provided in the report, ingestion rates were calculated using empirically based ingestion models from US EPA (1988), Nagy (1987) or Calder and Braun (1983) (Table 1-6). Other missing information needed to calculate NOAELs and LOAELs, such as body weights, was either obtained from standard EPA information on laboratory animals or from a paired study published separately. For the livestock receptor, average body weights and ingestion rates were obtained from NRC (2000).

Step 4. Apply uncertainty factors. Once study NOAELs and LOAELs were calculated, uncertainty factors were applied if warranted to extrapolate the study NOAELs and LOAELs to TRV_{NOAELS} and TRV_{LOAELS}. In general, application of uncertainty factors is not supported by science (Chapman et al. 1998), however in some cases where there were large gaps in understanding of effects, uncertainty factors based on US EPA (1995) methods were employed.

1.4.2 Review of the toxic effects of barium

Barium affects the nervous system of vertebrates; at low doses it is a muscle stimulant, but at high doses barium can lead to hypertension, vomiting, muscular tremors, diarrhea, gastrointestinal hemorrhage, and eventually paralysis and cardiac arrest (Sample et al. 1997). Subchronic toxicity in rats includes increased arterial pressure and decreased weight gains (US EPA 1984); in birds, ingestion of toxic amounts of barium salts results in growth suppression (Mehring et al. 1960, Taucins et al. 1969). Barium poisoning can be treated by ingesting a solution of sodium or magnesium sulfate, which forms insoluble barium sulfate.

Relevant studies on ruminant species are lacking, and the few published studies address only lethal dose limits of barium salts (NRC 1980) or changes on a cellular level (e.g., Almudena et al. 1996, Aromolaran and Large 1999), the significance of which to the health or well-being of the animal is unclear. NRC (1980) recommended a maximum tolerable dose of 20 parts per million (ppm) barium (as highly bioavailable salts) for livestock, however this recommendation was based on two types of studies: (1) lethal dose studies of barium, none of which addressed effects on cattle; and (2) an in vitro study on the effects of rumen microorganisms. It is unclear how a 20 ppm threshold dose was derived from the acute studies, which show for a variety of animals, only a range in lethal doses between 50 and 733 mg/L Ba as $BaCl_2$ or $BaCO_3$. NRC (1980) stated that the in-vitro study on rumen microorganisms by Martinez and Church (1970) showed that depressed cellulose digestion above 30 ppm $BaCl_2$ occurred, but it is uncertain what the clinical significance of this effect was on the livestock in the study. Thus, the 20 ppm recommendation is not supported by the cited literature. In 2005, NRC (2005) revised its recommendation to 100 ppm barium for horses, poultry and swine based on the same acute studies cited in the 1980 publication. The US EPA does not recommend barium water quality criteria for livestock.

Geomega found no other US-published resources that had evaluated livestock risk to barium in surface water, however Canada's recommended water quality guidelines for livestock ranged between 5 and 300 mg/L, based on US-published studies (CCREM 1987).

1.4.3 Review of the toxic effects of sulfate

Because sulfate is a component of numerous biologically important compounds and metabolic processes (Murray et al. 2000), it has been suggested that sulfate is an essential nutrient, although other sources (e.g., NRC 2005) refute this claim. Nevertheless, daily requirements of sulfur for livestock and poultry are recommended between 10% and 45% of total water intake (NRC 1974). For nonruminants, dietary recommendations are between 0.28% and 0.69 % (NRC 1980). Sulfur derived from sulfate is retained in tissues throughout the body of ruminants, as part of sulfur-containing amino acids synthesized by rumen microorganisms. Nonruminants must obtain sulfate sources from the environment, and are limited to using sulfate for formation of sulfate esters that are required for various metabolic processes.

Sulfate is one of the least toxic forms of sulfur, but the ability of animals to tolerate exposure to elevated sulfur levels depends on the rate of exposure (Mudd et al. 1967). Acute levels administered to livestock produced muscular twitching, colic, dyspnea, blindness, coma and death (Coghlin 1944, White 1964). Subchronic effects of toxic quantities of sulfate (usually administered as sodium sulfate in water) on livestock include reduced weight gain, presumably as a result of reduced feed or water intake. The toxicity of sulfur is reduced in the presence of some sodium compounds such as sodium fluoride (Dziewiatowski 1954).

Relative to barium, research on inorganic sulfate impacts to livestock is more extensive, but other animal test studies are not as developed. Ruminant studies indicate that sheep are far more tolerant of high levels of sulfate in drinking water than cattle (NRC 1980). Sulfate levels up to 5,000 ppm were not found to be detrimental to sheep (Pierce 1960). Cattle, however, appear to be less tolerant of sulfate in drinking water. It has been reported that excessive sulfate consumption can produce a laxative effect in various livestock species, as well as inhibiting rumen fermentation (Hubbert et al. 1958). Despite this, however, total tract digestion of feed consumed by various livestock species does not appear to be adversely affected by excessive sulfate intake, as shown by Zinn et al. (1997) and Qi et al. (1993), and reviewed by NRC (2005).

High sulfate intake in ruminants has been associated with reduced copper absorption (Suttle 1974) and thiamine deficiency (Gould 1998). It has been suggested that thiamine deficiency in cattle is a leading cause of polioencephalomalacia (PEM), although results have been inconsistent (Gould 1998). For ruminants, NRC (2005) recommended a general range of 600 to 2,500 ppm SO_4 for cattle (the most sensitive ruminant receptor), based on reported increases in the incidence of PEM; however, this recommendation contrasts that of other studies, including Loneragan et al. (1998), Patterson et al. (2002), and Patterson et al. (2003), which found no increased incidence of PEM below 3,500 ppm. Other sources of water quality guidelines for livestock (US EPA 1972, NRC 1974) have no specific recommendations for sulfate. NRC (2005) recommends up to 2,500 mg/L sulfate, but this is applicable only to feedlotted cattle. Canada's livestock guidelines range between 1,000 and 3,000 mg/L sulfate.

1.4.4 Review of the toxic effects of TDS

Several common components of TDS are required nutrients in animals. Calcium, magnesium, sodium, and chloride are involved in acid-base balance, muscle contraction, nerve signal transmission, nutrient transport and other functions (Murray et al. 2000). There are no recommended nutritional requirements for TDS; however, daily requirements of salt (as sodium chloride, NaCl) for livestock and poultry range between 6% and 40% of total water intake (NRC 1974).

Acute effects of excessive TDS intake in livestock include excess salivation, vomiting, diarrhea, ataxia, disorientation, blindness, seizures and paralysis (NRC 1980). Subchronic effects in mammals include reduced feed and/or water intake, and subsequent reduction in weight gains. In birds, effects include reduced reproductive rates and weight loss associated with prolonged reductions in food and water intake.

The toxicity of TDS to organisms will depend in part on the individual components. Sufficient research data is lacking on the toxic thresholds of individual TDS components for animals; however, the relative toxicity of TDS components is generally well understood. Embry et al. (1959), in a subchronic study on rats experimented with several different mixtures of TDS – sodium chloride, sodium sulfate, magnesium chloride, magnesium sulfate, or calcium chloride – and found that tolerance to sodium chloride was highest. Other salts affected growth rates at lower doses, with magnesium chloride and magnesium sulfate affecting growth at the lowest dose levels. Similar results were found by Weeth and Hunter (1971) and Rodenburg (1989) in their studies on cattle. The US EPA (1976) advised that "livestock and poultry can survive on saline waters up to 15,000 mg/L salts of sodium and calcium combined with bicarbonates, chlorides and sulfates. But only 10,000 mg/L of corresponding salts of potassium and magnesium could be tolerated. The approximate limit for highly alkaline waters containing sodium and calcium carbonates is 5,000 mg/L." NRC (1974) suggested that an upper limit of 5,000 mg/L TDS should be used as a benchmark for livestock (dairy and beef cattle, sheep, swine, and horses), based on a similar literature review.

According to the literature published to date, livestock species most susceptible to elevated TDS concentrations are growing cattle. Studies on sheep (Peirce 1957, 1959, 1962, 1963) indicate that sodium chloride levels up to 13,000 mg/L do not adversely affect sheep health, weight gain or wool production. Effects on sheep from other types of TDS (e.g., calcium chloride, bicarbonates, magnesium chloride) were typically evaluated in conjunction with sodium chloride. Peirce (1959) showed that combinations of sodium/magnesium chlorides (up to 11,800/1,000 mg/L) did not affect sheep health or performance; Peirce (1962) also demonstrated that calcium plus sodium chloride levels of 12,900 mg/L did not affect weight gain or wool production. In swine, Anderson and Stothers (1978) showed that 6,000 mg/L sodium chloride did not affect weight gain in pigs.

1.5 Effects Analysis II: Wyoming Field-Based Data Analysis

One limitation of a literature-based toxicity study review is that in most cases, the conditions employed in the studies are not representative of field conditions in Wyoming. Almost all livestock studies on TDS and sulfate toxicity involve feedlot environments, where test animals are given limited water and/or feed, and typically only short-term responses to sudden changes in the diet are measured. Differences between feedlot and field environments have been shown to result in large differences in response to TDS and sulfate toxicity in particular. Johnson and Patterson (2004) showed that cattle confined to feedlot environments and provided with natural water sources from South Dakota (with 3,000 mg/L sulfate) generally exhibited adverse effects, while cattle grazing on the open range did not exhibit adverse effects at water concentrations as high as 4,600 mg/L. The differences in tolerance thresholds were attributed to forage quality differences and more stressful conditions (higher temperatures, lack of shade, etc.) in feedlot environments.

Additionally, animals are known to adapt to higher levels of sulfate and TDS without long-term adverse effects (NRC 1974). In field populations, adaptation refers to the adjustment of an organism to its environment. Adaptation can produce large differences in the threshold of low-adverse effects levels. For example, in a review of laboratory toxicity trials, the consensus from NRC (1974) was that cattle (heifers) that were fed 7,000 mg/L or less of sodium chloride or sodium sulfate on a chronic basis did not experience adverse effects. In the field, however, tolerances were reported to be higher: Spafford (1941) and Ballantyne (1957) observed that cattle owned by various landowners could tolerate water containing up to 14,250 mg/L total salts (11,400 mg/L sodium chloride) with no reported adverse effects. In these cases, adverse effects were noted at 18,500 mg/L or higher of total salts. The omission of adaptive factors in many laboratory-based tests creates (perhaps an unnecessary degree of) conservatism inherent in extrapolating the results of laboratory-based toxicity tests to natural conditions.

Finally, it was revealed in the literature review that there is a large data gap between NOAELs and LOAELs; effects to receptors between these two extremes are unknown. Therefore, a field-based investigation was undertaken to gather effects data specific to users of water bodies in Wyoming. USDA and related livestock data for Wyoming and the US

were obtained, interviews with a handful of ranchers in the Bighorn and Powder River basins were conducted, and further information was gleaned from letters written by users of produced water sources (Appendix B).

Overall, the ranchers indicated that water containing sulfates up to 3,100 mg/L and TDS up to 5,390 mg/L did not result in adverse risk to livestock in Wyoming's Bighorn and Powder River basins. Weaning rates, body condition, breeding percentage and mortality rates were no different between pastures associated with natural water sources and those with produced water, which typically contain higher concentrations of sulfates and TDS. Adverse effects were apparent in livestock exposed to evapoconcentrated surface water that originally contained more than 4,000 mg/L sulfate and 7,000 mg/L TDS. Analyses of effects of these concentrations on wildlife were less conclusive; however, it appears that no adverse risk to wildlife occurred from exposure to water at Loch Katrine, which contains relatively elevated sulfates and TDS compared to background. Individual interview statements are summarized below. Full interview statements are provided in Appendix A.

The Flitners

The Flitners ranch all their cows (~1,000 head in 2005) in the spring and fall on BLM lands adjacent to Dry Creek near the Cody Highway. In this area, Dry Creek has average sulfate and TDS concentrations of 2,720 mg/L and 5,080 mg/L, respectively. Produced water sources account for 100% of water availability on these lands, because drought has eliminated other natural reservoirs. The Flitners have additional, private lands in the Bighorn basin and on Heart Mountain, and the cattle typically graze there during the summer months. Water resources in these areas originate from natural sources, with estimated concentrations of 1,180 mg/L and 2,310 mg/L sulfate and TDS, respectively, based on average background concentrations measured upstream of discharges (M. Blakesley, personal communication).

Weaning rates were recorded for calves that started out the spring in various produced water and natural-water-associated pastures (Appendix A, Table A-1). These records demonstrate that no adverse effect on weaning rates occurred on calves that drank the produced water, which contains elevated sulfate (2,720 mg/L) and TDS (5,080 mg/L) relative to natural

sources. The Flitners noted no other variation in cattle quality between those grazed on lands containing produced water versus land with natural water sources.

Mr. McCarty

Mr. Mike McCarty owns several ranches in the Bighorn basin. He utilizes four pastures (totaling 1,600 acres) on BLM lands that contain exclusively produced water sources originating from the Oregon Basin oil field. The herd sizes on these lands are between 650 and 700 head, all cattle. The pastures include Avon, South/North Oil Wells, Lake and Highway pastures. Surface water concentrations near these pastures average 4,830 mg/L TDS and 2,300 mg/L sulfate, with maximums as high as 5,390 mg/L TDS and 3,100 mg/L sulfate (measured between 2002 and 2006). Lake pasture has one well in addition to the produced water sources. Mr. McCarty owns another ranch near Cody, WY, which has natural water sources associated with the pasture. Surface water concentrations at the ranch are not precisely known, but assumed to be in the range of natural background concentrations for the Bighorn basin area, i.e., between 1,180 mg/L sulfate and 2,310 mg/L TDS.

The cows utilize the pastures associated with produced water sources between November and May. Two out of four pastures are used per year (allowing a 2-year fallow period). The cattle are allowed to forage on the open range, and are provided a mineral supplement package. The supplement contains a chelated copper form, recommended by Mr. Patterson (pasture manager for Mr. McCarty) for areas with higher sulfate concentrations associated with water or forage.

Mr. McCarty noted that there were no adverse effects on the livestock that use the pastures with produced water, which contains elevated sulfate (3,100 mg/L) and TDS (5,390 mg/L), compared to his other pastures at which there are natural water sources. He related the following measurement comparisons:

Measure:	Produced water	Natural water
1) Body condition	5	same
2) Breeding percentage	96%	same
3) Death rate	</= 2%, all cows < 10-11 yrs	same
4) Calf weaning rate	94-95%	same

Additionally, Mr. Patterson related that the cattle in this area perform very well, above industry standards and production numbers.

Mr. Patterson

Mr. Trey Patterson manages the Padlock ranch, located in northern Wyoming in the Powder River basin. Cattle graze year-round in the area. The ranch lands receive produced water from a CBNG facility near Decker, MT. The produced water is discharged to a fenced-off reservoir, and into stock tanks.

Water quality samples are taken periodically by Mr. Patterson. Concentrations generally reported are between 1 and <500 mg/L sulfate and up to ~3,600 mg/L TDS (as measured in 2001 and 2002). Sodium makes up a large proportion of the total TDS. Natural water in the area contains between 1,500 and 2,000 mg/L sulfate and up to 3,700 mg/L TDS. Weaning weights recorded over several years do not indicate any difference between cows raised on land with produced water compared to land with other water sources. No negative effects of consuming produced water have been seen or noted in cattle. Generally, Mr. Patterson notes that the increase in available water has resulted in an increase in cattle performance and forage quality.

Mr. Patterson also related his experience with a cattle ranch in North Dakota. Natural water sources at the ranch, containing about 4,000 mg/L sulfates, resulted in incidences of polio in the cattle that consumed this water. A supplemental mineral program was instituted there to help mitigate the effects of the high sulfates, and although some cattle continued to be affected, the ranch continued to use the water source because it was the only water available in the area. Despite this, the ranch was able to make a profit.

Mr. Shepperson

Mr. Shepperson recounted his experiences with cattle drinking from various locations in Salt Creek. He noted that in the summertime, evapoconcentration of the water upstream of produced water outfalls, with concentrations originally as much as 4,000 mg/L sulfate (average 1,200 mg/L) and ~15,000 mg/L TDS (average 2,000) (RETEC 2004), resulted in cattle disorientation and symptoms similar to PEM. Downstream of produced water outfalls, sulfate concentrations of ~1,100 mg/L and TDS concentrations averaging 4,300 mg/L did not

produce any adverse effects. His observations are supported by a use attainability analysis for Salt Creek (RETEC 2004).

Mr. Shepperson also noted that wildlife appeared to be using the water downstream of the outfalls, where population densities appear greater than upstream of the outfalls. Mr. Shepperson speculates that this phenomenon is a result of changes in water quantity as well as quality.

Mr. Schlaf and Mr. Meike

Interviews given by Mr. Schlaf and Mr. Meike relate experiences similar to the above examples, citing that the use of produced water sources in the Bighorn and Powder River basins did not result in any measurable adverse effect on their livestock herds.

Beneficial Use Letters

Beneficial use letters written to industry, BLM and state DEQ offices cite long-term dependence on produced water sources for cattle, sheep and horses without adverse effects. Concentrations were noted as high as 5,000 mg/L TDS, and 3,000 mg/L sulfates, in accordance with NPDES permits (e.g., J. Barquin et al. 2002, J. Fike 2002, J. Turnell 2002, E. Ledder 1988, M. Pitz and L. Meisinger 1988, M. Zinn 1988, D. Grabbert 1988).

Loch Katrine

Oil field discharges have created a number of wetland and riparian habitats in Wyoming, which attract a variety of wildlife. In particular, Loch Katrine, a playa lake maintained and enhanced by produced water in the Oregon Basin oil field in Park County, WY, provides breeding habitat for a variety of aquatic migratory birds (Ramirez 1993). A Fish and Wildlife Service analysis of avian risk in Loch Katrine (Ramirez 1993, 2002) and letters sent regarding wildlife use of the Loch Katrine wetland complex (Appendix B) indicate that chemical constituent concentrations in the water are not impacting avian populations or other types of wildlife that use this area. In addition, the area typically produces an estimated 100 to 150 broods of waterfowl and 50 to 100 broods of shorebirds, and is considered to have an above-average reproductive success rate (Audubon Wyoming 2006). Sulfate and TDS levels measured in the wetland in 1997 were 797 and 1,372 mg/L, respectively (Ramirez 2002). Produced water discharges with TDS concentrations up to 5,000 mg/L, and sulfate

concentrations up to 2,050 mg/L, contributed to the Loch Katrine without noticeable impacts on wildlife (Ramirez 2002).

1.6 Risk Characterization

This section contains reviews of specific studies in which water quality concentrations (WQCs) were derived. The WQCs were then used to identify a single recommended water quality benchmark for each constituent of interest.

A range of WQCs (mg/L) is presented for each constituent-receptor combination. The lower extreme of the range is based on the no observed adverse effect level (NOAEL) TRV. The NOAEL selected represents the highest dose reported not to have an adverse effect on the receptor. The upper extreme of the range is based on the low observed adverse effects level (LOAEL) TRV. The LOAEL selected represents the lowest dose reported to have a significant, sublethal adverse effect on the receptor. Selected TRV-NOAELs and TRV-LOAELs were converted to WQCs by the equation:

$$\text{WQC} = \frac{\text{N/LOAEL (mg constituent/kg body weight/day) x water ingestion rate (L/day)}}{\text{body weight (kg)}}$$

As part of every risk assessment, an uncertainty analysis should be conducted to identify data gaps and the magnitude of uncertainties associated with characterizing risk (US EPA 1998). Therefore an uncertainty analysis was conducted on the derived WQCs, and ranges were compared to the empirical data gathered from Wyoming ranchers. Based on the WQCs, uncertainty analysis and field-based data, a recommended water quality benchmark was identified for each constituent at which risk to wildlife and livestock in Wyoming would be unlikely.

1.6.1 Determination of water quality concentrations and benchmark for barium

There are few toxicity studies available for barium. Perry et al. (1983) and Deitz et al. (1992) showed a range of reported NOAELs for nonruminant mammals. These NOAELs are consistent with the LOAEL identified in Deitz et al. (1992). There were no ruminant-specific studies that addressed sublethal effects that could clearly be interpreted for the health or well-being of these receptors, and hence the Perry et al. (1983) and Deitz et al. (1992) studies were used as a basis for both ruminant and nonruminant receptor TRVs. For birds, there were also limited studies from which to draw upon; Johnson et al. (1960) identified a subchronic

NOAEL and LOAEL in chicks, and hence these concentrations were used to derive WQCs for birds. Subchronic is defined the duration of toxicity test of less than 1 year for mammals, or less than 6 weeks for birds.

A summary of all studies reviewed, and final studies selected to derive WQCs for barium, are shown in Table 1-7. Because a ruminant-specific study addressing chronic health or well-being effects was not identified, studies on other mammals were used, and an uncertainty factor of 10 applied to these results consistent with US EPA (1995) methodology. The final WQCs for barium for which there will be no risk to receptors include:

Nonruminant mammal (rodent)	100 - <915
Ruminant (growing heifer)	13 - <120
Passerine bird (mallard)	360 - <735
Petition proposed limit:	**0.2**
Recommended benchmark:	**13**

Table 1-8. Barium water quality range from no adverse effects to low adverse effects, compared to the proposed surface water effluent limit for Wyoming. Water quality concentrations between the extremes will not likely result in risk to receptors. All results in mg/L.

The degree of uncertainty associated with the recommended benchmarks is moderate to high, because there is a general lack of toxicity studies on ruminants and birds. Although uncertainty factors were employed in the derivation of water quality benchmarks for ruminants, the technical basis for the use of a 10-factor is weak (Chapman et al. 1998). Nevertheless, even the lowest barium water quality benchmark derived (13 mg/L for ruminants) was over an order of magnitude higher than the proposed limit. Similarly, Canada's lowest recommended water quality criteria for livestock at 5 mg/L is also over an order of magnitude higher than the proposed limit. Finally, NRC (2005) recommends 100 ppm barium for horses, poultry and swine.

Due to the high level of uncertainty, **the recommended water quality benchmark for livestock and wildlife protection is 13 mg/L**, which is not only the lowest derived WQC, but is also consistent with published water quality criteria for livestock.

The recommended water quality benchmark for barium, however, is not consistent with the proposed limit. Reported support in the petition for the 0.2 mg/L barium limit is based on a Utah Extension Service publication (Bagley et al. 1997), which lists a US EPA water quality recommendation for livestock of 0.2 mg/L. The US EPA citation in Bagley et al. (1997) is presumably the 1972 water quality criteria publication referenced in the document; however, there is no recommendation for barium in this literature source. No other studies supporting a 0.2 mg/L barium limit were found, including Colorado State University's extension service bulletin which revised its guidelines to exclude any limit for barium.

1.6.2 Determination of water quality concentrations and benchmark for sulfate

In the review and selection of toxicity studies for indicator species, special emphasis was placed on matching the form of sulfur that will be found in surface water bodies (SO_4) to the form of sulfur administered in the study, because animal tolerance and metabolism of sulfur will vary depending on its chemical form.

Upon review of rodent studies, Brown and Gamatero (1970) found a subchronic NOAEL of 18.1 mg/kg/d in rats; however, a LOAEL was not identified in the study. Weeth and Hunter (1971) later reported a subchronic NOAEL of 668 mg/kg/d for rats. No LOAEL could be identified from a literature review. Although Cohen et al. (1958) and Daniel and Waisman (1969) identified subchronic LOAELs in the range of 410 - 515 mg/kg/d, the form of sulfate in these studies was organic, administered as DL-methionine in the diet, and hence these studies were not considered adequate to derive a LOAEL for inorganic sulfate.

In birds, no adverse effects were found at doses of >1,000 mg/kg/d reported by Krista et al. (1961); however, Harter and Baker (1978) reported reduced growth rates at 288 mg/kg/d. Both studies administered sodium sulfate in water to chickens over a subchronic duration period. In another study with laying hens, Adams et al. (1975) identified a NOAEL of 101 mg/kg/d, finding no effects on egg production, feed intake rates or mortality.

Of the subchronic toxicity studies evaluated for growing cattle (no chronic studies exist), NOAELs were typically identified in the studies at 604 mg/kg/d or less (Embry et al. 1959). Fewer LOAELs were adequately identified in the available studies; Embry et al. (1959) identified a LOAEL at 699 mg/kg/d, noting decreased weight gains and feed intake rates. Although Grout et al. (2006) reported a LOAEL at 170 mg/kg/d, this LOAEL was lower than the reported NOAEL (270 mg/kg/d) from the same study. Weeth and Hunter (1971) found that at 337 mg/kg/d, significant effects on weight gain were seen in growing cattle. However, this study (as well as many others) was performed in a feedlot environment; Johnson and Patterson (2004) demonstrated that the conditions in feedlots are more stressful to the animal, resulting in reduced sulfate toxicity thresholds to growing cattle compared to conditions in open rangeland environments. Patterson et al. (2003) and Johnson and Patterson (2004) reported a feedlot-associated LOAEL of 251 mg/kg/d, but a NOAEL from the open rangeland tests at 360 mg/kg/d (Johnson and Patterson 2004), noting that although declines were seen in water intake rates, no effect on weight gain was found.

The open rangeland-associated NOAEL from Johnson and Patterson (2004) is not only more consistent with most other studies, but is also consistent with the Wyoming field-based empirical data, which shows that at concentrations up to 3,100 mg/L sulfate (~259 mg/kg/d), no adverse effects are seen in livestock. Hence, the NOAEL identified for water quality derivation in this risk analysis is 360 mg/kg/d (from Johnson and Patterson 2004), and the LOAEL identified is 699 mg/kg/d (from Embry et al. 1959).

Effects on growing cattle were noted at lower concentrations in these studies than for adult cows and steers. Weeth and Caps (1972) noted no effects on intake rates, feed efficiency or growth rates in adult cattle fed 122 mg/kg/d sodium sulfate. The lowest LOAEL at which effects on adult cattle were noted were reported by Patterson et al. (2004) at 327 mg/kg/d, noting significant declines in growth rates of adult cows, though no effects were noted on cow reproduction or calf weight gain (calf-cow pairs were evaluated in the study). Results of Ward and Patterson (2004) and Patterson et al. (2002) were consistent with Patterson et al. (2004), reporting LOAELs of 352 and 381 mg/kg/d, respectively.

A summary of all studies reviewed, and final studies selected to derive WQCs for sulfate, are shown in Table 1-9. To show the relative differences in the sensitivity of developing ruminants versus adult ruminants, sulfate WQCs were derived for an adult steer to compare with the concentration derived for a growing heifer. From these results, it is apparent that the upper end of acceptable WQCs is much lower for the growing heifer than the adult steer.

The final WQCs for sulfate for which there will be no risk to receptors include:

Nonruminant mammal (rodent)	5,070
Ruminant (growing heifer)	3,660 – <7,100
Ruminant (adult steer)	2,800 – <7,500
Passerine bird (mallard)	1,780 – <5,080
Current effluent limit:	**3,000**
Petition proposed limit:	**500**
Recommended benchmark:	**3,010**

Table 1-10. Sulfate water quality range from no adverse effects to low adverse effects, compared to the current and proposed surface water effluent limits for Wyoming. Water quality concentrations between the two extremes will not likely result in risk to receptors. All results in mg/L.

There is a considerable range of lower-end WQCs for the various receptors, from 1,780 to 5,070 mg/L. Studies on growing cattle and adult steers are the most abundant for sulfate, and associated uncertainties with the range of water quality is low. However, very few NOAELs were reported for adult steers, and doses administered to adults were less than those of studies with growing heifers. Hence, the NOAEL derived in the table above is actually lower for adults (2,800 mg/L) than for growing heifers (3,660 mg/L) despite the reported higher sensitivity of growing heifers compared to adults. All of the adult steer studies were conducted in feedlot environments, which probably contributed to the lower reported NOAELs.

Additionally, there is a large gap between the lower-end 2,800 mg/L) and the upper-end (<7,500 mg/L) extremes for adult steers, due to fewer toxicity studies on adults rather than growing heifers. These differences in data availability are not surprising, since the most commonly reported adverse effect from sublethal sulfate intake is reduced growth rates, hence growing organisms are typically used to evaluate toxicity.

Uncertainties associated with bird and nonruminant receptors were moderate. The relative paucity of data for these types of species contributed to lower-end WQCs derived for birds and mammals being lower than for livestock, with a large difference between lower- and upper-end concentrations.

The ranges of WQCs were used to derive a single recommended water quality benchmark for sulfate. Only NOAELs were reported for rodent receptors, indicating that concentrations up to 5,070 mg/L would still be protective of these types of mammals. For remaining receptors, the geometric mean of the low- and high-end concentrations was taken to obtain an estimated concentration at which risk to these receptors would be unlikely (methods based on EPA guidance for ecological risk assessments, e.g., US EPA 2003). Geometric means of the water quality benchmarks are 5,100, 3,010 and 4,590 mg/L for growing and adult cattle and birds, respectively. Therefore, **the recommended water quality benchmark for sulfate is 3,010 mg/L** because this number is the lowest of the geometric means for cattle and birds, it is within the range of NOAEL-based WQCs for rodents, and it is consistent with the field-based data from Wyoming water users. This benchmark also takes into account the effects on both growing and adult cattle.

This recommended water quality benchmark is consistent with the current regulatory effluent limits for sulfate. In contrast, the petitioners' proposed limit (500 mg/L) is not supported by this risk analysis. The proposed amendment to sulfate water quality was based on a recommended limit of 500 mg/L for calves. Support for this recommendation is lacking, however, and cannot be found in the literature. The support referenced in the petition is the Utah State University Extension service bulletin. This bulletin references Kober (1993) in support of its sulfate guideline for livestock. However, the Kober (1993) paper, recommends that 3,500 ppm is unfit for sows, and "[w]ater with levels above 4,500 ppm should not be

used." "Slight" effects on livestock were cited in the paper for 1,500 ppm and above, although those effects were not elaborated upon beyond the possibility of temporary diarrhea. The other reference provided is from the Wyoming Department of Agriculture Analytical Service. This web publication does not reference any support for its recommendation of ≤ 1000 mg/L sulfate as "suitable" for livestock. Furthermore, the web publication does not define "suitable," referencing only that the criteria are for classification purposes only.

1.6.3 Determination of water quality concentrations and benchmark for TDS

Because variation in TDS makeup will affect toxicity thresholds, and much of produced water effluent is dominated by sodium chloride, this review focused on compiling studies which addressed toxicity to sodium chloride. Other types of TDS constituent studies were also reviewed, although far fewer exist. Studies involving sulfate-dominated TDS waters were not considered for TDS analyses, since sulfate toxicity is addressed elsewhere.

Review of chronic or subchronic toxicity studies on growing cattle shows a wide range in NOAEL and LOAEL thresholds for NaCl-type waters. Growth effects in growing cattle have been reported in the range of 800 mg/kg/d to >2,100 mg/kg/d (Weeth and Haverland 1961). This wide range in toxic thresholds appears to depend on the season in which the cattle are exposed, as well as other factors, such as diet and timing of watering and feeding (Ray 1989). Interestingly, significant growth effects were seen at a lower dose (800 mg/kg/d) during winter months than in summer months (900 mg/kg/d) The lower LOAEL, in winter, reported by Weeth and Haverland (1961) could be attributed to reported differences in drinking rates and body weights between experimental groups.

NOAELs reported by Spafford (1941), Weeth and Hunter (1971), Weeth (1962) and Embry et al. (1959) are consistent with the LOAEL reported in Weeth and Haverland (1961); only Weeth et al. (1960) found that a dose of over 1,600 mg/kg/d TDS (as NaCl) did not result in any adverse effects on growth. Other studies evaluated effects only on food/water intake and aspects of digestibility, including Lassiter and Cook (1963), Ray (1989) and Johnson et al. (1959). Although growth was not measured in these studies, NOAELs and LOAELs reported are still consistent with Weeth and Hunter (1971) and Weeth and Haverland (1961). A summary of all evaluated studies on growing cattle are shown in Table 1-11.

Fewer studies have focused on evaluating effects in adult cattle, but the effects of TDS (as NaCl) on milk production in dairy cows has been widely studied. Significant declines in milk production have been reported between 380 and 600 mg/kg/d (Challis et al. 1987 and Jaster et al. 1978, respectively) but Bahman et al. (1993) did not see any effect on milk production at 610 mg/kg/d, and no effects were reported by Frens (1946) at over 900 mg/kg/d. Experiment durations and seasonal differences varied among studies, as did the source of water. Jaster et al. (1978) added NaCl to tap water, the sources of water in the Challis et al. (1987) and Bahman et al. (1993) studies were natural well waters. Only Challis et al. (1987) reported all individual constituent concentrations, which showed the water to be a calcium sulfate type, while data from the Bahman et al. (1993) study suggest that water contained primarily sodium and magnesium, which is more consistent with the makeup of produced water in Wyoming.

Studies on nonlivestock species are primarily limited to rat studies. The most comprehensive and quantitative study was initiated by Embry et al. (1959), who demonstrated a range of effects on rats that were administered different types of TDS components. Effects were seen at lower concentrations for water containing MgCl and $MgSO_4$ (790 mg/kg/d) compared to NaCl waters (>1,540 mg/kg/d). Calcium chloride resulted in reduced water consumption and growth rates at the lowest level (365 mg/kg/d). These results appear roughly consistent with Heller (1932, 1933) and Heller and Larwood (1930), as reported by NRC (1974).

Toxicity studies for birds were conflicting. Only one study, by Krista et al. (1961), tested the effects of NaCl on mallard duckling growth and intake rates. The NOAEL and LOAEL from this study were 269 and 385 mg/kg/d, respectively. A related series of studies on hens, measuring eggshell defects, demonstrated LOAELs as low as 104 mg/kg/d (Belnave and Yolowitz 1987, Belnave et al. 1989, Yolowitz et al. 1990) but all other studies on poultry demonstrated LOAELs at 350 mg/kg/d or higher (Heller 1933, Scrivner 1946, Krista et al. 1961). NOAELs demonstrated for these other studies were not lower than ~115 mg/kg/d (Heller 1933, Scrivner 1946). Particular details regarding the environmental conditions of the hens and feed/water diet are lacking in the Belnave and Yolowitz study series, which created unacceptable uncertainties associated with the study selection process.

Studies selected for ruminant and birds receptors were restricted to NaCl-dominated water only, as few (if any) studies were published on other types of TDS. Findings published by Weeth and Haverland (1961) and Weeth and Hunter (1971) were found to be most representative of the range of concentrations for which risk is not likely in growing cattle. Embry et al. (1959) was selected as the representative study on rats, and two NOAELs were identified as representative of the range of study effects: a low NOAEL based on MgCl exposure, and a higher NOAEL based on NaCl exposure. The range of study effects selected for the passerine bird included the NOAEL and LOAEL from Krista et al. (1961), as this study addressed effects specifically on mallard ducks.

The final WQCs for TDS for which there will be no risk to receptors include:

Nonruminant mammal (rodent)	4,750 – <11,700
Ruminant (growing heifer)	7,380 – <8,200
Passerine bird (mallard)	4,750 – <6,790
Current effluent limit:	**5,000**
Petition proposed limit:	**2,000**
Recommended benchmark:	**5,600**

Table 1-12. TDS water quality range from no adverse effects to low adverse effects, compared to the current and proposed surface water effluent limits for Wyoming. Water quality concentrations between the two extremes will not likely result in risk to receptors. All results in mg/L.

Uncertainty associated with the range of WQCs derived for growing cattle is low. When compared to barium and sulfate, a larger dataset was available for growing cattle; toxicity thresholds were largely consistent among studies but N/LOAELs varied widely between studies. The wide diversity in NOAELs is the result of lack of data at higher exposures rather than differences in cattle response. Most studies identified NOAELs but not LOAELs, hence uncertainties were slightly greater for the upper-extreme ranges of WQCs. However, almost all studies conducted experiments in feedlot-type environments that are not representative of conditions in Wyoming associated with higher TDS concentrations due to

produced water outputs. The Johnson and Patterson (2004) study suggests that general toxicity thresholds in feedlot environments will be lower than in open range environments due to harsher environmental conditions in the feedlots. Hence, the studies used to derive WQCs for growing cattle are conservatively based.

The literature-based toxicity review primarily looked at effects of sodium chloride-dominated TDS water, which is consistent with much of produced water discharges. In some locations, discharges have significant components of carbonates as well. Literature review on general effects (Section 1.4) indicates that carbonate-dominated TDS waters result in toxicity to nonruminant mammals at slightly lower concentrations. However, literature-based toxicity thresholds for TDS in growing cattle are consistent with the field-based data gathered from Wyoming ranchers at locations with variable TDS makeup, including those with carbonate-dominated waters. Data from these interviews indicate that concentrations up to 5,390 mg/L do not result in adverse effects on growing or adult cattle.

Uncertainties associated with WQCs for nonruminant mammals and birds are moderate to high. There were very few available studies for rodents, although results were relatively consistent between studies. Toxicity studies on birds were conflicting; most studies such as Krista et al. (1961) were adequately designed, and confidence using these studies to derive WQCs is high, but particular details regarding the environmental conditions of the hens and feed/water diet are lacking in other studies (i.e., the Belnave and Yolowitz series), which showed lower toxicity thresholds.

To derive a single recommended water quality benchmark for TDS, the geometric mean of the low- and high-end concentrations was taken to obtain an estimated concentration at which risk to these receptors would be unlikely. Geometric means of the water quality benchmarks are 7,460, 7,800, and 5,680 mg/L for rodents, growing cattle and birds, respectively. Therefore, **the recommended water quality benchmark for TDS is 5,600 mg/L,** because this number is the lowest of the geometric means for cattle and birds (rounded down), it is within the range of NOAEL-based water quality criteria for other types of livestock (i.e., dairy cows), and it is consistent with field-based data from Wyoming water users.

The recommended water quality benchmark for TDS derived in this paper is consistent with the current regulatory effluent limits, as well as other published benchmarks for livestock from extension services around the country (e.g., Bagley et al. 1997, Faries et al. 1998, Looper and Waldner 2002). In contrast, the petitioners' proposed TDS limit of 2,000 mg/L does not represent the maximum tolerable level in livestock or wildlife. The citation provided as support lacks consistency with Wyoming produced water. Whereas Wyoming produced water typically has a sodium-bicarbonate or sodium-chloride signature, the reference, a South Dakota extension bulletin (Lardy and Stoltenow 1988) recommends ≤3,000 mg/L for *sulfate*-dominated TDS water for conditions in South Dakota. Thus, this recommendation more accurately describes toxicity thresholds for sulfate. It is important to note that all of the references cited in the petition are non-peer reviewed recommendations based on a review of either scientific literature or other extension publication bulletins.

1.7 Summary and Conclusions

To analyze the adequacy of the current effluent limits and the validity of the petitioners' proposed limits to protect wildlife and livestock, a risk analysis was done of livestock and wildlife chemical risk from TDS, sulfate and barium levels in surface water bodies created or impacted by produced water in Wyoming. This was accomplished by investigation along two lines of evidence. The first line included peer-reviewed scientific literature on water quality effects on animal species; the investigation sought to determine the water quality attribute (TDS, sulfate, barium) levels that are protective of animal species of interest, including livestock (cattle and sheep) and wildlife (mammals and birds). The second line of evidence included data compiled from ranchers and others in Wyoming who use produced and natural water sources for their livestock or farming use.

The analysis followed the US EPA's Guidelines for Ecological Risk Assessment (US EPA 1998), which outlines three basic steps for ERAs: problem formulation, analysis, and risk characterization.

1.7.1 Problem Formulation Summary

In the problem formulation stage, background information on the availability and quality of water bodies in Wyoming (both from natural and produced water sources) was reviewed, and animal use of those water bodies was described. There are more than 64,000 currently active CBNG and conventional oil and gas industry wells in Wyoming. Some of the water produced as a result of oil and gas extraction is discharged into reservoirs or naturally occurring drainages. Livestock and a variety of wildlife species utilize both natural and enhanced (from produced waters) surface water bodies for food, shelter, breeding ground and water resources. Examples of the water quality from active produced water discharges across Wyoming compared to the petition proposed standards are shown in Table 1-1. Much of this water could not be discharged if the petition-proposed water quality effluent limits were adopted by the WDEQ.

An ecological conceptual model was presented to describe the relationships between the stressors (produced water bodies) and biological components. Finally, a set of endpoints was identified to ensure that the risk assessment goals are consistent with the petitioners'

statements and goals regarding WDEQ water quality regulations. The assessment endpoint identified in this risk analysis is the protection of the health and well-being of populations of Wyoming livestock and wildlife species from any adverse effects due of consuming surface water.

1.7.2 Exposure Analysis Summary

The analysis phase of the risk assessment examined the two primary components of risk: exposure and effects. In the exposure analysis, the exposure profiles for barium, sulfate and TDS were reviewed and exposure profiles for indicator species were identified. The fate and transport of constituents of interest in the environment play a significant role in determining toxicity to receptors. The chemical composition of the water, e.g., pH, hardness, dissolved organic carbon content, etc., strongly influences the speciation of constituents and the degree of uptake by biological organisms.

Barium compounds such as barium nitrate and barium chloride are soluble in water. However, the solubility of barium is often limited by the presence of sulfate and carbonate which bind the barium in sparingly soluble forms including barium sulfate and barium carbonate compounds. These forms of barium are relatively nonbioavailable.

Aqueous sulfate reacts with nearly all constituents, from metals to salts to organic matter, to form chemical complexes. In animals, inorganic sulfur is converted into organic sulfur, an essential component of proteins and other organic compounds.

Total dissolved solids (TDS) is a measure of all constituents dissolved in water. In natural and produced water, the most abundant of these constituents are typically chlorides, carbonates, bicarbonates and sulfates (collectively referred to as 'anions'), and calcium, magnesium, potassium, and sodium (collectively referred to as 'cations'). Most compounds must be dissolved in water to be absorbed from the digestive tract.

The receptors chosen for the risk analysis included a developing ruminant (growing heifer), a nonruminant small mammal (rodent), and waterfowl (mallard duck). These receptors are representative of the types of livestock and wildlife species in Wyoming that are exposed to surface water bodies, including locations where produced water effluent might be deposited.

1.7.3 Effects Analyses Summary

The effects analysis was divided into two parts. In the first part, existing toxicity studies and published guidelines were reviewed for each of the constituents of interest, and the methods used to derive TRVs were described. During the literature review, it was recognized that there were gaps between the constituent concentration clearly identified not to result in any effect, and the concentration found to result in a significant adverse effect. Concentrations in between these extremes (NOAEL, LOAEL) have not yet been evaluated and hence the potential for risk is unknown. We conservatively based the water quality benchmarks on the lowest of geometric means between the NOAEL and LOAEL. In addition, there are many differences in the environmental conditions between literature-based toxicity studies and environmental conditions in Wyoming. These differences have important impacts on animal tolerance to constituent exposure.

To reconcile the gaps in data and differences in study conditions from the Wyoming environment, a second method of effects evaluation was undertaken that involved a compilation of field-based data of water body users in Wyoming. Interviews with ranchers and other users of water bodies in Wyoming were undertaken to identify anecdotal as well as quantitative measures of effects. The field-based data served to support toxicity study results and fill in data gaps in the literature-based studies.

Overall, the ranchers indicated that water containing sulfates up to 3,100 mg/L and TDS up to 5,390 mg/L did not result in adverse risk to livestock in Wyoming's Bighorn and Powder River basins. Weaning rates, weaning weights, body condition, breeding percentage and death rates were no different between pastures associated with natural water sources, and those with produced water, which typically contain higher concentrations of sulfates and TDS. Adverse effects were apparent in livestock exposed to evapoconcentrated surface water that originally contained more than 4,000 mg/L sulfate and 7,000 mg/L TDS. Analyses of effects of these concentrations on wildlife were less conclusive; however, it appears that no adverse risk to wildlife occurred from exposure to water at Loch Katrine, which contains elevated sulfates and TDS relative to background.

1.7.4 Risk Characterization Summary

In the risk characterization step, ranges of WQCs were derived for each receptor-constituent combination from the reviewed literature sources. The WQCs were then used to derive a single recommended water quality benchmark for each constituent.

There were relatively few toxicity studies available for barium. Hence, additional uncertainty factors were employed to derive WQCs for livestock. The final WQCs for barium ranged from 13 to <915 mg/L. Although the degree of uncertainty associated with these benchmarks was high, even the lowest barium water quality benchmark derived (13 mg/L for ruminants) was over an order of magnitude higher than the proposed limit. Similarly, Canada's lowest recommended water quality criteria for livestock at 5 mg/L is also over an order of magnitude higher than the proposed limit.

Sulfate toxicity thresholds for birds and nonruminant mammals were consistent between studies. NOAELs for growing cattle were typically identified in the studies at 604 mg/kg/d or less, though one or two studies identified LOAELs at lower concentrations. Most studies were performed in a feedlot environment. Johnson and Patterson (2004) demonstrated that the conditions in feedlots are more stressful to the animal, resulting in reduced toxicity thresholds to growing cattle compared to conditions in open rangeland environments. The reported NOAEL from the open rangeland tests was 360 mg/kg/d (Johnson and Patterson 2004).

The final WQCs for sulfate ranged from 1,780 mg/L (lowest NOAEL) to <7,500 mg/L (highest LOAEL). These WQCs were consistent with the concentrations identified in the field-based studies, which found that concentrations up to 3,100 mg/L do not result in adverse risk to either wildlife or livestock.

The toxicity of TDS depends in part on its dominant constituents. The literature review focused on sodium-chloride-dominated TDS waters. The WQCs for TDS ranged from 4,750 to <11,700 mg/L. Uncertainty associated with the range of WQCs derived for growing cattle is low. Relative to barium and sulfate, a larger dataset was available for growing cattle; toxicity thresholds were largely consistent among studies, but N/LOAELs varied widely between studies. However, due to the feedlot conditions in most toxicity studies, these

WQCs for livestock are conservative. Moreover, literature-based toxicity thresholds for TDS in growing cattle are consistent with the field-based data gathered from Wyoming ranchers, who indicate that concentrations up to 5,390 mg/L do not result in adverse effects on growing or adult cattle.

The results of the risk analysis yielded the following recommended water quality benchmarks for barium, sulfate and TDS:

Benchmark/Limit	Barium	Sulfate	TDS
Recommended benchmark:	13	3,010	5,600
Current effluent limit:	None	3,000	5,000
Petition proposed limit:	0.2	500	2,000

Table 1-13. Summary table of recommended water quality benchmarks for barium, sulfate and TDS that are protective of livestock and wildlife receptors, compared to the current WDEQ effluent limits and the petition's proposed effluent limits. All results in mg/L.

The recommended benchmarks derived in this analysis are consistent with the current WDEQ effluent limits for sulfate and TDS. Furthermore, this ERA shows that there would be no incremental reduction in the injury to the health and well-being of animals and wildlife if water quality effluent limits were reduced to the petitioners' requested limits. The petitioners' proposed limits for barium, TDS and sulfate are not supported either by this analysis or by the literature cited in the petition.

2 Economic and Social Effects of Water Quality Limits of Produced Water

2.1 Introduction

The Wyoming Department of Environmental Quality (WDEQ) is reviewing a petition to change the current effluent limits for total dissolved solids (TDS) and sulfate, and to add an effluent limit for barium, for coal bed natural gas (CBNG) industry produced water. The petitioners argue that the current effluent limits are not "protective of stock and wildlife." However, the State, before recommending water quality standards (including effluent limits) for Wyoming, must consider a range of criteria (W.S. 35-11-302(vi)), including:

(A) the character and degree of injury to or interference with the health and well-being of people, animals, wildlife, aquatic life and plant life affected;

(B) the social and economic value of the source of pollution;

(C) the priority of location in the area involved;

(D) the technical practicability and economic reasonableness of reducing or eliminating the source of pollution; and

(E) the effect upon the environment.

In direct response to the petition, the ecological risk assessment (ERA, Chapter 1 of this report) evaluated W.S. 35-11-302(vi)(A), the character and degree of injury to the health and well-being of livestock and wildlife affected by effluent limits. However, other factors that bear upon the reasonableness of effluent limits should not be overlooked. Principally, the character and degree of injury to the well-being of the people, and the social and economic value of produced water discharge should be carefully weighed, because the decision to change current effluent limits would affect not only water *quality*, but ultimately water *quantity*. This is because unnecessarily stringent effluent limits for produced water discharges will result in reduced water discharge to surface water bodies, since the economics of treating large quantities of produced water are such that injection/reinjection, deep disposal, and/or reduced exploration and development are likely results of additional

treatment requirements. For examples, see Table 1-1 for a comparison of current discharge water quality data to the petition proposed limits.

Social and economic value to residents in Wyoming, and possible injury caused by reductions in exploration/development and produced water discharge are described in subsequent sections of this report. Although the petition targets only CBNG production in Wyoming, conventional oil production operations could also be affected by state-wide changes in effluent limits, and hence the effects on these industries are also considered.

Counties principally affected by produced water discharges include Bighorn, Hot Springs, Washakie and Park counties in the Bighorn basin; Freemont and Natrona counties in the Platte River basin; and Converse, Campbell, Johnson, Natrona and Sheridan counties in the Powder River basin. Hence, for purposes of this report, economic and social considerations are focused on these areas only.

2.2 W.S. 35-11-302(vi)(B) - The Social and Economic Value of the Source of Pollution

Since the advent of conventional and CBNG produced water discharge in Wyoming, numerous livestock owners, farmers and wildlife populations have used the increase in water supply to their advantage. Letters of beneficial use, written by landowners and received by industry, BLM and state agencies, describe a heavy dependence on produced water discharge to support their livelihood in ranching and farming (Appendix B). Examples include:

- Produced water in Five Mile Creek supports over 2,500 head of livestock for two operators (B. Garland 2002, L. Mantle 2002).
- R. Pattison (2002) is able to generate income by renting irrigated pastureland to cattle and sheep ranchers. The productivity of the irrigated pastureland is the result of using produced water discharges.
- J. Wilson and T. Wilson (2006) rely on produced water sources from the Gebo and Little Sand Draw oil fields to maintain their cattle herds on 19,000 acres of BLM lands.
- R. Larson (2002) uses produced water discharges for livestock and irrigation operations in his 3,000-acre pasture.
- A. Baird (1988) was able to increase his crop production by 300% between 1968 and 1988 with the use of produced water. Similarly, P. Ward (2006) cites a 300% increase in alfalfa hay production attributable to produced water sources.
- Produced water from Hamilton Dome oil field has been used to irrigate about 500 acres of ranchland along Cottonwood Creek, which otherwise could not be irrigated (J. Baird 1988).

In addition to individuals' letters, use attainability analyses for Salt Creek and Cottonwood Creeks (RETEC 2004, SWWRC et al. 2002) surveyed agricultural uses of these areas, and found that most of the available land that receives produced water discharges is now used almost year-round for livestock grazing of cattle and sheep. Ranches in the Salt Creek area consist of both privately owned land and leased land. Almost all of the ranches have access to Salt Creek or related tributaries that receive discharged produced water. Ranching on the lands adjacent to Salt Creek produced over 4,500 head of cattle and 3,300 head of sheep in 2002. Distributed between eight operations, this inventory accounts for 0.3% of all cattle and

0.7% of all sheep raised in Wyoming in 2002 (NASS 2002). About 35 landowners have property adjacent to Cottonwood Creek; nearly all of them benefit from produced water discharges through irrigation and/or stock watering. An estimated two-thirds of all crop production in the Cottonwood Creek area was attributable to produced water discharges. A good portion of the crops includes grass hay and alfalfa, which are used to feed cattle in winter months, hence further benefiting ranchers.

Produced water discharges also support populations of wildlife species that may not otherwise be viable. Improved water quality of the streams from produced water discharges in the Powder River basin, and the perennial streams created in the Bighorn basin from produced water discharges, attract many wildlife species and supports greater populations, including big game, small game birds, and wild horses. The increase in game populations also generates greater revenue from hunting, fishing, and related tourism in the Cottonwood Creek area (SWWRC et al. 2002). The drainages create additional foraging areas for a variety of large and small mammals and, subsequently, important prey resources for raptors. The creeks are used as stopover resting and foraging areas for a variety of migratory birds and waterfowl species, and habitat for threatened and endangered species. Finally, discharges may also support critical habitat for water-dependent species such as beaver and muskrat (RETEC 2004, SWWRC et al. 2002).

In the Bighorn basin, the Loch Katrine, a playa lake enhanced and maintained by produced water from the Oregon Basin oil field in Park County, WY, is a nesting and feeding ground for many species of migratory birds, raptors and waterfowl, including two species of threatened and endangered species: peregrine falcon and bald eagle; and three candidate species: the long-billed curlew, white-faced ibis, and ferruginous hawk (Ramirez 1993). The The Loch Katrine has received state and federal grants to maintain and improve the wetland complex. These funds help support local jobs and bird conservation programs.

Letters of beneficial use cite other instances of wildlife use of newly created and improved habitat in the Bighorn and Powder River basins (e.g., J. Wilson 1988, I. Schultz 1988, D. Grabbert 1988). Wild horse populations also frequent the Dry Creek area (G. Flitner, personal communication), and letters of beneficial use cite heavy dependence on the

discharges from the Oregon Basin oil field for maintaining wild horse herd sizes (FOAL 2006). Finally, in the Platte River basin, use attainability analyses identified 97 species of birds and mammals in the area near Poison Spider Creek that benefit from produced water discharges (Gene R. George & Associates et al. 2005).

The quality of produced water discharges in certain circumstances improves water quality of natural drainages. In drainages within the Powder River basin, natural background concentrations of TDS and sulfates can reach as much as 22,000 mg/L TDS and 12,000 mg/L sulfate, resulting in acute adverse effects in cattle and wildlife, including death (RETEC 2004, A. Baird 1988, J. Baird 1988). Ranchers in this area have indicated a preference for using produced water discharge, as concentrations from the effluent are lower than natural background concentrations in Salt Creek (RETEC 2004). In the Bighorn basin, increases in water flow in Dry Creek lessen the effects of evapoconcentration of natural waters, which can result in adverse effects on cattle (D. Schlaf; Appendix A).

2.3 W.S. 35-11-302(vi)(A) - The Character and Degree of Injury to or Interference with the Health and Well-Being of People, Animals, Wildlife, Aquatic Life and Plant Life Affected

The ERA (Chapter 1) found that there would be no incremental reduction in injury to the health and well-being of animals and wildlife if effluent limits were changed to the petitioners' requested limits. In addition, the social and economic injury to the people was evaluated as a result of changing the effluent limits.

The decision to change current effluent limits would affect not only water *quality*, but ultimately water *quantity,* because unnecessarily stringent effluent limits for produced water would likely result in reduced water discharge to surface water bodies. The economics of treating large quantities of produced water are such that injection/reinjection, deep disposal, and/or reduced exploration and development are likely results of additional treatment requirements.

2.3.1 Economic injuries of reduced exploration and development

Economically, field revenue from oil and gas extraction facilities provides jobs and associated earnings, production taxes and royalties, as well as basic export revenue. State-wide, the oil and gas industry supported 2,995 employees in 2002, with a total annual payroll of $162 million (US Bureau of the Census 2002). In addition, support activities for oil and gas operations, including drilling of oil and gas wells, employed an additional 9,200 employees with earnings totaling $332.6 million in 2002. The value of shipments, sales and receipts for oil and natural gas industries in Wyoming totaled $3.9 billion (in 2002), representing ~14% of the total sales, shipments and receipts for the state. At least a portion of these revenues is expected to be negatively impacted by a loss of opportunity to surface discharge produced water.

For example, in the Bighorn basin, the Hamilton Dome oil field produces both oil and natural gas. Elimination of this oil field would result in a loss of $28.7 million of total annual economic output (in 1997 dollars), and 136 jobs in Hot Springs County, with earnings totaling $4.1 million annually (SWWRC et al. 2002). An additional 51 jobs across Wyoming are supported by this oil field.

In Natrona County, elimination of the South Casper Creek field, a crude oil production facility that surface-discharges produced water, would have resulted in the loss of over $3 million of the county's basic exports in 2002, and losses of associated jobs, with annual earnings totaling $487,142 in 2002 (Gene R. George & Associates et al. 2005).

Elimination of oil fields in the Salt Creek area of the Powder River basin would result in the loss of over 175 jobs and $4.6 million in annual earnings (in 1997 dollars) for Natrona and Johnson counties (Taylor 1999).

2.3.2 Social injury of reduced oil and gas exploration/development

The presence and activity of oil and gas extraction facilities significantly contribute to the well-being of local communities, via fiscal contributions of taxes and royalties. County income from these operations supports various public facilities, including schools, hospitals, libraries, fire departments, environmental programs, and the county general fund.

In Natrona County, elimination of the South Casper Creek field would result in a reduction of property tax income by 2.5%, severance taxes by 0.04%, sales and use taxes by 0.16%, and 2.5% of federal royalties for the county (on average, between 1997 and 2002; Gene R George & Associates et al. 2005). The total dollar amount (in 2002 dollars) of the loss of these tax and royalty contributions is estimated at $424,085.

Loss of funds associated with the Hamilton Dome oil field would reduce social contributions to Hot Springs County (in terms of fiscal contributions) totaling 29% of total property taxes, 9% of general fund revenues, 27% of the library system's total revenues, 2% of county hospital revenues, 9% of the county weed and pest management program, 29% of the rural fire district budget, and additional funds for school districts averaging $1.4 million annually (SWWRC et al. 2002).

Elimination of the Salt Creek fields would result in losses of $2.8 million in property tax revenue for Natrona County (in 1997 dollars): $2 million for public schools, $500,000 for county government, and $300,000 for community colleges (Taylor 1999). State severance taxes for the Salt Creek fields in 1997 were estimated at $2.4 million; 2.6% ($62,257) of the

total severance tax was received by Natrona County and 0.2% ($4,789) was received by Johnson County.

2.3.3 Economic injury of eliminating produced water discharges

Farming and ranching is a mainstay of many local economies across Wyoming. There were 5,282 cattle and calf ranches in Wyoming in 2002 (4,590 being beef cow ranches) and 5,191 irrigated cropland farms (NASS 2002). The total number of cattle inventoried in 2002 in counties[1] impacted by produced water discharges was 598,000 head. The combined marketing receipts from agricultural sales in Wyoming totaled $864 million in 2002, with an average of ~$91,700 per operation. Of the total, $726 million was derived from livestock sales (~$645 per head). Operators incurred $518.5 million in production expenses, including livestock, feed, fuel, hired labor, and interest on loans. This leaves a residual net cash return of $207.5 million, or an average of ~$39,000 per livestock operation (before property taxes).

Drought conditions in an already semiarid climate with declining land availability and difficult market conditions have contributed to economic hardships for Wyoming farmers and ranchers in recent years. Rancher interviews in October and November 2006 cite drought-related herd reductions, between 10% and 30% or more (Appendix A). Others cite total dependence on produced water sources, as natural water bodies have disappeared (e.g., M. Brown 2006, L. Mantle 2002, D. Griebel 2002, J. Fike 2002, P. Renner 2002, M. May 2002, N. Sanford 2002, R. Larsen 2002, T. Brown and M. Brown 1988, D. Grabbert 1988). The number of cattle ranches across Wyoming declined 18% between 1997 and 2002. However, with the advent of produced water discharges, many ranchers and farmers are able to continue to make a living in Wyoming; in fact, cattle inventories have increased in recent decades, relative to national inventory numbers (Figure 2-1).

Data from the 2002 National Agricultural Statistics Service was gathered to evaluate economic indices in Wyoming and estimate losses from potential reductions in produced water outputs. In 2002, Wyoming farmers and ranchers reported an aggregate of 34.4 million acres of land in use as part of their operations. The total includes private, state and federal lands covered by grazing allotments, used as pastureland or grazing range. About

[1] Bighorn, Campbell, Converse, Fremont, Hot Springs, Johnson, Natrona, Sheridan, Washakie

1.54 million acres, mostly cropland, is irrigated. In the Cottonwood Creek area of the Powder River basin, 50% of irrigated land is pastureland, which provides winter and spring range and winter feed for the cattle and livestock herds (SWWRC et al. 2002).

Water loss from the Cottonwood Creek area would reportedly correspond to reductions in herd size, between 15% and 20%, resulting in an estimated loss of $2 million in livestock sales, according to the use attainability analysis for Hot Springs County (SWWRC et al. 2002). Additional loss of irrigated pastureland was estimated at 8%. These pasturelands correspond to 1,600 acres of irrigated cropland and 4,000 tons of annual hay production. The use attainability analysis also estimates economic losses of 1.7% ($3.3 million) of total annual economic output (in 1997 dollars) and $645,000 in annual labor income associated with direct reduction in annual livestock receipts.

Ranchers (McCarty, Flitner, and Schlaf) in the Bighorn basin estimated reductions in herd sizes between 30% and 50% from loss of produced water in Dry Creek (Appendices A and B), resulting in an estimated loss of $387,000 to $645,000 in annual livestock sales (@ $645 per head).

Herd reductions resulting from produced water losses in Salt Creek are estimated between 20% and 40% (RETEC 2004). This area supports more than 4,575 head of cattle (surveyed in 2002); corresponding losses of livestock sales from this area are estimated between $590,175 and $1.1 million (@ $645 per head).

Letters of beneficial use from individuals indicate that reduced discharge to surface water bodies would result in herd reductions in many counties across Wyoming. The total number of cattle inventoried in 2002 in counties[1] impacted by produced water discharges was 598,000 head. Combined herd losses of 15% to 50% in these counties would incur estimated losses between $57 million and $192 million in livestock sales (@ $645 per head).

Many ranchers cite additional costs of developing alternate water sources (wells, water hauling, ice breaking, etc.) if produced water were not available (e.g., M. Dennis 2006, D. Griebel 2003, N. Sanford 2002; G. Flitner and M. McCarty, personal communication; Appendix A). J. Kearns (1989) estimated an initial cost of $140,000 and $10,000 annually to

maintain watering wells on Bighorn basin properties if produced water were not available. Associated job losses are cited in several areas: at Cottonwood Creek, an estimated 20 full- or part-time jobs would be eliminated if there were no produced water discharge; and D. Flitner estimates that a portion of the 40 full- or part-time jobs in his Bighorn basin pastures are maintained by the use of grazing lands supported by produced water discharges (D. Flitner 2006). B. Basse, chairman of the Hot Springs County Commissioners, cites a heavy economic dependence on agriculture, tourism, and oil/gas industries, all of which would be negatively impacted by reduced water discharges in this area (SWWRC et al. 2002).

Finally, the economic impact of loss of wildlife populations would primarily affect revenue generated from hunting, fishing and tourism. In 2001, tourism accounted for an estimated $1 billion in state revenue (Wyoming 2006). Sales from hunting and fishing licenses, travel, and lodging would be reduced as a result of loss of wildlife in many areas benefiting from produced water discharge. Revenues raised through license sales support state wildlife agencies, their conservation projects, and their hunter education and aquatic resources education programs. In addition, the Loch Katrine wetland complex receives governmental financial support for its maintenance and operation, which includes local jobs and bird conservation programs.

2.4 Summary and Conclusions

Wyoming DEQ must consider a range of criteria before recommending effluent limits (W.S. 35-11-302(vi)). These criteria include the character and degree of injury to the well-being of people, and the social and economic value of produced water discharge should be carefully weighed, because the decision to change current effluent limits would not only impact water *quality*, but also ultimately water *quantity*.

Numerous landowners in the Powder River and Bighorn basins of Wyoming benefit from produced water discharges, through irrigation and/or stock watering, with several examples highlighted above. Produced water also supports populations of wildlife species that may otherwise not be viable, including wild horse populations. In addition, produced water discharges in certain circumstances improve the water quality of natural drainages.

The risk assessment found that current WDEQ effluent limits pose no measureable adverse effect to the health and well-being of domestic livestock and wildlife. Furthermore, there would be no incremental reduction in wildlife or livestock injury if water quality effluent limits were changed to the petitioners' requested limits. The social and economic injury to people was evaluated as well.

Economic injuries of reduced exploration and development included lost revenue from oil and gas extraction facilities in the form of jobs and associated earnings, and basic export revenue:

- Elimination of the South Casper Creek field would result in losses of $3 million (in 2002 dollars) to the basic exports of Natrona County, with additional losses of 18 jobs with annual earnings totaling $487,142 (in 2002).
- Elimination of the Hamilton Dome oil field would result in losses of $28.7 million (in 1997 dollars) in state total annual economic output, with associated losses of 136 jobs in Hot Springs County alone with earnings totaling $4.1 million annually. An additional 51 jobs across the state of Wyoming are supported by this oil field.
- Elimination of the Salt Creek fields of the Powder River basin would result in the loss of over 175 jobs and $4.6 million in annual earnings (in 1997 dollars) for Natrona and Johnson counties.

Social impacts include loss of financial contributions toward the improvement and well-being of local communities. County income from operations supported by produced water discharges include various public facilities including schools, hospitals, libraries, fire departments, environmental programs, and the county general fund:

- In Natrona County, elimination of the South Casper Creek field would result in reduction of related taxes and royalty contributions totaling $424,085 (in 1997 dollars). These contributions account for 2.5% of county property tax income, 0.04% of severance taxes, 0.16% of sales and use taxes, and 2.5% of federal royalties for the county;

- Loss of funds associated with the Hamilton Dome oil field would reduce fiscal contributions to Hot Springs County totaling 29% of total property taxes, 9% of total general fund revenues, 27% of the library system's total revenues, 2% of county hospital revenues, 9% of the county weed and pest management program, 29% of the rural fire district budget, and additional funds for school districts averaging $1.4 million annually (in 2002 dollars).

- Elimination of the Salt Creek fields in Natrona County would result in losses of $2.8 million in property tax revenue (in 1997), of which $2 million went to public schools, $500,000 to county government, and another $300,000 to community colleges. Additionally, state severance taxes for the Salt Creek fields in 1997 were estimated at $2.4 million; 2.6% ($62,257) of the total severance tax was received by Natrona County, and 0.2% ($4,789) was received by Johnson County.

Even with continued industry presence, estimated costs of eliminating produced water discharges include:

- 15% to 20% loss of cattle in the Cottonwood Creek area, corresponding to an estimated $2 million in lost livestock sales;

- economic losses of 1.7% ($3.3 million) of total annual economic output and $645,000 in annual labor income in Hot Springs County;

- an 8% loss of irrigated pastureland in the Cottonwood Creek area, corresponding to a loss of 1,600 acres of irrigated cropland and 4,000 tons of annual hay production;

- livestock losses estimated between 30% and 50% by several ranchers in the Bighorn basin, resulting in estimated losses of $387,000 to $645,000 in annual livestock sales;

- livestock losses estimated between 20% and 40% in the Salt Creek area, corresponding to an estimated $590,175 to $1.1 million in lost annual livestock sales;

- negative impacts state-wide from loss of livestock revenue;

- additional costs to ranchers to develop alternative water sources such as wells, water hauling and breaking ice;
- associated job losses related to ranching and farming;
- lost revenue from hunting, fishing and tourism due to declining wildlife populations; and
- lost access to federal funding and associated employment at the Loch Katrine wetland complex.

Loss of opportunity to surface discharge water would have a negative impact on oil and gas production, as well as jobs, across the state of Wyoming. State-wide, the oil and gas industry supported 2,995 employees in 2002, with a total annual payroll of $162 million (US Bureau of the Census 2002). In addition, support activities for oil and gas operations, including drilling of oil and gas wells, employed an additional 9,200 employees with earnings totaling $332.6 million in 2002. The value of shipments, sales and receipts for oil and natural gas industries in Wyoming totaled $3.9 billion (in 2002), representing ~14% of the total sales, shipments and receipts for the state. At least a portion of this revenue is expected to be impacted by the loss of opportunity to surface discharge water. A state-wide analysis of economic and social benefits and injury from loss of produced water surface discharge, exploration and development is recommended to evaluate the total impact of the petitioners' proposed effluent limits.

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Table 1-1. Water quality concentrations of TDS, sulfate and barium of some outfalls and downstream sampling locations of oil and gas facilities in the Bighorn, Platte and Powder River basins.

Basin	Associated Oil/Gas Facility	General Location	Drainage or Outfall	Avg - TDS	Max-TDS	Avg - Sulfate	Max-Sulfate	Barium	Data source
Platte (Wind) River	S. Casper Creek field	North Platte and tributaries	Poison spider & Oregon Trail	3,153	3,450	1,561	1,746		Gene R. George & Assoc. 2005 (2002-2004 data)
Bighorn	Hamilton Dome field	Cottonwood Creek	Cottonwood B, WY0000680, WY0000175	4,011	7,320	1,640	3,270		SWWRC et al. 2002 (2002 data)
Bighorn	Oregon Basin oil field	Dry Creek	Maverick Springs	1,161		492			M. Blakesly, pers. comm
			Chatterton	1,204		511			
			Circle Ridge	703		80			
			Byron Battery #2 Injection			1,815			
			Garland Unit Battery	2,900		1,450			
			Battery #1 South Outfall	4,475	4,600	2,080	2,180		
			Battery #2 North Outfall	5,345	5,390	2,735	2,950		
			Battery #3-5 South Outfall	4,530	4,530	1,870	1,870		
			Battery #1 North	5,100		3,085			
			Pitchfork	2,065		772			
			Steamboat Butte - North	3,838		1,690			
			Steamboat Butte - South	1,297		532			
Powder River	Fidelity facilities	Downstream locations	Tongue River	1,508					R. Edds, pers. comm.
			Wrench Ranch	1,054					
			Lake de Smet	830					

Basin	Associated Oil/Gas Facility	General Location	Drainage or Outfall	Avg - TDS	Max-TDS	Avg - Sulfate	Max-Sulfate	Barium	Data source
Powder River	Anadarko facilities	Outfall	Alpha Pod #2	2,400		<10		1.7	J. Cline, pers. comm.
		Outfall	County Line Alpha Pod	3,000				1.9	
		Outfall	Delta/Epsilon Skew Inlet IMR	2,800	3,500	ND	ND	3.8	
		Outfall	County Line Beta Pod #1	2,708		64			
Powder River	Lance operations	Powder River	Powder River water compositions typical of Lance CBNG operations	2,500		4		1.6	D. Stephens, pers. comm.
Powder River	Salt Creek fields	Salt Creek	Salt Creek at main discharge area	3,995	4,580	1,132	1,680		RETEC 2004
		Salt Creek	Salt Creek downstream of discharges	3,876	4,610	1,235	1,700		
		Powder River	Powder River downstream of discharges	2,202	3,640	920	1,340		
			Petition Proposed effluent limits:	**2,000**		**500**		**0.2**	

Notes:
all results in mg/l
Data reflects samples collected between 2002 and 2006.
ND = non-detect

Table 1-2. Wildlife species recorded in the Cottonwood Creek area near the confluence of the Bighorn River.

Mallard duck
Blue-winged teal
Canada goose
Great blue heron
Sandhill Crane
Wilson's phalarope
Spotted Sandpiper
Killdeer
Mountain Plover
Gray partridge
Chukar
Sage grouse
Ring-necked pheasant
Mourning dove
Northern harrier
Red-tailed hawk
Golden eagle
Bald eage
Prairie falcon
Merlin
American kestrel
Great horned owl
Borrowing owl
Yellow-billed cuckoo
Belted kingfisher
Common nighthawk
Western kingbird
Cassin's kingbird
Horned lark
Black-billed magpie
Western meadowlark
Brewer's blackbird
Pine siskin
Vesper sparrow
Savannah sparrow
Grasshopper sparrow
Lark sparrow
Song sparrow

Table 1-2. Wildlife species recorded in the Cottonwood Creek area near the confluence of the Bighorn River.

Lark bunting
Cliff swallow
Sage thrasher
Rock wren
American robin
Mountain bluebird
Masked shrew
Western small-footed myotis
Desert cottontail
Least chipmunk
Wyoming ground squirrel
Montane vole
Long-tailed vole
Coyote
Red fox
Long-tailed weasel
Badger
Bobcat
Mountain lion
Moose
Mule deer
White-tailed deer
Pronghorn antelope

Notes:

Reproduced from SWWRC et al. 2002.

Table 1-3. Wildlife species recorded in the Loch Katrine wetland complex.

Canada goose	Branta canadensis
Redhead	Aythya americana
lesser scaup	A. affinis
mallard	Anas platyrhynchos
pintail	A. acuta
gadwall	A. strepera
American wigeon	A. americana
northern shoveler	A. clypeata
greenwinged teal	A. crecca
blue-winged teal	A. discors
cinnamon teal	A. cyanoptera
eared grebe	Podiceps nigricollis
American coot	Fulica americana
black-necked stilt	Himantopus mexicanus
American avocet	Recurvirostra americana
sandhill crane	Grus canadensis
white-faced ibis	Plegadis chihi
long-billed curlew	Numenius americanus
killdeer	Charadrius vociferus
black tern	Chlidonias niger
Wilson's phalarope	Phalaropus tricolor

Table 1-4. Birds and mammals surveyed in the South Casper Creek field near Poison Spider Creek.

Mallard
Gadwall
Wigeon
Ruddy Duck
Virginia Rail
Sora
American Coot
Killdeer
Baird's Sandpiper
California Gull
Turkey Vulture
Golden Eagle
Northern Harrier
Greater Sage Grouse
Mourning Dove
Western Kingbird
Say's Phoebe
Western Flycatcher
Horned Lark
Unknown Swallow
Black-billed Magpie
House Wren
Gray Catbird
Sage Thrasher
European Starling
Wilson's Warbler
Common Yellowthroat
Brewer's Sparrow
Chipping Sparrow 1
Savannah Sparrow
Vesper Sparrow
Unknown Sparrow
Lark Bunting
Western Meadowlark
Brewer's Blackbird
Northern Oriole

Table 1-5. Exposure parameters for each indicator receptor.

Receptor class	Species	IR_{water} (L-day)	IR_{food} (kg wet-day)	BW (kg wet wt)
Rodent	rat	0.046 EPA 1988	0.028 US EPA 1988	0.35 US EPA 1988
Ruminant-juvenile	growing steer	29.5 Winchester and Morris 1956	6.24 NAS 2000	300 NAS 2000
Passarine bird	mallard	0.064 US EPA 1993	0.251 US EPA 1993	1.13 US EPA 1993
Ruminant-adult	adult steer	34.8 Winchester and Morris 1956	7.76 Winchester and Morris 1956	800 NAS 2000

Notes:

IRwater = ingestion rate of water

IRfood = ingestion rate of food

BW = body weight

Table 1-6. Ingestion rate equations.

Equation	Species	Reference
$IR_{water} = 0.059(BW)^{0.67}$	for birds (L-day)	Calder and Braun 1983
$IR_{water} = 0.10(BW)^{0.7377}$	for laboratory mammals (L-day)	US EPA 1988
$IR_{food} = 0.648(BW)^{0.651}$	for birds (g-day)	Nagy 1987
$IR_{food} = 0.056(BW)^{0.6611}$	for laboratory mammals (kg-day)	US EPA 1988

Notes:

IRwater = ingestion rate of water

IRfood = ingestion rate of food

BW = body weight

Table 1-7. Barium toxicity study database and selected studies to derive water quality concentrations

Constituent	Receptor type	Reference	Chemical Form Administered	Organism	Route of Administration	Endpoints	Study Duration	NOAEL (mg/kg/d)	LOAEL (mg/kg/d)
Barium	**bird**	**Johnson et al. (1960)**	**BaOH2**	**chicken (chicks)**	**oral in diet**	**mortality**	**4 weeks**	**208**	**417**
Barium	bird	Tancins et al. (1969)	BaCl2 and BaCO3	chicken	oral in diet	weight gain, mortality		N/A	10.05
Barium	mammal (rat)	Borzelleca et al. (1988)	BaCl2	rats	gavage	growth, reproduction	10 days	138	198
Barium	**mammal (rat)**	**Dietz et al. (1992)**	**BaCl2**	**rats**	**oral in water**	**growth, reproduction, development, mortality**	**92 days**	**61.1**	**121**
Barium	mammal (rat)	McCauley et al. (1985)	BaCl2	rats	oral in water	absorption	16 to 46 weeks	N/A	N/A
Barium	**mammal (rat)**	**Perry et al. (1983)**	**BaCl2**	**rats**	**oral in water**	**growth, hypertension**	**16 months**	**13.2**	**N/A**
Barium	mammal (rat)	Schroeder and Mitchener (1975)	BaCl2	rats	oral in water	growth	lifetime	0.25	N/A
Barium	mammal (rat)	Tardiff et al. (1980)	BaCl2	rats	oral in water	adrenal weights	90 days	45.7	N/A

Notes:

Bolded text indicates studies selected to derive recommended water quality benchmarks for barium, sulfate and TDS.

Table 1-9. Sulfate toxicity study database and selected studies to derive water quality concentrations.

Constituent	Receptor type	Reference	Chemical Form Administered	Organism	Route of Administration	Endpoints	Study Duration	NOAEL (mg/kg/d)	LOAEL (mg/kg/d)
Sulfate	bird	Adams et al. (1975) (exp 1)	Na2SO4, MgSO4	chicken (hens)	oral in water	water/food intake, reproduction, mortality		101.2	404.9
Sulfate	bird	Adams et al. (1975) (exp 2)	Na2SO4, MgSO4	chicken (hens)	oral in water	water/food intake, reproduction, mortality		303.7	1619.2
Sulfate	**bird**	**Harter and Baker (1978)**	**Na2SO4, KSO4**	**chicken**	**oral in diet**	**growth**	**28 days**	**N/A**	**288.3**
Sulfate	bird	Katz and Baker (1975)	KSO4	chicken	oral in diet	feed efficiency, growth rate	7 weeks	1.1	N/A
Sulfate	bird	Krista et al. (1961)	Na2SO4	chicken	oral in water	egg production, intake rate		1196.0	1214.4
Sulfate	bird	Leach et al. (1960)	L-methionine	chicken	oral in diet	feed efficiency, growth rate	8 days	N/A	81.9
Sulfate	bird	Sasse and Baker (1974)	L-methionine	chicken	oral in diet	growth	8 days	N/A	81.9
Sulfate	mammal (livestock)	Digesti and Weeth (1976)	Na2SO4	growing cattle	oral in water	food/water intake, weight gain	90 days	245.8	N/A
Sulfate	**mammal (livestock)**	**Embry et al. (1959) (exp 1)**	**Na2SO4**	**growing cattle**	**oral in water**	**food/water intake, weight gain**	**84 days**	**489.2**	**698.9**
Sulfate	mammal (livestock)	Embry et al. (1959) (exp 2)	Na2SO4	growing cattle	oral in water	food/water intake, weight gain	112 days	604.7	N/A
Sulfate	mammal (livestock)	Grout et al. (2006) (exp 1)	Na2SO4	growing cattle	oral in water	water intake	11 days	421.9	N/A
Sulfate	mammal (livestock)	Grout et al. (2006) (exp 2)	MgSO4	growing cattle	oral in water	water intake	11 days	270.1	170.3
Sulfate	mammal (livestock)	Johnson and Patterson (2004)	natural water sources	growing cattle	oral in water	food/water intake, weight gain (feedlot)	112 days	N/A	251.4
Sulfate	mammal (livestock)	Johnson and Patterson (2004) (exp 1)	natural water sources	growing cattle	oral in water	food/water intake, weight gain	63 days	570.7	N/A
Sulfate	**mammal (livestock)**	**Johnson and Patterson (2004) (exp 2)**	**natural water sources**	**growing cattle**	**oral in water**	**food/water intake, weight gain (open range)**	**112 days**	**360.4**	**N/A**
Sulfate	mammal (livestock)	Loneragan et al (2001)	natural or treated water sources.	adult steers	oral in water	water intake, growth, feed efficiency	112 days	N/A	N/A
Sulfate	mammal (livestock)	Patterson et al. (2002)	natural/well water sources	adult steers	oral in water	food/water intake, weight gain, PEM	84 days	55.7	380.6
Sulfate	mammal (livestock)	Patterson et al. (2003)		growing cattle	oral in water	food/water intake, weight gain	3 months	N/A	N/A
Sulfate	mammal (livestock)	Patterson et al. (2004)	Na2SO4	adult cows	oral in water	water intake, weight gain, reproductive impacts	84 days	47.7	326.8
Sulfate	mammal (livestock)	Ward and Patterson (2004)	Na2SO4	adult cows	oral in water	water intake, weight gain, reproductive impacts	84 days	47.7	351.8
Sulfate	mammal (livestock)	Weeth and Caps (1972)	Na2SO4	growing cattle	oral in water	water intake, growth, feed efficiency	30 days	365.8	N/A
Sulfate	mammal (livestock)	Weeth and Hunter (1971)	Na2SO4	growing cattle	oral in water	food/water intake, weight gain	30 days	11.0	343.5
Sulfate	mammal (livestock)	Zimmerman et al. (2003)	MgSO4	cattle	oral in water	water intake, behavior	unknown	N/A	N/A
Sulfate	**mammal (rat)**	**Brown and Commatero (1970)**	**Na2SO4**	**rats**	**oral in diet**	**feed efficiency, growth rate**	**28 days**	**18.08**	**N/A**
Sulfate	mammal (rat)	Cohen et al. (1958)	DL-methionine	rats	oral in diet	growth	72 days	N/A	412.8
Sulfate	mammal (rat)	Daniel and Whisnant (1969)	L-methionine	rats	oral in diet	growth	24 days	172	516
Sulfate	mammal (rat)	Smith (1973)	methionine and CaSO4	rats	oral in diet	sulfate metabolism	7 days	16	N/A
Sulfate	**mammal (rat)**	**Weeth and Hunter (1971)**	**Na2SO4**	**rats**	**oral in water**	**growth**	**unknown**	**668.0**	**N/A**

Notes:

Bolded text indicates studies selected to derive recommended water quality benchmarks for barium, sulfate and TDS.

Table 1-11. TDS toxicity study database and selected studies to derive water quality concentrations.

Constituent	Receptor type	Reference	Chemical Form Administered	Organism	Route of Administration	Endpoints	Study Duration	NOAEL (mg/kg/d)	LOAEL (mg/kg/d)
TDS	bird	Behnke and Scott (1986) (exp 1)	NaCl	chicken (hens)	oral in water	food intake, reproduction		N/A	37.4
TDS	bird	Behnke and Yolowitz (1987)	NaCl	chicken (hens)	oral in water	eggshell quality	5 weeks	N/A	111.2
TDS	bird	Behnke et al. (1989)	NaCl	chicken (hens)	oral in water	egg production, food/water intake	5 weeks	20.0	104.1
TDS	bird	Heller (1933)	NaCl	chicken (hens)	oral in water	egg production, growth	10 weeks	304.6	456.8
TDS	bird	Heller (1933)	MgSO4	chicken (hens)	oral in water	egg production, growth	10 weeks	456.8	N/A
TDS	bird	Heller (1933)	CaCl	chicken (hens)	oral in water	egg production, growth	10 weeks	N/A	456.8
TDS	bird	Kare and Biely (1948)	NaCl	chicken (chicks)	oral in food & water	feed efficiency, weight gain, mortality	29 days	7073.0	N/A
TDS	bird	Krista et al. (1961) (exp 1)	NaCl (municipal water)	chicken (chicks)	oral in water	food/water intake, growth	4 weeks	598.8	1947.9
TDS	bird	Krista et al. (1961) (exp 2)	NaCl (municipal water)	chicken (hens)	oral in water	food/water intake, growth	16 weeks	598.8	1497.0
TDS	**bird**	**Krista et al. (1961) (exp 3)**	**NaCl (municipal water)**	**ducklings**	**oral in water**	**food/water intake, growth**	**21 days**	**269.2**	**384.6**
TDS	bird	Scrivner (1946)	NaCl	1-day old turkey	oral in water	mortality	2 weeks	116.7	350.0
TDS	bird	Selye (1943)	NaCl	chicken (chicks)	oral in water	mortality, nephrosclerosis	20 days	727.3	2181.8
TDS	bird	Yolowitz et al. (1990)	NaCl	chicken (hens)	oral in water	egg production, defects, food/water intake	7 - 8 weeks	N/A	131.2
TDS	mammal (livestock)	Bahman et al. (1993)	brackish water well, total TDS measured.	dairy cows	oral in water	milk production, growth	196 days	613.2	N/A
TDS	mammal (livestock)	Ballantyne (1957)	NaCl	growing & adult cattle	oral in water	mortality	not reported	84.6	N/A
TDS	mammal (livestock)	Ballantyne (1957)	NaSO4	growing & adult cattle	oral in water	mortality	not reported	169.2	N/A
TDS	mammal (livestock)	Ballantyne (1957)	MgSO4	growing & adult cattle	oral in water	mortality	not reported	169.2	N/A
TDS	mammal (livestock)	Blosser and Soni (1956)	"Dissolved solids @ 105C"	dairy cows	oral in water	milk production	6 weeks	23.1	N/A
TDS	mammal (livestock)	Challes et al. (1987)	well water (NaCl measured)	dairy cows	oral in water	milk production		51.5	386.1
TDS	mammal (livestock)	Embry et al. (1959)	NaCl	growing cattle	oral in water	food/water intake, growth	112 days	790.8	1129.7
TDS	mammal (livestock)	Frens (1946)	NaCl	dairy cows	oral in water	milk production		937.5	N/A
TDS	mammal (livestock)	Heller (1933)	NaCl	dairy cows and steers	oral in water	milk production, reproduction, weight gain	21 weeks	1833.9	N/A
TDS	mammal (livestock)	Jaster et al. (1978)	NaCl	dairy cows	oral in water	milk production	28 days	23.6	611.1
TDS	mammal (livestock)	Johnson et al. (1959)	CaCO3 (water source from settling pit)	growing cattle	oral in water	rumen pH, microbial activity	16 weeks	202.3	N/A
TDS	mammal (livestock)	Lassiter and Cook (1961)	NaHCO3	growing cattle (yearlings)	oral in water	food/water intake, digestibility	21 days	398.9	N/A
TDS	mammal (livestock)	Patterson et al. (2003)	NaCl	growing cattle	oral in water	food/water intake, weight gain	3 months	N/A	N/A
TDS	mammal (livestock)	Ramsey (1924)	NaCl	cattle	oral in water	water intake, weight gain, survival	3 mo - 2 yrs	747.8	N/A
TDS	mammal (livestock)	Ray (1989)	CaCl, NaSO4, NaHCO3, NaCl (all added together).	growing cattle	oral in water	food/water intake, efficiency of growth	112 days	189.7	875.3
TDS	mammal (livestock)	Robertson et al. (1996)	sulfate-dominated	steers	oral in water	food/water intake, digestibility	43 days	87	N/A
TDS	mammal (livestock)	Solomon et al. (1995)	natural water sources	dairy cows	oral in water	milk production, water intake	4 months	2.8	63.4
TDS	mammal (livestock)	Spafford (1941)	NaCl	cattle	oral in water	water intake, survival	unknown	619.9	804.8
TDS	mammal (livestock)	Weeth (1962)	MgSO4 added to a TDS of 245	growing cattle	oral in water	food/water intake, growth	4 months	73.3	N/A
TDS	mammal (livestock)	Weeth and Haverland (1961) (exp 1)	NaCl	growing cattle	oral in water	food/water intake, growth	30 days	14.6	2136.6

Table 1-11. TDS toxicity study database and selected studies to derive water quality concentrations.

Constituent	Receptor type	Reference	Chemical Form Administered	Organism	Route of Administration	Endpoints	Study Duration	NOAEL (mg/kg/d)	LOAEL (mg/kg/d)
TDS	**mammal (livestock)**	**Weeth and Haverland (1961) (exp 2)**	**NaCl**	**growing cattle**	**oral in water**	**food/water intake, growth**	**30 days**	**912.8**	**809.3**
TDS	**mammal (livestock)**	**Weeth and Hunter (1971)**	**NaCl**	**growing cattle**	**oral in water**	**growth**	**30 days**	**725.7**	**N/A**
TDS	mammal (livestock)	Weeth et al. (1960)	NaCl	growing cattle	oral in water	food/water intake, growth	30 days	1675.5	1932.4
TDS	**mammal (rat)**	**Embry et al. (1959) (exp 1)**	**NaCl**	**rats**	**oral in water**	**water intake, growth**	**112 days**	**1540.9**	**N/A**
TDS	mammal (rat)	Embry et al. (1959) (exp 2)	MgCl	rats	oral in water	water intake, growth	112 days	627.2	940.7
TDS	**mammal (rat)**	**Embry et al. (1959) (exp 3)**	**MgSO4**	**rats**	**oral in water**	**water intake, growth**	**112 days**	**N/A**	**790.2**

Notes:

Bolded text indicates studies selected to derive recommended water quality benchmarks for barium, sulfate and TDS

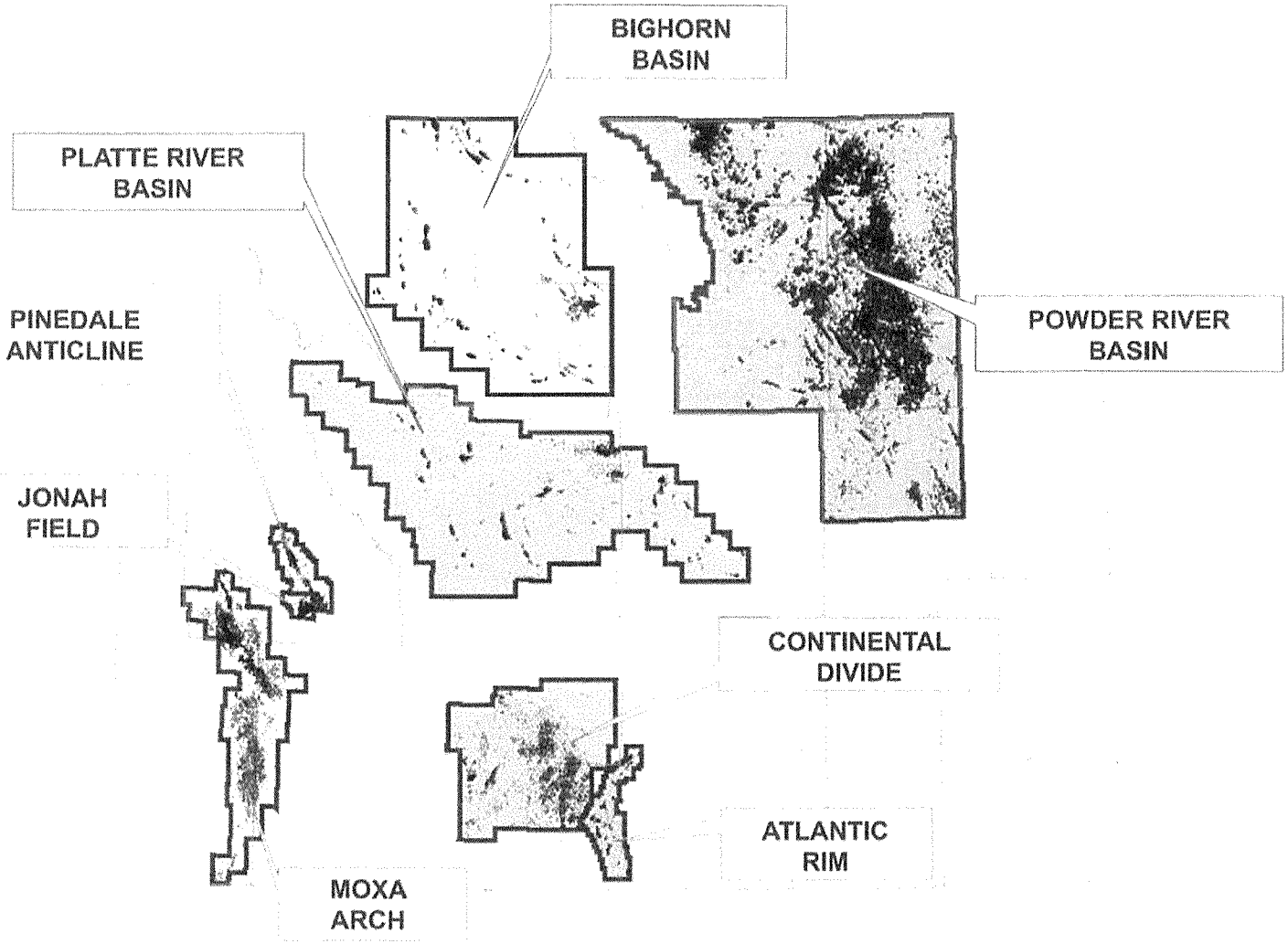
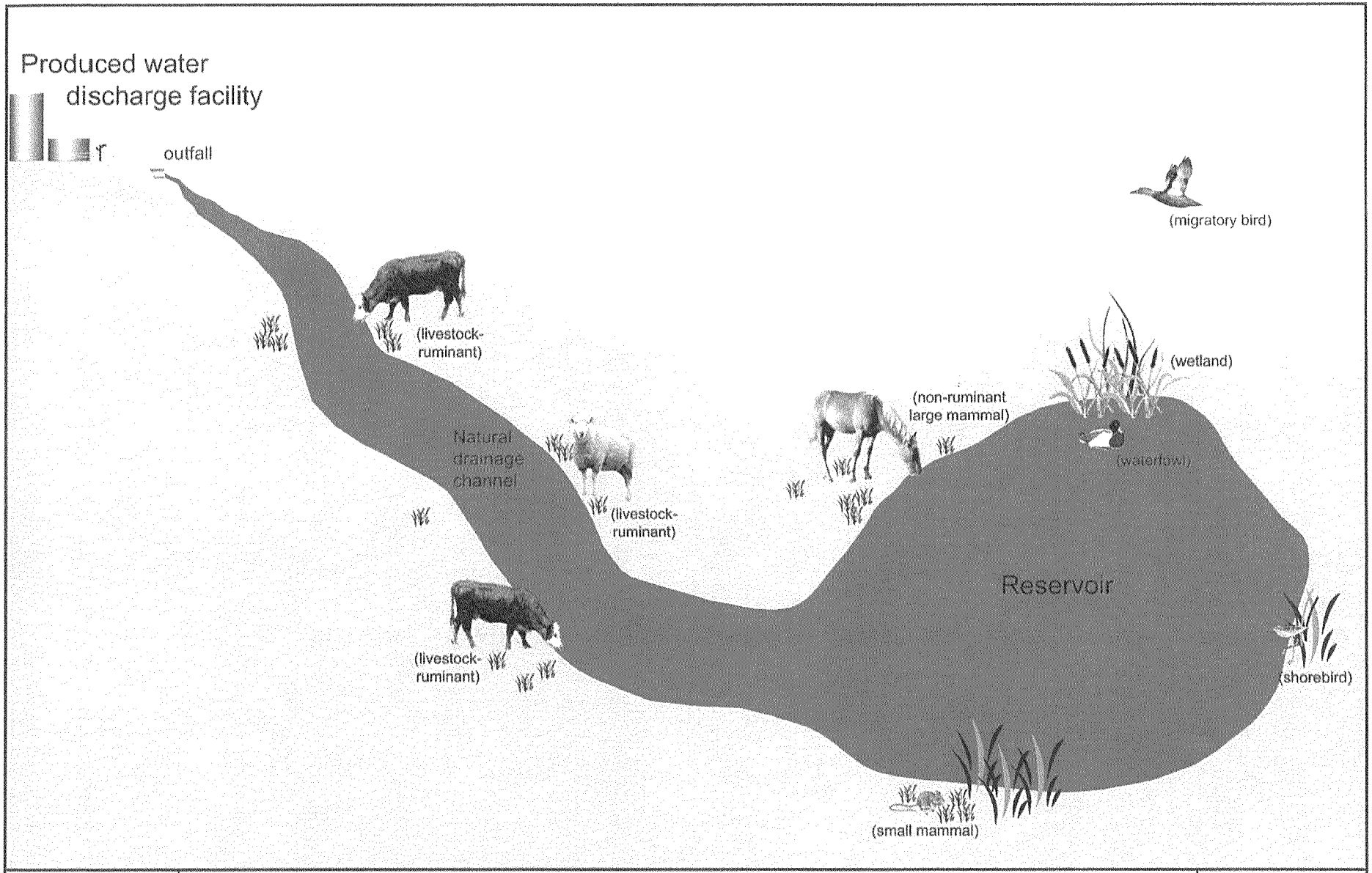


Figure reproduced from Wyoming Game and Fish Department, http://gf.state.wy.us/

GEOMEGA 1/4/07 C06-450A WDEQ TDS Standards	Current active oil and gas wells in Wyoming.	Figure 1-1



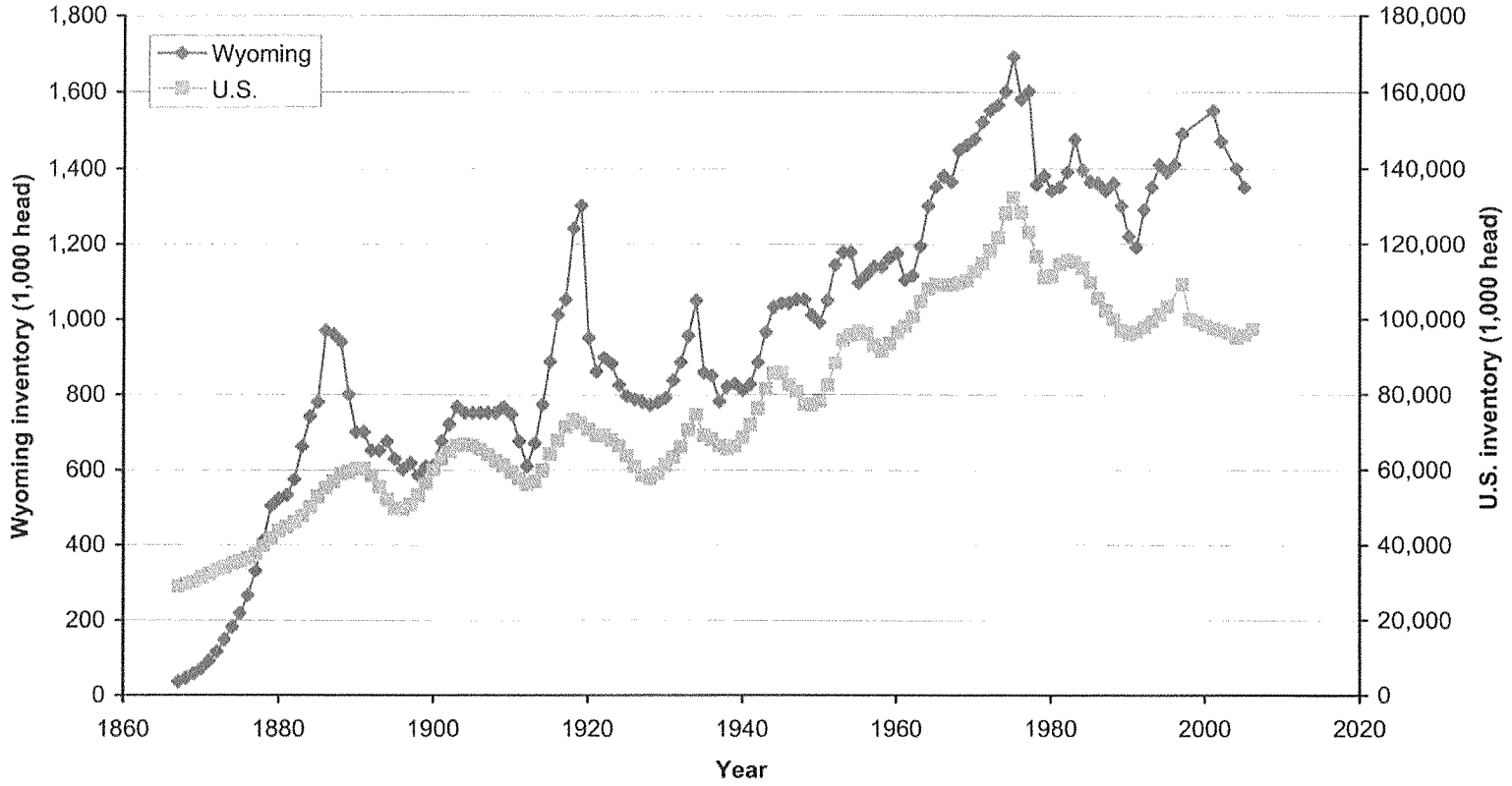
GEOMEGA

1/4/07

C06450A
WDEQ TDS Standards

Ecological conceptual model of source-receptor relationships between produced water discharge facilities and livestock and wildlife receptors.

Figure
1-2



GEOMEGA

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C06450A
WDEQ TDS Standards

Cattle and calf inventories (1,000 head) for Wyoming and the U.S. between 1860 and 2006.

Figure
2-1

Appendix A

Interviews with Local Ranchers in the Bighorn and Powder River Basins

January 16, 2007

Prepared for:

Petroleum Association of Wyoming
951 Werner Court, Suite 100
Casper, WY 82601

Prepared by:

Geomega Inc.
2995 Baseline Road, Suite 202
Boulder, CO 80303

Introduction

A field-based data gathering and analysis exercise was undertaken to gather effects data specific to users of water bodies in Wyoming. In-person and telephone interviews were conducted on a handful of ranchers in the Bighorn and Powder River structural basins in Wyoming to gather information on the nature and extent of produced or natural water usage and effects noted from use. Where available, data was obtained from these ranchers to quantitatively evaluate the effects from exposure to the various sources of water. Interviews were given with:

Name	Basin Affiliation
1. Mr. Greg Flitner, and Mr. Dave Flitner	Bighorn
2. Mr. Mick McCarty	Bighorn
3. Mr. Don Meike	Powder River
4. Dr. Trey Patterson	Powder River
5. Mr. Don Schlaf	Bighorn
6. Mr. Frank Shepperson	Powder River

The following sections describe the information given by the various ranchers during the interviews.

In-person interview with Mr. Greg and Dave Flitner, 10/24/06

The Flitners manage beef cattle, sheep and some horses. They ranch all their cows (~950 head in 2005) in the spring and fall on BLM lands adjacent to Dry Creek near the Cody Highway. Dry Creek has average sulfate and TDS concentrations of 2,720 mg/L and 5,080 mg/L, respectively. Produced water sources account for 100% of water availability on these lands, because drought has eliminated other natural reservoirs. The Flitners have additional, private lands in the Bighorn basin and leases on Heart Mountain and Johnson County, and the cattle typically graze there during the summer months. Water resources in these areas originate from natural sources, with estimated concentrations of 1,180 mg/L and 2,310 mg/L sulfate and TDS, respectively, based on average background concentrations.

In 2005, herd size on produced water pastures totaled 950 cows. Total herd size was 950 cows, 800 yearlings, 150-200 qtr horses. Due to drought, herd size has been reduced an estimated 50% since 1997.

The Flitners noted no variation in cattle quality between lands containing produced water discharges and natural waters, and in fact related that sometimes production from pastures utilizing produced water is better due to increased water availability. No cattle refusal of water was noted. Weaning weights were recorded in calves that started out the spring in various produced water and natural water-associated pastures (Table A-1). These records demonstrate that no adverse effect on weaning weights occurred on calves that drank the produced water containing elevated sulfate and TDS relative to natural sources. Seven-year average weaning weights from the Dry Creek (produced water) pastures were in fact higher than the pastures that did not have produced water availability. The Flitners do not utilize a supplemental mineral program.

If produced water were to stop being available, Mr. Greg Flitner estimates they would have to cut ~50% of the herd size, with associated employee cuts. The Flitners currently employ 40 full and part time jobs. In addition, the Flitners stated that loss of the produced water in Dry Creek would result in them vacating these pastures, as they would no longer be economic to graze. Conflicts between cattle, wildlife, and wild horses would be expected to increase without the produced waters.

In-person interview with Mr. Mick McCarty, 10/23/06

McCarty Ranching, LLC, a family owned company, operates several ranches in the Bighorn basin, with a total herd size of about 2,000 head. They utilize 4 pastures totaling 1600 acres of private and 28,000 acres of BLM lands which contain exclusively produced water sources originating from the Oregon Basin facility. The herd size on these lands is between 400 and 600 head, all cattle. The pastures include Avon, South/North Oil Wells, Lake and Highway pastures. The produced water from the Oregon Basin is discharged into Dry Creek, which runs throughout these pastures. Oregon Basin produces approx. 500,000 barrels of water/day, of which 100,000 BPD is surface discharged and the rest reinjected (M. Blakesley, pers. comm). Surface water concentrations near these pastures average 4,830 mg/L TDS and 2,300 mg/L sulfate, with maximums as high as 5,390 mg/L TDS and 3,100 mg/L sulfate (measured between 2002 and 2006). Lake pasture has 1 water well in addition to the produced water sources. Mr. McCarty noted that the cattle seem to prefer drinking the water near the outfall point where the produced water is discharged to Dry Creek, perhaps due to the warmer temperature of the water.

The cows utilize the produced water pastures between November and May. Two out of 4 pastures are used per year (allowing a 2-year fallow period). The cattle only forage on the open range, plus they are given a mineral supplement package and protein formulated by Dr. Trey Patterson. They prefer winter fat, kochia, grasses, and salt sage where available. There are other ranches owned or leased by McCarty Ranching LLC that receive only natural water sources.

Upon acquiring the land associated with produced water sources, Mr. McCarty Ranching, LLC retained Dr. Trey Patterson to design a supplemental protein and mineral package to maximize production from these pastures. Because Dr. Patterson's experience is that the higher sulfates in the water can render copper and other trace metals less available for absorption by the cattle, the mineral package contains a chelated copper form which remains bioavailable even when consumed with water containing high sulfates. Dr. Patterson related that the cattle in the area perform very well, above industry standards and production numbers.

Mr. McCarty noted that there were no adverse effects on the livestock that use the pastures with produced water as compared to their pastures at which there are natural water sources. He related the following measurement comparisons:

Measure:	Produced water	Natural water
1) Body condition	5	same
2) Breeding percentage	96%	same
3) Death rate	2%, cows	same
4) Calf weaning rate	94-95%	same
5) Weaning weight	Varies by calving time.	same

A few other natural water bodies used to exist on some of the land but have dried up due to drought. The pastures east of highway 120 rely exclusively on produced water sources. The droughts have also reduced their total herd size, from about 2,500 to 1,700 this year, and perhaps another drop in herd size next year.

The presence of produced water on the BLM lands has resulted in cost savings for McCarty Ranching LLC, since obtaining other water sources (wells, hauling water) would be very expensive. Ranching would not be economic to them without the produced water. He speculates that it would also affect hundreds of other ranchers in the Bighorn basin.

Telephone interview with Mr. Don Meike, 11/1/06

Mr. Don Meike ranches cattle (500 head) and sheep (2,500 head) on 45,280 acres along the in the Powder River basin near the juncture of Salt Creek and Powder River. He has ranched in this area since 1901. Herd sizes have declined 50% due to drought and rabbit infestation. Mr. Meike recalled that before 1950, Salt Creek and Powder River were unusuable 9 months out of the year due to the high salinity concentrations in the water. Cattle were typically moved to a meadow pasture or to lower Powder River, or to land in the mountains. In addition to the chemical concentrations causing adverse effects on cattle, physical risk of cattle getting stuck in the muddy river bottom was a concern.

With the advent of produced water, Salt Creek and Powder River are now usable on a year-round basis. Management of the herds has increased, and flexibility of management is greater, as a result of the increased water supply. No adverse effects on the cattle herds were seen using produced water sources compared to natural water sources previously. The cattle graze on the open range and also receive a mineral supplement package.

Telephone interview with Dr. Trey Patterson, 11/1/06

Dr. Patterson is a manager at the Padlock Ranch located in north central Wyoming and Southern Montana. The ranch is large, one of the top six in the US. From their website (www.padlockranch.com), the Padlock Ranch employs 45 people, and raise and market over 9,000 calves a year. The ranch grazes cow-calf pairs on native grassland in Montana and Wyoming. Grazing lands are a mixture of private and leased land. In support of grazing operations, the ranch irrigates 5,000 acres of farmland, including an annual production of 10,000 tons of dry hay, 20,000 tons of corn silage, 15,000 tons of hay silage and barley. The production supports the winter feeding program and feedlots.

Cattle graze year round in the area. The ranch lands receive produced water from a CBNG facility near Decker, Montana. The produced water is discharged to a reservoir which is fenced off, and into stock tanks.

Water quality samples are taken periodically.. Concentrations generally reported are between 1 mg/L and < 500 mg/L sulfate and up to ~3600 mg/L TDS (as measured in 2001 and 2002). Sodium is a large proportion of the total TDS. At times, the sodium level is high enough that the mineral supplementation program for the cattle is altered.

In contrast, some natural water in the area has much higher sulfate and TDS, between 1,500 and 2,000 sulfate and up to 3,700 TDS. Produced water contributions have helped to lower the levels of sulfate and TDS in year-round water that cattle consume.

No negative effects of consuming produced water on cattle have been seen or noted. Weaning weights recorded over several years do not indicate any difference between cows raised on land with produced water compared to land with other water sources. Generally, Dr. Patterson notes that the increase in available water has resulted in an increase in cattle performance and forage utilization. Costs to the rancher are reduced because additional water does not have to be hauled.

The drought has affected manynatural water sources, limiting their use or rendering them unususable. At times, the ranch has had to wean earlier due to drought levels.

Dr. Patterson also related that his experience with cattle ranch in South Dakota. Natural water sources at the ranch containing about 4,000 mg/L sulfates resulted in incidences of polio in the cattle that consumed this water source. A supplemental mineral program was instituted there to help mitigate the effects of the high sulfates, and although some cattle continued to be affected, the ranch continued to use the water source because it was the only water available in the area. Despite this, the ranch was able to make a profit.

Telephone interview with Mr. Don Schlaf, 11/1/06

Mr. Schlaf has ranched his lands since 1904. He currently ranches cattle (~300 head), and historically has also ranched sheep. Mr. Schlaf utilizes BLM pastures associated with the Dry Creek drainage, east of Cody. These allotments include Elk, 15-mile and Dorsey. He rotated his cattle on a 5-month schedule on each of the pastures at Dry Creek. At times, Dry Creek was the only source of water available as other stock ponds had dried up. Mr. Schlaf had a cow die inexplicably in the past, and sent brain tissue samples into the veterinarian for analysis of sulfate levels, as sulfates were typically higher in Dry Creek than for other water bodies. The results showed that the sulfate levels in Dry Creek did not cause the death of the cow. Lab results indicated, "the amount of sulfur in the tissue sample was not sufficient to cause polio."

Mr. Schlaf also related that, in the past when Dry Creek was an intermittent stream, incidences of polio and blindness occurred in his cattle as a result of drinking evapoconcentrated pools of water.

Telephone interview with Mr. Frank Shepperson, 11/1/06

Mr. Frank Shepperson owns ~1,500 head of cattle on 80,000 acres in the Salt Creek valley of the Powder River basin in Wyoming (Commerce, Natrona and Johnson counties). The ranch includes the bulk of the Salt Creek oil field. It has 25.8 miles of frontage on Salt Creek, including the sections immediately adjacent to the discharge points. It also has access to several tributaries (such as Coal Draw and Castle Creek).

Salt Creek is the main water source on his lands. Other creeks in the area (above Salt Creek) include Teapot and Castle creeks, both of which have natural water sources. The natural water sources contain an average of 2,000 mg/L TDS and 1,200 mg/L sulfates in 2003 and 2004, but concentrations are at times as high as 4,000 mg/L sulfate and 7,000 mg/L TDS. Downstream of produced water inputs, concentrations average 1,100 mg/L sulfate and 4,300 mg/L TDS.

Mr. Shepperson's cattle use both the natural and produced water sources, and he notes that produced water sources are the preferred water to use for his cattle. The use of natural waters in the area have, at times, caused breeding rates and number of head to decline relative to other areas in Wyoming receiving natural water sources. Other effects of the natural water sources included dehydration, blindness, disorientation and death typically due to consumption of evapoconcentrated puddles of water left in the dry creek beds. Wildlife densities also appeared to decline when only natural water sources were available. According to Mr. Shepperson, weight data collected by the University of Wyoming indicated that cattle weights were significantly affected in areas where access was limited to only natural water sources. Conversely, the weight data did not indicate that produced water sources adversely affected cattle weights.

Another positive effect of produced water sources is that the creeks now run year-round, instead of being intermittent. The intermittent nature of the creeks before the event of produced water resulted in isolated, concentrated water puddles surrounded by thick mud. The cattle would not only drink the concentrated water, but would also get stuck in the mud, causing physical injury.

Mr. Shepperson also noted that wildlife appeared to be using the water downstream of the outfalls, and densities appear greater than populations present upstream of the outfalls. Mr. Shepperson speculates that this phenomenon is a result both of changing water quantity as well as quality.

Table A-1. Weaning rates of calves on the Flitners' ranches between 1999 and 2005. The Dry Creek pasture is associated with produced water sources, whereas the remaining pastures have access to only natural water sources.

Year	Dry Creek	Potato Ridge	Home Place	Whistle Creek
1999	473	451	469	483
2000	501	492	476	500
2001	462	454	473	465
2002	487	509	512	525
2003	522	503	497	503
2004	515	498	526	486
2005	526	482	501	492
Average:	**498**	**484**	**493**	**493**

Darwin Griebel
Star Route - Box 2815
Kinnear, Wyoming 82516

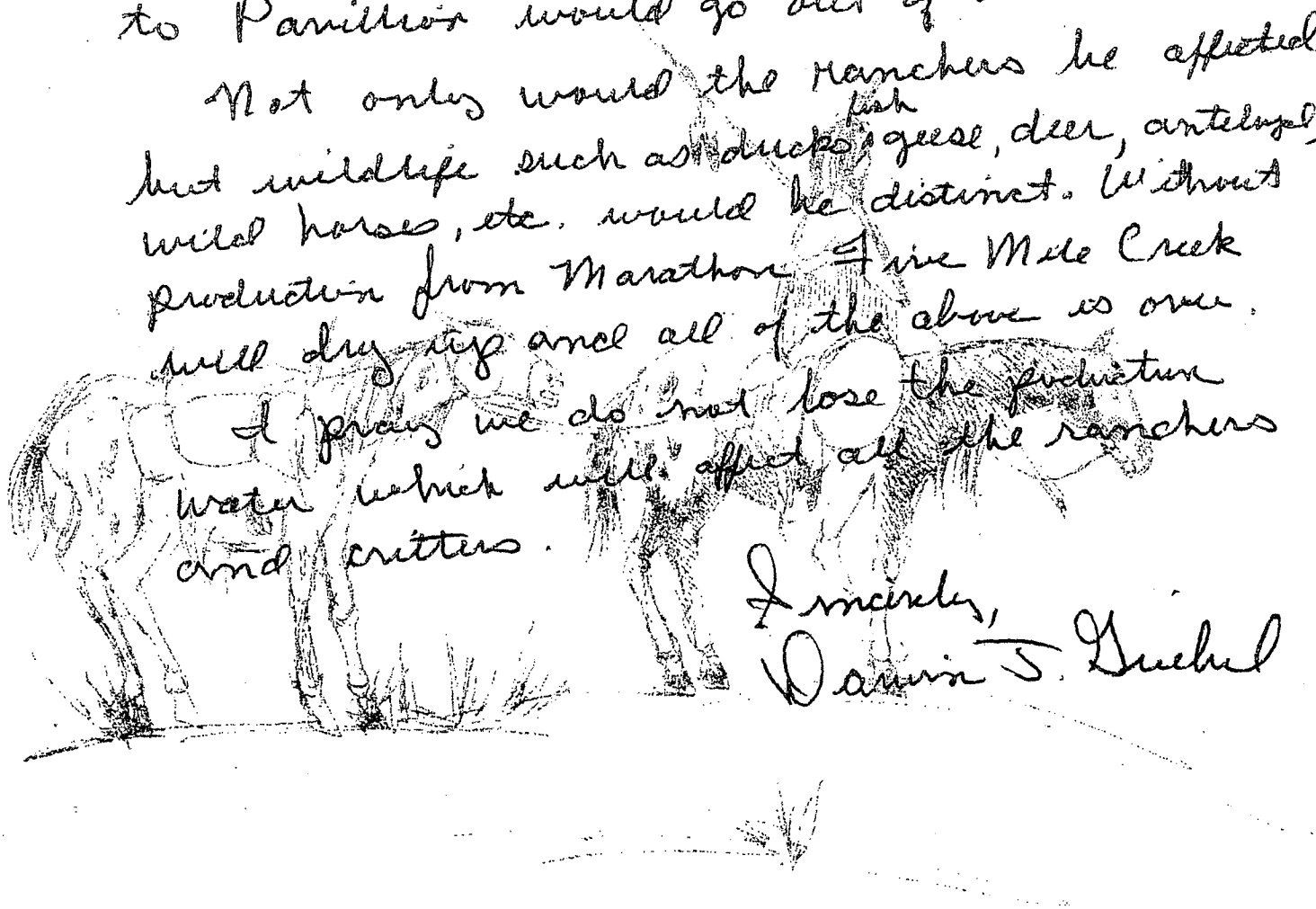
Dear Mr. Blakesley & Mike Dick,

I am an enrolled member of the Eastern Shoshone Indian Tribe. I am a permittee on range unit #38 and depend heavily on the production water for my livestock — without it all the ranches within the Marathon production area from Circle Ridge to Pavillion would go out of business.

Not only would the ranchers be affected — but wildlife such as ducks, fish, geese, deer, antelope, wild horses, etc. would be distinct. Without production from Marathon — Five Mile Creek will dry up and all of the above is over.

I pray we do not lose the production water which will affect all the ranchers and critters.

Sincerely,
Darwin J. Griebel



WYOMING HORSES
366 N PAVILLION RD.
PAVILLION, WY 82523
(307) 856-5708 or (307) 856-8552

January 3, 2002

Marvin Blakesly
Marathon Oil Co.
1501 Stampede Ave.
Cody, WY 822414

Dear Marvin;

Our ranch is located on Five Mile Creek four miles north of Pavillion, Wyoming. We have been here since 1973 and ours is the first ranch on the Midvale Irrigation Project that Five Mile Creek passes through. . We have 200 to 800 head of livestock that drink the water that flows down Five Mile during the year. Without the water that is discharged from the Marathon oil wells above us we may not have had stock water during the drought years of 1979, 2000, and 2001.

There is a good supply of minnows and small fish in the creek as well as abundant wildlife that drink and live in proximity to the creek.

Thank you for the steady supply of fresh water.

Yours truly,

Lonnie Mantle

Wyoming Horses
Lonnie & Grace Mantle
Bob & Dar Vogel

Richard Pattison

153 Pattison Farms Rd.

Pavillion, WY. 82523

Marvin Blakesley

1501 Stampede Ave.

Cody, WY 82414

Re: Marathon Oil's contribution to the stream flow in 5-Mile Creek

Dear Mr. Blakesley:

I am writing to you to inform you, that I am a landowner in Midvale Irrigation District. My property lies along the Five Mile Creek Drainage and I have two water gaps on the drainage. I also rent land that has an additional two water gaps. Last year Philip Ranch placed sheep and cattle on my properties and used two of the four water gaps. The last two years have been drought years and water shortages. Even with this drought condition, the stream flows have stayed up with consistent flows. Without the flow from Marathon's oilfields at Circle Ridge and Maverick Springs, the constant flow in 5 Mile Creek would not been possible and in all probability would have dried up. Pleased be informed that any loss of streamflow in Five Mile Drainage would jeopardize my being able to furnish pasture with a good water supply. Any water supply into the drainage that would be turned off or restricted, would hinder my cash flow from pasture rental.

Thank you for your time.

Sincerely,

Richard Pattison

FIVE MILE RANCH
LIMITED LIABILITY COMPANY
179 Indian Ridge Road
Pavillion, Wy. 82523

January 9, 2002

Mr. Marvin Blakesley
Marathon Oil Company
1501 Stampede Avenue
Cody, Wy. 82414

Dear Mr. Blakesley,

I am writing this letter in support of Marathon's EPA discharge permit. The water discharged into Five Mile Creek is a benefit to us in watering livestock. We have 1200 acres on the northwest edge of the Midvale Irrigation project and water 1500 – 2000 cattle each winter from Five Mile Creek. The flow in Five Mile during dry years is almost totally due to Marathon's discharge on our farm because we are on the northwest edge of the irrigation project and do not benefit from irrigated ground drains into the creek. We support the continuation of Marathon's permit to discharge into Five Mile Creek.

Sincerely,

Bill Garland

Bill W. Garland

January 18.2002

To Who It May Concern:

This letter is in reference to the water discharge that Marathon Oil Company releases into Five Mile Creek from their Circle Ridge Oil Field. I have ranched in this area for over fifty years and if it weren't for this discharged water my cattle and the wildlife in the area would have virtually no water. I appreciate the care Marathon Oil Company gives to the quality of water they release, making it drinkable for the animals. I can't say enough about how important this discharged water is to my cattle, and therefore, my livlihood, especially in drought years like the past two when all other water sources have dried up.

Thank you,

James H Fike Jr.

James H. Fike Jr.

Feb. 10, 2002

Attn: Marvin Blakesly
Marathon Oil Company
1501 Stampede Ave.
Cody, Wyo. 82414

Dear Sir:

The Barquin family and their children and grandchildren have been using the produced water from the Circle Ridge and Maverick Springs fields for sixty years or more to water the cattle. This water flows from the fields down Muddy Creek to 5 mile creek. There is also a large reservoir located above the old Barquin Mine. This reservoir is home to a mulitude of geese, ducks, and fish.

We certainly would like to see this produced water to continue to flow.

Sincerely,

James Barquin Jr.
James Barquin Jr.
Jim Barquin III
Jim Barquin III
Ty Nicholls
Ty Nicholls
Brodie Nicholls
Brodie Nicholls
Jolene Scheer
Jolene Scheer
Darwin Griebel
Darwin Griebel

Darwin Griebel
Star Route - Box 2815
Kinnear, Wyoming 82516

November 6, 2003

To Whom It May Concern:

I am asking the Wind River Environmental Quality Commission to renew Marathon's permit to discharge water. This water benefits our cattle, deer, antelope, and waterfowl.

The water is discharged year round so it is available when other sources are not.

This produced water is the only water available to some of the areas in our range unit. These areas could not be fully utilized with out the water.

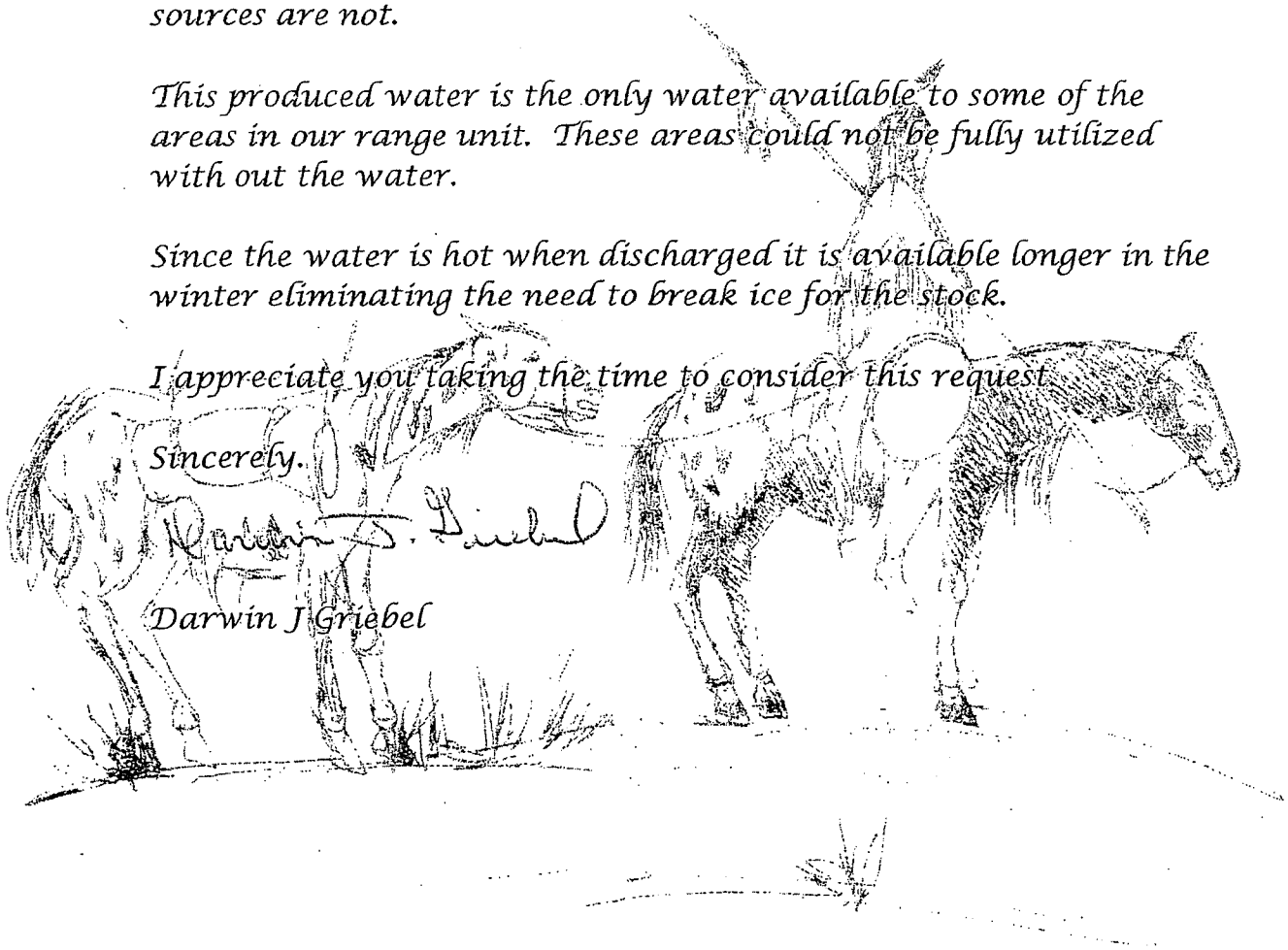
Since the water is hot when discharged it is available longer in the winter eliminating the need to break ice for the stock.

I appreciate you taking the time to consider this request.

Sincerely,

Darwin J. Griebel

Darwin J Griebel



xc ALM MCQ CPC

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
CODY RESOURCE AREA
P.O. BOX 518
CODY, WYOMING 82414

TAKE PRIDE IN AMERICA

6870
(190)

February 8, 1989

Roger Kearns
Rocky Mountain Region Production Manager
Marathon Oil Company
1501 Stampede Ave.
Cody, WY 82414

Dear Mr. Kearns:

This office recently completed a cooperative management plan with the Wyoming Game and Fish Department to improve the habitat quality of wetlands in the northern Bighorn Basin. One of the principal objectives of this plan is to enhance waterbird production habitat at Loch Katrine in Oregon Basin.

Because of the water produced by Marathon, Loch Katrine is one of the highest valued wetlands in Wyoming and a priority area to receive federal, state and private enhancement funds. We have documented the use of this wetland by two federal endangered species: the bald eagle and the American peregrine falcon; and three "candidate" species for protection under the Endangered Species Act: the long-billed curlew, white-faced ibis and ferruginous hawk. The Loch also supports several wildlife species of high federal concern, including the trumpeter swan, tundra swan, sandhill crane and white pelican, and several species listed by the state as needing special management, including the black tern, snowy egret and merlin. Loch Katrine supports one of only six black-necked stilt breeding populations in Wyoming.

With enhancement, we believe the Loch eventually could produce approximately 3,500 waterfowl and 10,000 shorebirds annually. Not only would this greatly benefit waterbird populations in North America, but also would provide excellent opportunities for wildlife viewing and photography in the Cody area.

As you know, Loch Katrine receives mostly produced water from the Sidney Battery in the Oregon Basin Oil Field. This water is of good quality and supports the existing wetlands vegetation and waterbird populations. Unfortunately, its flow into Loch Katrine depends entirely on production activities in the oil field.

Before we commit federal funds to enhance Loch Katrine, or request support from the state or private organizations like Ducks Unlimited, Inc., we must

PAT CHILDERS IS PREPARING RESPONSE. PHP 3/1/89

PFP ✓ MCQ ✓
RJC RWQ
DJG
RETURN

OB UPDS SIDEY 2/7/89

~~1310.46 OB MISC.~~

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22,505 BPD = 345,000,000 GALS/YR

secure a dependable source of water. Our hydrology analysis indicated that a minimum of 345 million gallons of water per year must flow into Loch Katrine to support the objective 325 acre wetland. This is about 94 percent of the water released from the Sidney Battery.

Eric Greenquist, the wildlife biologist on my staff, would like to begin consultations with your staff to determine Marathon's willingness to further contribute to the enhancement of Loch Katrine under a cooperative program with the BLM. Specifically, we would like Marathon to provide the specified amount of water, and consider supporting the habitat enhancement effort with funds or labor and heavy equipment. We feel that Loch Katrine represents an outstanding opportunity to demonstrate the value of produced water to wildlife and the local economy.

Please have your representative contact Eric Greenquist at this office. Thank you.

Sincerely,

Lydia D. Livingston

for Thomas E. Enright
Area Manager

Rocky Mountain Region
Production United States

Marathon Oil Company

P.O. Box 2690
Cody, Wyoming 82414
Telephone 307/587-4961

EPC Holders

CC PPatterson
MCQ

May 15, 1989

RECEIVED
MAY 24 1989
Environm. and Safety

Eric Greenquist
Bureau of Land Management
1714 Stampede Avenue
Cody, Wyoming 82414

Dear Mr. Greenquist:

Marathon supports waterfowl enhancement in Lock Katrine and Marathon will make an effort to continue discharging water as it supports waterfowl and other wildlife in the area. The limiting factors for discharging water are economics affecting oil production and the EPA and DEQ requirements. We are unable under current economic conditions to commit to supply funds or manpower and equipment to enhance this habitat. We are willing, however, to reasonably cooperate and conduct our field activities in the vicinity of Lock Katrine so as to augment BLM efforts.

Marathon has compiled the information you requested for evaluating the Lock Katrine Areas in Oregon Basin as a site to improve wetland habitat. Attached are copies of Marathon's semi annual discharge monitoring reports for the period 1984 through 1988 for the Sidney Battery that are filed with the EPA and DEQ. As you are aware the discharged water from the Sidney Battery is the source of water for Lock Katrine. Marathon's current estimate of the expected life of this battery is about 30 years; however, continued discharge of water is dependent on DEQ and EPA decisions. I should mention that Marathon does not plan to continue water flow measurements in the future since the new DEQ and EPA requirements call for more frequent testing of oil and grease content of discharged water but will not require any discharge volumes.

An alternate future source of water for Lock Katrine, should it be needed, could be provided by water supply wells by using available wellbores near Lock Katrine when Marathon no longer needs the wells for our operations. At that time, Marathon could plug the wells back to the zone of interest and transfer the ownership to the Bureau of Land Management provided a satisfactory agreement could be reached between the BLM and Marathon. Please be advised that Marathon Oil Company has not pump tested any zones for sustained aquifer potential. Our current aquifer usage is from two wells completed in the Lakota Formation and are used periodically for supplying small water volumes. The discharge at the Sidney Battery is around 33,000 barrels of water

PP
MCQ
File OB NPDES Sidney 27197

per day (BWPD) and it is unknown if any fresh water aquifer is capable of producing an equivalent volume of water and on a sustained basis. Once an available well was plugged back and turned over to the BLM, Marathon estimates the cost to perforate and stimulate the well, run a 10,000 BWPD submersible pump on 3-1/2" tubing, and electrify the well to be between $120,000 and $140,000 per well. The monthly operating costs for a well like this are estimated between $8,000 and $10,000 per well. This is of course assuming the aquifer is capable of providing the necessary volume of water.

If you have any questions please contact C. P. Childers at the above address and/or phone number.

Sincerely

MARATHON OIL COMPANY

J. R. Kearns
Production Manager
Rocky Mountain Region

JRK/rrm

Attachment

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
Cody Field Office
P.O. Box 518
Cody, Wyoming 82414-0518

TAKE PRIDE IN AMERICA

JUL 17 2006

3100
(020)

Mr. Marvin Blakesley
Marathon Oil Company
1501 Stampede Avenue
Cody, Wyoming 82414

Dear Mr. Blakesley:

This letter is in response to your recent request that the Bureau of Land Management (BLM) consider opposing proposed changes to water quality discharge standards in the Big Horn Basin.

As you are aware, collectively, the freshwater discharges from oil and gas production have improved the riparian and wetland values on thousands of acres of public lands within the Big Horn Basin. In order to capitalize on the produced water the Cody Field Office has invested several tens of thousands of dollars to further improve these augmented wetlands. We would view any effort to stop the surface discharges as a negative environmental impact. Produced water directly benefits a variety of BLM resources and uses including watering for livestock and wild horses, stable flows for wetland and riparian communities, and shorebird and waterfowl habitat.

Specifically, Marathon's discharges constitute approximately 75 percent of the water Loch Katrine, a playa in the extreme northern end of the Oregon Basin Oil Field, receives. These discharges help support a 1,200 acre wetlands complex and over 850 intermittent acres of water within a sagebrush and mixed grass steppe community. The produced water increases the size of the wetland by 200 to 600 acres, and directly contributes to an added annual production of 500-1000 shorebirds and 500-1000 waterfowl. Further, produced water also drains into Oregon Coulee and Coal Mine Draw which contributes significantly to stable flows in the upper Dry Creek drainage. The wetland and riparian habitats associated with this drainage is substantially enlarged by the increased flows, especially during the naturally low flow periods of late summer.

The BLM funded a contaminants study in the early 1990s to assess possible negative impacts to waterfowl and the wetland environment in Oregon Basin. The study was conducted by the U.S. Fish and Wildlife Service and the conclusion was that wetlands were benefiting significantly from the produced water.

If we can be of further assistance, please contact Mary D'Aversa at (307) 578-5900.

Sincerely,

Michael J. Blymyer
Field Manger, Cody

FOAL: Friends Of A Legacy—McCullough Peaks Mustangs

1019 Meadow Lane Ave.
Cody, WY 82414

September 27, 2006

Mark Gordan, Chairman
Environmental Quality Council of Wyoming
Herschler Building, 1 West
122 West 25th Street, Room 1714
Cheyenne, WY 82002

Dear Mr. Gordan:

Good day to you. I represent the non-profit organization, FOAL, which is the acronym for: Friends Of A Legacy—McCullough Peaks Mustangs. We are recognized by the State of Wyoming as a non-profit corporation, and we have achieved 501©3 status from the IRS. We are an advocacy group. FOAL's purpose, as stated in our by-laws, is to provide educational opportunities to the general public, to enhance the habitat for all creatures living within the McCullough Peaks Wild Horse Herd Area, and to assist the US Bureau of Land Management in managing the wild horses in the McCullough Peaks herd. In keeping with our purpose, I am writing you concerning proposed amendments to Appendix H of Chapter #2 of Water Quality Rules and Regulations for the State of Wyoming.

FOAL is strongly opposed to the amendments cited above, as they would apply to the Oregon Basin Oil Field operated by Marathon Oil Co. in Northwest Wyoming. Our opposition is based upon the following information, which we believe is truthful and accurate. The Dry Creek drainage meanders through the southerly edge of the McCullough Peaks Wild Horse Herd Management Area, beginning approximately 25 miles downstream from the Oregon Basin Oil Field surface discharges. Wild horses, pronghorn, mule deer, numerous species of birds, and domestic livestock drink from the water in Dry Creek, apparently with no ill effects. In recent drought years, the perennial water available in Dry Creek has become increasingly important to the creatures living within reach of it. Without the abundant and continual surface discharges from the Oregon Basin Oil Field, the water in the Dry Creek drainage would, in all likelihood, dry up in most years by mid-August, and would continue to be dry until replenished by rain, snow, or spring run-off. Current surface water discharges from the Oregon Basin Oil Field barely meet existing Effluent Limits standards. Marathon Oil has determined that it will be cost-prohibitive to treat discharge water from the Oregon Basin Oil Field in order to comply with the new standards being proposed. Marathon Oil plans to utilize a more cost effective option of injecting the water back into deep geologic formations, should the new standards be imposed. The net result from that scenario would be a degradation of the habitat in the McCullough Peaks Wild Horse Herd Management Area.

Another request in the petition to amend Appendix H of Chapter #2 addresses the quantity of water to be discharged, based upon what will be actually consumed by livestock and wildlife. Dry Creek runs for nearly fifty miles downstream from the Oregon Basin Oil Field. Regulating discharges to correspond with actual downstream use seems to be totally impractical in this instance.

Thank you for your time. Please feel free to contact me concerning this matter, if you wish.

Sincerely,

Marshall Dominick

Marshall Dominick

President, FOAL

Cc
John Cora, Director, Water Quality Division, Dept. of Environmental Quality, Herschler Bldg. – 4W, Cheyenne, WY 82002

John Wagner, Administrator, Water Quality Division, D.E.Q., Herschler Bldg. – 4W, Cheyenne, WY 82002

Bill DiRienzo, Water Quality Division, D.E.Q., Herschler Bldg. – 4W, Cheyenne, WY 82002

Governor's Office, State Capitol, 200 West 24th Street, Cheyenne, WY 82002-0010

Kate Fox, Davis and Cannon Law Firm, P.O. Box 43, Cheyenne, WY 82003

Marvin Blakesley, Marathon Oil Co., 1501 Stampede Ave., Cody, WY 82414

Michael J. Blymyer, Field Manager, BLM—Cody Field Office, P.O. Box 518, Cody, WY 82414

Tricia Hatle, Wild Horse Specialist, BLM –Cody Field Office, P.O. Box 518, Cody, WY 82414

file

ANTLERS RANCH, INC.
PO Box 156
Cody, WY 82414

February 22, 2002

re: Antlers Ranch, Inc. - Marathon Oil Co.

Gentlemen:

I am the President of Antlers Ranch, Inc.. The formation water being discharged from the treater in the Sunshine Field flows through Antlers Ranch deeded property and provides a necessary and vital part of the water supply for our ranching operation. Actually the discharged water can be diverted so that it flows either into the Gooseberry drainage or into the Wood River drainage. This water is the only live water source for our livestock and the economic viability of this portion of agricultural land is dependant upon the continued discharge of the water.

The water is also used extensively for riparian and wildlife habitat. I know that numerous species of deer, antelope and other wildlife depend upon this water to utilize this area.

Hopefully, you will continue to discharge the water as it is tremendously important to our ranch and also the wildlife using the area.

If there are any questions, please let me know.

Sincerely,

ANTLER RANCH, INC.

Michael Q. May

Michael Q. May, President

January 8, 2002

Mr. Marvin Blakesley
Marathon Oil
1501 Stampede Ave
Cody, WY 82414

Dear Mr. Blakesley,

We've been asked to write concerning North Sunshine Field water discharge. Water discharge from North Sunshine is absolutely vital for the integrity of Kinney Creek and Gooseberry Creek.

Water discharge is important in maintaining water volume in Gooseberry Creek during years of normal precipitation and essential in maintaining creek volume in drought years. Creek volume is important for maintenance of wildlife habitat, riparian areas, irrigation flow, fire suppression, and livestock interests.

In several instances, North Sunshine water discharge is the only form of water for livestock, wildlife, and riparian area health and this is especially true in drought years. Discharged water enters Gooseberry Creek at the mouth of Kinney Creek and during the 2001 summer season Gooseberry Creek was dry above the Kinney Creek entrance.

Discharged water is essential to irrigation along Gooseberry Creek in years of normal moisture and during drought periods. Irrigation water volume on Gooseberry Creek is directly affected by water discharged from North Sunshine.

Increased water volume in Kinney Creek and Gooseberry Creek may, in the future, be beneficial in wildfire suppression.

In summary, North Sunshine water discharge is vital to the health and well being of riparian areas, wildlife habitat, and livestock interests along Kinney Creek and Gooseberry Creek.

Sincerely,

Paddy Renner.

Paddy Renner
PAR Ranch

LARSEN RANCH CO.
976 Road 4DT
Meeteetse, Wyoming 82433
January 3, 2002

re: Gooseberry Creek

To Whom It May Concern:

As President of Larsen Ranch Co., I want to advise you regarding the formation water being discharged from the treater in the Sunshine Field which flows across Antlers Ranch, Inc. onto Larsen Ranch Co. property and into the drainage of Gooseberry Creek.

For our ranch, the water in discharged treater water is vitally important. It is the only live water source for livestock in our 3,000 acre pasture. The economic importance of this water source is vital. We could not use this piece of ground in the same way if the water source was eliminated. We strongly support the continued discharge being allowed.

The water is also used extensively by the wildlife. It provides important habitat for the wildlife and ultimately supplements water in Gooseberry Creek for our livestock and irrigation. The water in Gooseberry Creek is important for riparian habitat for numerous species of birds and mammals.

During the summer of 2001, Gooseberry Creek was intermittently dry. Approximately three (3) miles above the point where the treater water empties into the Creek, the Creek was totally dry. The beaver in the area had to move downstream approximately one mile below where the treater water empties into the Creek because their other dam was left dry by the drought. The beaver built a large dam in that area which is again providing important habitat for the wildlife.

During the wildfire in the summer of 2001, the beaver dam was the only place where helicopters could fill the buckets to drop on the fire.

Over the years there has been some attempts at stocking fish on Gooseberry Creek, but because of the low flow of Gooseberry Creek and the high summer temperatures, these efforts have not been successful. However, any hope of maintaining or increasing the habitat and/or fisheries is importantly dependent upon the supplement from the treater water into Gooseberry Creek.

We would be more than glad to show any interested parties the importance of this water not only to Larsen Ranch Co., but also for wildlife and other habitat in the vicinity. We support the continued use of this water for a supplemental source of water to this area.

Sincerely,
LARSEN RANCH CO.

Ralph C. Larsen

Ralph C. Larsen, President

WYOMING
GAME AND FISH DEPARTMENT
"Conserving Wildlife — Serving People"
Jim Geringer, Governor
John Baughman, Director

December 21, 2001

Marvin Blakesley
Marathon Oil Company
1501 Stampede Ave.
Cody, WY 82414

Dear Mr. Blakesley:

I have the following information in regards to your request concerning the beneficial use by wildlife of production water produced at several or your oil fields.

The Gebo, North Sunshine and Pitchfork fields all produce water that is used yearlong by many species of wildlife. In particular pronghorn antelope, sage grouse, Hungarian and chukar partridge benefit by using these water sources. In addition mule deer and numerous species of nongame birds use these water sources on a daily basis. The presence of these water sources increases the distribution and abundance of most wildlife species.

The Gebo field drains into an unnamed tributary to the Big Horn River. Production water that meets DEQ standards is beneficial to the mainstem river fishery by providing additional water. The North Sunshine field drains into Gooseberry Creek – a Class 4 water supporting wild, native populations of mountain suckers, longnose dace, fathead minnows and a few brook trout. The Pitchfork field drains into the Rawhide Creek drainage – a Class 3 water supporting wild and native Yellowstone cutthroat, Snake River cutthroat, white suckers, mountain suckers, silvery minnows and longnose dace. Production water that meets or exceeds DEQ standards is beneficial to the aquatic resources in these drainages where water shortages are chronic.

Sincerely,

John Emmerich
Wildlife Management Coordinator

Ron McKnight
Regional Fisheries Supervisor
2820 State Highway 120
Cody, WY 82414

Headquarters: 5400 Bishop Boulevard, Cheyenne, WY 82006-0001
Fax: (307) 777-4610 Web Site: http://gf.state.wy.us

WYOMING
GAME AND FISH DEPARTMENT
"Conserving Wildlife — Serving People"
Jim Geringer, Governor
John Baughman, Director

December 21, 2001

Marvin Blakesley
Marathon Oil Company
1501 Stampede Ave.
Cody, WY 82414

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John Emmerich
Wildlife Management Coordinator

Ron McKnight
Regional Fisheries Supervisor
2820 State Highway 120
Cody, WY 82414

Headquarters: 5400 Bishop Boulevard, Cheyenne, WY 82006-0001
Fax: (307) 777-4610 Web Site: http://gf.state.wy.us

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
Cody Field Office
P.O. Box 518
Cody, Wyoming 82414-0518

RECEIVED
JUN 19 2000
ENVIRONMENTAL, SAFETY AND REGULATORY

3160
(020)

Marvin Blakesley
Marathon Oil
1501 Stampede Avenue
Cody, Wyoming 82414

JUN 15 2000

RE: Beneficial Use of Produced Water WY-0001899; WY-0022900; WY-0001911; WY-0001902

Dear Marvin:

This letter is in response to you recent request for notation of beneficial uses associated with your freshwater discharges in Oregon Basin.

As you know, part of Marathon's discharges drain into Loch Katrine, a playa lake in the extreme northern end of the field which consists of a 1,200 acre wetlands complex sustained by 866 intermittent acres of water within a sagebrush and mixed grass steppe community. Loch Katrine now receives approximately 75 percent of its water from the Oregon Basin Oil Field. Produced water increases the size of the wetland by 200 to 600 acres and directly contributes to an added annual production of 500-1000 shorebirds and 500-1000 waterfowl.

Produced water also drains into Oregon Coulee and Coal Mine Draw contributes significantly to stable flows in upper Dry Creek Drainage. The wetland and riparian habitats associated with these drainage are substantially enlarged by the increased flows, especially during the naturally low flow periods of late summer.

Collectively, the freshwater discharges have improved the riparian and wetland values on well over 1,000 acres. This office has invested several tens of thousands of dollars in further improvements of these augmented wetlands and would view any effort to stop the surface discharges as a negative environmental impact. The BLM funded a contaminants study a number of years ago to assess the possible negative impacts to waterfowl and the wetland environment. That study was conducted by the United States Fish and Wildlife Service and the concluded that the wetlands were benefitting significantly from the produced water.

If we can be of further assistance, please contact me at (307)578-5909.

Sincerely,

Tom Hare, Asst. Field Manager

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
CODY RESOURCE AREA
P.O. BOX 518
CODY, WYOMING 82414

TAKE PRIDE IN AMERICA

6870
(190)

February 8, 1989

Roger Kearns
Rocky Mountain Region Production Manager
Marathon Oil Company
1501 Stampede Ave.
Cody, WY 82414

Dear Mr. Kearns:

This office recently completed a cooperative management plan with the Wyoming Game and Fish Department to improve the habitat quality of wetlands in the northern Bighorn Basin. One of the principal objectives of this plan is to enhance waterbird production habitat at Loch Katrine in Oregon Basin.

Because of the water produced by Marathon, Loch Katrine is one of the highest valued wetlands in Wyoming and a priority area to receive federal, state and private enhancement funds. We have documented the use of this wetland by two federal endangered species: the bald eagle and the American peregrine falcon; and three "candidate" species for protection under the Endangered Species Act: the long-billed curlew, white-faced ibis and ferruginous hawk. The Loch also supports several wildlife species of high federal concern, including the trumpeter swan, tundra swan, sandhill crane and white pelican, and several species listed by the state as needing special management, including the black tern, snowy egret and merlin. Loch Katrine supports one of only six black-necked stilt breeding populations in Wyoming.

With enhancement, we believe the Loch eventually could produce approximately 3,500 waterfowl and 10,000 shorebirds annually. Not only would this greatly benefit waterbird populations in North America, but also would provide excellent opportunities for wildlife viewing and photography in the Cody area.

As you know, Loch Katrine receives mostly produced water from the Sidney Battery in the Oregon Basin Oil Field. This water is of good quality and supports the existing wetlands vegetation and waterbird populations. Unfortunately, its flow into Loch Katrine depends entirely on production activities in the oil field.

Before we commit federal funds to enhance Loch Katrine, or request support from the state or private organizations like Ducks Unlimited, Inc., we must

secure a dependable source of water. Our hydrology analysis indicated that a minimum of 345 million gallons of water per year must flow into Loch Katrine to support the objective 325 acre wetland. This is about 94 percent of the water released from the Sidney Battery.

Eric Greenquist, the wildlife biologist on my staff, would like to begin consultations with your staff to determine Marathon's willingness to further contribute to the enhancement of Loch Katrine under a cooperative program with the BLM. Specifically, we would like Marathon to provide the specified amount of water, and consider supporting the habitat enhancement effort with funds or labor and heavy equipment. We feel that Loch Katrine represents an outstanding opportunity to demonstrate the value of produced water to wildlife and the local economy.

Please have your representative contact Eric Greenquist at this office. Thank you.

Sincerely,

for Thomas E. Enright
Area Manager

March 15, 2002

Marvin Blakesley
Marathon Oil Company
1501 Stampede Avenue
Cody, Wyoming 82414

RE: Produced Water From Pitchfork Oilfield

Dear Mr. Blakesley

I am providing the following information concerning the beneficial uses of produced water from Marathon's Pitchfork Oilfield.

The produced water that is discharged from the Pitchfork Oilfield is beneficial to my ranching operation. The water flows from Marathon's facilities into Rawhide Creek, and then flows several miles before entering the Greybull River. The water is of good quality and is used by my cattle throughout most of the year. The water provides an important year round water source for several of my pastures. We also utilize the water for irrigation of our crop lands. Rawhide Creek, above the Pitchfork Field discharge, often goes dry during the summer. The produced water provides a steady flow throughout the year.

The water also provides many beneficial uses to wildlife, including deer, antelope, sage grouse, chukar, and Hungarian partridge. Some non-game species of fish and wildlife are also dependent on this discharged water.

Any loss of this water would be detrimental to my ranching operations and would create a negative environmental impact.

Sincerely,

Jack Turnell
Turnell Cattle Company

February 25, 2002

Marvin Blakesley
Marathon Oil Company
1501 Stampede Avenue
Cody, Wyoming 82414

RE: Produced Water From Gebo Oilfield

Dear Mr. Blakesley

As per our recent telephone conversation, I am providing the following information concerning the beneficial uses of produced water from Marathon's Gebo Oilfield.

The produced water that is discharged from the Gebo Oilfield is vital to my livestock operation. The water flows from Marathon's facilities into Coal Draw, and then flows several miles before entering the Big Horn River. Coal Draw is normally dry, except during heavy rains or snow melt. The produced water provides the only water flow in Coal Draw during most of the year. The water is of good quality and is used by my cattle throughout most of the year. The water is warm, thus providing an unfrozen water source during the winter months. The warm water helps my cattle maintain weight during the winter months, because they do not have to burn calories to heat the water to body temperature. If this water was not present, I would have to haul water to my livestock, at considerable cost to my ranching operations.

The water also provides many beneficial uses to wildlife, including deer, antelope, pheasant, chukar, and Hungarian partridge. Muskrats, ducks, and many non-game species of wildlife are also dependent on this discharged water.

The produced water provides a several mile long riparian zone along Coal Draw, which would not be present without the discharged water. It creates wetlands in the lower end of Coal Draw, prior to entry into the Big Horn River.

Any loss of this water would be detrimental to my ranching operations and would create a negative environmental impact.

Sincerely,

Norman Sanford

Norman Sanford
Sanford Ranches

ANTLERS RANCH, INC.
PO Box 156
Cody, WY 82414

February 22, 2002

re: Antlers Ranch, Inc. - Marathon Oil Co.

Gentlemen:

I am the President of Antlers Ranch, Inc.. The formation water being discharged from the treater in the Sunshine Field flows through Antlers Ranch deeded property and provides a necessary and vital part of the water supply for our ranching operation. Actually the discharged water can be diverted so that it flows either into the Gooseberry drainage or into the Wood River drainage. This water is the only live water source for our livestock and the economic viability of this portion of agricultural land is dependant upon the continued discharge of the water.

The water is also used extensively for riparian and wildlife habitat. I know that numerous species of deer, antelope and other wildlife depend upon this water to utilize this area.

Hopefully, you will continue to discharge the water as it is tremendously important to our ranch and also the wildlife using the area.

If there are any questions, please let me know.

Sincerely,

ANTLER RANCH, INC.

Michael Q. May

Michael Q. May, President

January 8, 2002

Mr. Marvin Blakesley
Marathon Oil
1501 Stampede Ave
Cody, WY 82414

Dear Mr. Blakesley,

We've been asked to write concerning North Sunshine Field water discharge. Water discharge from North Sunshine is absolutely vital for the integrity of Kinney Creek and Gooseberry Creek.

Water discharge is important in maintaining water volume in Gooseberry Creek during years of normal precipitation and essential in maintaining creek volume in drought years. Creek volume is important for maintenance of wildlife habitat, riparian areas, irrigation flow, fire suppression, and livestock interests.

In several instances, North Sunshine water discharge is the only form of water for livestock, wildlife, and riparian area health and this is especially true in drought years. Discharged water enters Gooseberry Creek at the mouth of Kinney Creek and during the 2001 summer season Gooseberry Creek was dry above the Kinney Creek entrance.

Discharged water is essential to irrigation along Gooseberry Creek in years of normal moisture and during drought periods. Irrigation water volume on Gooseberry Creek is directly affected by water discharged from North Sunshine.

Increased water volume in Kinney Creek and Gooseberry Creek may, in the future, be beneficial in wildfire suppression.

In summary, North Sunshine water discharge is vital to the health and well being of riparian areas, wildlife habitat, and livestock interests along Kinney Creek and Gooseberry Creek.

Sincerely,

Paddy Renner

Paddy Renner
PAR Ranch

LARSEN RANCH CO.
976 Road 4DT
Meeteetse, Wyoming 82433
January 3, 2002

re: Gooseberry Creek

To Whom It May Concern:

As President of Larsen Ranch Co., I want to advise you regarding the formation water being discharged from the treater in the Sunshine Field which flows across Antlers Ranch, Inc. onto Larsen Ranch Co. property and into the drainage of Gooseberry Creek.

For our ranch, the water in discharged treater water is vitally important. It is the only live water source for livestock in our 3,000 acre pasture. The economic importance of this water source is vital. We could not use this piece of ground in the same way if the water source was eliminated. We strongly support the continued discharge being allowed.

The water is also used extensively by the wildlife. It provides important habitat for the wildlife and ultimately supplements water in Gooseberry Creek for our livestock and irrigation. The water in Gooseberry Creek is important for riparian habitat for numerous species of birds and mammals.

During the summer of 2001, Gooseberry Creek was intermittently dry. Approximately three (3) miles above the point where the treater water empties into the Creek, the Creek was totally dry. The beaver in the area had to move downstream approximately one mile below where the treater water empties into the Creek because their other dam was left dry by the drought. The beaver built a large dam in that area which is again providing important habitat for the wildlife.

During the wildfire in the summer of 2001, the beaver dam was the only place where helicopters could fill the buckets to drop on the fire.

Over the years there has been some attempts at stocking fish on Gooseberry Creek, but because of the low flow of Gooseberry Creek and the high summer temperatures, these efforts have not been successful. However, any hope of maintaining or increasing the habitat and/or fisheries is importantly dependent upon the supplement from the treater water into Gooseberry Creek.

We would be more than glad to show any interested parties the importance of this water not only to Larsen Ranch Co., but also for wildlife and other habitat in the vicinity. We support the continued use of this water for a supplemental source of water to this area.

Sincerely,
LARSEN RANCH CO.

Ralph C. Larsen

Ralph C. Larsen, President

WYOMING
GAME AND FISH DEPARTMENT
"Conserving Wildlife — Serving People"
Jim Geringer, Governor
John Baughman, Director

December 21, 2001

Marvin Blakesley
Marathon Oil Company
1501 Stampede Ave.
Cody, WY 82414

Dear Mr. Blakesley:

I have the following information in regards to your request concerning the beneficial use by wildlife of production water produced at several or your oil fields.

The Gebo, North Sunshine and Pitchfork fields all produce water that is used yearlong by many species of wildlife. In particular pronghorn antelope, sage grouse, Hungarian and chukar partridge benefit by using these water sources. In addition mule deer and numerous species of nongame birds use these water sources on a daily basis. The presence of these water sources increases the distribution and abundance of most wildlife species.

The Gebo field drains into an unnamed tributary to the Big Horn River. Production water that meets DEQ standards is beneficial to the mainstem river fishery by providing additional water. The North Sunshine field drains into Gooseberry Creek – a Class 4 water supporting wild, native populations of mountain suckers, longnose dace, fathead minnows and a few brook trout. The Pitchfork field drains into the Rawhide Creek drainage – a Class 3 water supporting wild and native Yellowstone cutthroat, Snake River cutthroat, white suckers, mountain suckers, silvery minnows and longnose dace. Production water that meets or exceeds DEQ standards is beneficial to the aquatic resources in these drainages where water shortages are chronic.

Sincerely,

John Emmerich
Wildlife Management Coordinator

Ron McKnight
Regional Fisheries Supervisor
2820 State Highway 120
Cody, WY 82414

Headquarters: 5400 Bishop Boulevard, Cheyenne, WY 82006-0001
Fax: (307) 777-4610 Web Site: http://gf.state.wy.us

WYOMING GAME AND FISH DEPARTMENT

Jim Geringer, Governor | Dr. Tom Thorne, Acting Director

"Conserving Wildlife - Serving People"

June 10, 2002

WER 10322

Dennis Hemmer, Director
Wyoming Department of Environmental Quality
Herschler Building, 4 West
Cheyenne, WY 82001

Dear Mr. Hemmer:

In recent weeks, the Wyoming Game and Fish Department has received a number of requests for beneficial use statements from oil and gas operators. Most of these have been for permit renewals of historic, produced-water discharges. We understand that all oil and gas facility discharges now require a statement of beneficial use for either wildlife or agriculture.

Approximately three years ago, Department personnel in the Powder River Basin were becoming inundated by requests from coal bed methane operators for beneficial use statements. We even received a request from the Wyoming Business Council to provide a statewide or regional statement of beneficial use for all discharges meeting water quality standards. The decision was made by the Department at that time to not issue such statements. We felt it would not be possible to easily determine if any given discharge would provide benefits or cause adverse impacts to fish and wildlife, or their habitats, without site-specific reviews and considerable analysis. Such reviews would create a huge burden on our personnel. Our position was stated in Department letters to your Water Quality Division as early as 1999 and was discussed with you by our former Director, John Baughman.

Our position today is unchanged. We will not issue such statements unless the discharge is part of a project on which we partner with industry and on which there is a Department-approved habitat enhancement plan. Given the many thousands of potential beneficial use statement requests, particularly for new discharges by the coal bed methane industry, it is not remotely possible for this Department to be involved.

The Department would like to make one exception to our position on this matter. As I indicated, the recent requests have been for historic discharges that are being considered for permit renewals, with no changes in water quantity or quality. In these instances, we feel a beneficial use for fish and/or wildlife has been demonstrated over time. On a few of these requests, our personnel have conducted site-specific reviews and we have provided two statements of beneficial use. However, this cannot continue as we are receiving more and more of these requests. Therefore, we wish to provide the following generic statement that will apply to all historic discharges for which there are no water quantity or quality changes:

Headquarters: 5400 Bishop Boulevard, Cheyenne, WY 82006-0001
Fax: (307) 777-4610 Web Site: http://gf.state.wy.us

The Wyoming Game and Fish Department recognizes that historic discharges by oil and gas production facilities have demonstrated a beneficial use to fish and/or wildlife. Provided there are no changes to the quantity of discharge, and the water quality continues to meet DEQ standards for discharge, any permit renewal for these discharges will be considered by the Department as having a beneficial use for fish and/or wildlife.

The Department will not issue additional beneficial use statements for these historic discharges. We will assume that the Department of Environmental Quality, Water Quality Division, will accept the above statement as applicable for all historic discharges as described. We will advise all operators requesting statements under these conditions that DEQ has received our blanket statement. For new discharges or discharges that do not meet the conditions described above, we will not issue beneficial use statements except as noted for partnered projects. In these instances, we would appreciate DEQ personnel advising operators to either secure a beneficial use statement through a consultant or from the affected landowner, and not direct them to the Department as has happened on a number of occasions in the past.

Please advise us if you have questions regarding this letter. We would be glad to meet with you and your staff if you so desire. If we have not heard from you by July 12, we will assume our approach is acceptable. Thank you for your assistance in this matter.

Sincerely,

BILL WICHERS
DEPUTY DIRECTOR

BW:TC:as

cc: Gary Beach
Leah Kraffl
Roland Peterson

Darwin Griebel
Star Route - Box 2815
Kinnear, Wyoming 82516

November 6, 2003

To Whom It May Concern:

I am asking the Wind River Environmental Quality Commission to renew Marathon's permit to discharge water. This water benefits our cattle, deer, antelope, and waterfowl.

The water is discharged year round so it is available when other sources are not.

This produced water is the only water available to some of the areas in our range unit. These areas could not be fully utilized with out the water.

Since the water is hot when discharged it is available longer in the winter eliminating the need to break ice for the stock.

I appreciate you taking the time to consider this request.

Sincerely.

Darwin J. Griebel

Darwin J Griebel

United States Department of the Interior

Fish and Wildlife Service
Lander Fish & Wildlife Management Office
Partners for Wildlife Branch
170 North First Street
Lander, WY 82520
307/332-8719 Fax:307/332-9857
Internet: R6FFA-LAN

Melvin Blakesley
Marathon Oil Company
1501 Stampede Ave.
Cody, WY 82414

November 18, 2003

Dear Melvin,

I had a conversation with Mike Quick the other day about Mission Pond project and any updates that we could provide. For starters, the dikes needed some rip-rap on the faces to protect from wind and wave action and that was accomplished last summer in coordination with the Tribe and High Country Construction Company. The structures are now all up to spec. and working fine. Outside of that, the birds have responded, especially shorebirds using the available exposed mud flats this summer. Several broods of waterfowl were seen on the ponds this past summer and overall I rate the project a success. The vegetative response has been quite remarkable, sedges and rushes pioneering the newly flooded uplands, which is encouraging considering the absence of vegetation on much of Mexican Flats. From past wetland studies, Mission Ponds should continue to increase in production for the next five to ten years then level off, having comparable flora and fauna of a natural wetland basin.

We thank you for your support on the Mission Pond habitat development and look forward to working with you on any new habitat projects in the near future.

Sincerely,

Mark Hogan

Mark Hogan
WY Private Lands Coordinator

Nov. 30,2003

Attn: Marvin Blakesly
Marathon Oil Company
1501 Stampede AveCody, Wyo. 82414

Dear Sir:

The Barquin family and their children and grandchildren have been using the produced water form the Marathon Steamboat field for sixty years or more to water the cattle. This water flows from the Mission Pond to the river.

We need this water because it is discharged year around and it is the only water available for the livestock and the wildlife.

For some of this area this produced water is the only water available and if not discharged, the range could not be fully utilized with out the cost of providing water. This is particularly true in drought years, when other sources of water are reduced or dry up.

Since the water is hot when discharged, it is available longer in the winter without having to break ice. Cattle may maintain their weight and survive cold weather better because they do not have to expend as much energy bringing the water they drink to body temperature.

Besides the livestock, the wildlife, which includes deer, elk, antelope, waterfowl, game birds and beaver also utilize this water year round.

We would certainly like to see this produced water flow year round. It is necessary for the continuation of our livestock operations.

Sincerely,

James Barquin Jr.
James D. Barquin Jr.

Jim Barquin III
Jim Barquin III

Jolene Scheer
Jolene A. Scheer

Ty Nicholls
Ty Nicholls

Brodie Nicholls
Brodie Nicholls

[redacted]

10929 Hwy 26
Kinnear, Wy. 82516

November 12, 2003

Marvin Blakesley, HES
Marathon Oil Company
1501 Stampede Ave.
Cody, Wy. 82414

Mr Blakesley,

I am writing in regards to the Steamboat field's discharged water. There is a stream that runs year around through our property that gets its water from this discharged water. We have cattle, horses, and goats that drink from it. There are also deer, coyotes, rabbits, pheasants, chuckers, eagles, and other wild animals that benefit from it.

Thank you for providing this benefit of the water to us.

Sincerely,

Doug and Linda Hill

Dear Mr. Blakeley,

I'm sorry that I can't help you with the kind of letter you need for EPA.

But died two years ago, and I don't have any cows any more.

Surely you can get the needed information from other people in the area. Water is vital.

Sincerely,

Mrs. Robert Hagerman

Contacts Sending Beneficial Use letters

Rec. 1/28/02	Darwin Griebel	-	856 - 2950
Rec. 1/4/02	Lonnie Mantel	-	856 - ~~4225~~ 5708
Rec. 1/16/02	Bill Garland	-	856 - 4225
	Lewis Meeks	-	856 - 7875
	Jeff Locker	-	856 - 6887 (Death in family 2 weeks)
*Rec. 2/25/02	Jim Barquin	-	856 - 5840
Rec. 1/28/02	Jim Fyke	-	856 - 6229
?	Jerry Huelle	-	856 - 5856
*Rec. 2/25/02 ?	Jolene + Vern Scheer	-	856 - ~~0565~~ 6193
Rec 1/10/02 ?	Dick Pattison	-	856 - 2113
*Rec 2/25/02 ?	Ty Nicholls (Scheer's son in law)	-	857 - 6677

* Same letter

Feb. 10, 2002

Attn: Marvin Blakesly
Marathon Oil Company
1501 Stampede Ave.
Cody, Wyo. 82414

Dear Sir:

The Barquin family and their children and grandchildren have been using the produced water from the Circle Ridge and Maverick Springs fields for sixty years or more to water the cattle. This water flows from the fields down Muddy Creek to 5 mile creek. There is also a large reservoir located above the old Barquin Mine. This reservoir is home to a mulitude of geese, ducks, and fish.

We certainly would like to see this produced water to continue to flow.

Sincerely,

James Barquin Jr.
James Barquin Jr.
Jim Barquin III\
Jim Barquin III
Ty Nicholls
Ty Nicholls
Brodie Nicholls
Brodie Nicholls
Jolene Scheer
Jolene Scheer
Darwin Griebel
Darwin Griebel

January 18.2002

To Who It May Concern:

This letter is in reference to the water discharge that Marathon Oil Company releases into Five Mile Creek from their Circle Ridge Oil Field. I have ranched in this area for over fifty years and if it weren't for this discharged water my cattle and the wildlife in the area would have virtually no water. I appreciate the care Marathon Oil Company gives to the quality of water they release, making it drinkable for the animals. I can't say enough about how important this discharged water is to my cattle, and therefore, my livlihood, especially in drought years like the past two when all other water sources have dried up.

Thank you,

James H Fike Jr.

James H. Fike Jr.

FIVE MILE RANCH
LIMITED LIABILITY COMPANY
179 Indian Ridge Road
Pavillion, Wy. 82523

January 9, 2002

Mr. Marvin Blakesley
Marathon Oil Company
1501 Stampede Avenue
Cody, Wy. 82414

Dear Mr. Blakesley,

I am writing this letter in support of Marathon's EPA discharge permit. The water discharged into Five Mile Creek is a benefit to us in watering livestock. We have 1200 acres on the northwest edge of the Midvale Irrigation project and water 1500 – 2000 cattle each winter from Five Mile Creek. The flow in Five Mile during dry years is almost totally due to Marathon's discharge on our farm because we are on the northwest edge of the irrigation project and do not benefit from irrigated ground drains into the creek. We support the continuation of Marathon's permit to discharge into Five Mile Creek.

Sincerely,

Bill W. Garland

Richard Pattison

153 Pattison Farms Rd.

Pavillion, WY. 82523

Marvin Blakesley

1501 Stampede Ave.

Cody, WY 82414

Re: Marathon Oil's contribution to the stream flow in 5-Mile Creek

Dear Mr. Blakesley;

I am writing to you to inform you, that I am a landowner in Midvale Irrigation District. My property lies along the Five Mile Creek Drainage and I have two water gaps on the drainage. I also rent land that has an additional two water gaps. Last year Philip Ranch placed sheep and cattle on my properties and used two of the four water gaps. The last two years have been drought years and water shortages. Even with this drought condition, the stream flows have stayed up with consistent flows. Without the flow from Marathon's oilfields at Circle Ridge and Maverick Springs, the constant flow in 5 Mile Creek would not been possible and in all probability would have dried up. Pleased be informed that any loss of streamflow in Five Mile Drainage would jeopardize my being able to furnish pasture with a good water supply. Any water supply into the drainage that would be turned off or restricted, would hinder my cash flow from pasture rental.

Thank you for your time.

Sincerely,

Richard Pattison

WYOMING HORSES
366 N PAVILLION RD.
PAVILLION, WY 82523
(307) 856-5708 or (307) 856-8552

January 3, 2002

Marvin Blakesly
Marathon Oil Co.
1501 Stampede Ave.
Cody, WY 822414

Dear Marvin;

Our ranch is located on Five Mile Creek four miles north of Pavillion, Wyoming. We have been here since 1973 and ours is the first ranch on the Midvale Irrigation Project that Five Mile Creek passes through. . We have 200 to 800 head of livestock that drink the water that flows down Five Mile during the year. Without the water that is discharged from the Marathon oil wells above us we may not have had stock water during the drought years of 1979, 2000, and 2001.

There is a good supply of minnows and small fish in the creek as well as abundant wildlife that drink and live in proximity to the creek.

Thank you for the steady supply of fresh water.

Yours truly,

Lonnie Mantle

Wyoming Horses
Lonnie & Grace Mantle
Bob & Dar Vogel

Darwin Griebel
Star Route - Box 2815
Kinnear, Wyoming 82516

Dear Mr. Blakesley & Mike Dlick,

I am an enrolled member of the Eastern Shoshone Indian Tribe. I am a permittee on range unit #38 and depend heavily on the production water for my livestock — without it all the ranchers within the Marathon production area from Circle Ridge to Pavillion would go out of business.

Not only would the ranchers be affected — but wildlife such as ducks, fish, geese, deer, antelope, wild horses, etc. would be distinct. Without production from Marathon & Five Mile Creek will dry up and all of the above is over.

I pray we do not lose the production water which will affect all the ranchers and critters.

Sincerely,
Darwin S. Griebel

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Letter of Surface Discharge Support from the Bureau of Land Management

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Private Individuals' Letters Supporting Surface Discharge from Various Oilfields

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United States Department of the Interior

BUREAU OF LAND MANAGEMENT
CODY RESOURCE AREA
P.O. BOX 518
CODY, WYOMING 82414

TAKE PRIDE IN AMERICA

9194
(190)

C. F. Childers
R. F. Meehan
F. M. Krugh
M. E. Blakesley
Return to Hold

November 03, 1988

Mr. John Wagner
Water Quality Division
Wyoming Dept. of Environmental Quality
Herschler Bldg., 4th Floor West
Cheyenne, WY 82002

Dear Mr. Wagner:

We understand that the Wyoming Department of Environmental Quality, Water Quality Division, is in the process of drafting new "Wyoming Surface Water Quality Standards" for EPA review and approval. The Bureau of Land Management, Cody Resource Area, would appreciate an opportunity to review and comment upon any proposed changes to the existing standards.

Our interest in water quality, from point source discharges, is primarily related to the surface discharge of water produced in conjunction with oil and gas production and the various beneficial uses to which this water is presently applied. In the Cody Resource Area, produced water is providing benefits to riparian vegetation, waterfowl and shorebird habitat, and drinking water sources for livestock and terrestial wildlife. We view this produced water as an important benefit to our management of the public land.

If you should have any questions regarding out interest in the new regulations, or the beneficial uses of produced water in the Cody Resource Area, please contact Thor Stephenson or Eric Greenquist of my staff.

Sincerely,

Thomas E. Enright

Thomas E. Enright
Area Manager

CC: Marathon Oil Company

CPC
PAP

EDWARD J. LEDDER
Medicine Bow River Ranch
Post Office Box 410
Medicine Bow, Wyoming 82329

October 18, 1988

Marathon Oil Company
Box 2690
Cody, Wyoming 82414

Attention: Mr. Terry Skinner
Production Superintendent

Dear Mr. Skinner:

This will confirm our conversation in which you indicated that environmental action might be taken to stop the flow of fresh water produced from your well on our property and diverted into the Medicine Bow River which runs thru our Medicine Bow River Ranch for some five miles.

As a retired Chairman, CEO of Abbott Laboratories with production facilities in many of our states, I am generally in favor of the environmental controls which our Federal, State, and Local authorities have placed on industry, farming, ranching, etc.

In this particular case I am not.

I understand that you are required to test this water going into the Medicine Bow River every quarter, that you do conduct these tests properly and up to this point the discharge meets the requirements established.

As a rancher, if you were required to stop discharging this water into the river, we personally would not be affected on a commercial basis because we already have adequate wells to feel our livestock and horses. At the worst we might be required to drill one additional well.

I believe however that any proposed standard changes or restrictions on existing standards that would result in stopping or restricting the water contribution to the Medicine Bow River would be detrimental for the following reasons:

First, our cattle and horses drink this water daily and thrive on it. I have checked with the former owners and they confirm that their cattle, horses, and sheep have used this water over the years with no problem. (They also confirm that they put this in correspondence when requested a year or two ago.)

Second, the deer and antelope and other wildlife use this water on its course down to the river and seem to prefer it to river water when the river water is available. (It is warm and stays open a good part of the year.)

Third, and most important, the Medicine Bow River (at least in the five mile stretch thru our ranch) is dry some two years out of three according to the former owners and local knowledge. Your supply of additional water provides a small continuing supply of water for the wildlife all along this portion of the river until it comes up again in the fall.

You supply enough water to maintain the pools in the riverbed which the ducks use and which hold some 20" German Brown Trout. Hence it permits these fish to live and multiply that would otherwise perish. This seems to us to be a very strong reason to continue the present flow of water you are supplying rather than restrict it in any way assuming the quality of water is maintained as it has been in the past.

If you have any questions on the above or any other area of the proposed restriction on what we consider to be a very desirable practice, please get back to us.

Sincerely,

Edward J. Bedder

EDWARD J. BEDDER
Medicine Bow River Ranch

To whom it may concern:

The following ranchers, sportsman, and other interested persons feel that the lease water going into creeks is a benefit to livestock and wildlife.

Ruby A Ross
Gordon T Ross
Rob A Ross
Stewart Sides
Luther O Penfield
Peter H. Penfield
Larry T Lowe
Ray Robb
John T Robb
Harold D. Miller
Patricia A Miller
Beverly J Miller
James R Middleton
Peggy A. Middleton
Foster C Miller
John Olson
Michael T. Hart
George W Tanner
Bill Greer
JC Shallow
Wade Hart Jr
Pat Hart

Frances L Hart
Wally Hart
Brad P. Hart
Ray Moore
Walt Hart
Eric Jones
Phillip Green
Dan Black
Dennis Ellis
Mike Lawrence
William A. Burt
Ralph Hayes
Carl Miller
Howard L Hawley
Ken Kerson
Mike Crain
Jerry Markland
Edward J Jones
Gloria Greer
Gary J Bayne
Dwight Krein
Phil Jones
Jim Premers

TOP QUALITY
FEEDER CATTLE

Diamond Bar Ranch

Matt M. Brown
Teresa H. Brown
Manager

Box 20, Owl Creek Route
THERMOPOLIS, WY 82443

Office: 307-867-2344
Home: 307-867-2422

October 25, 1988

To Whom It May Concern:

I just recently learned of the hearings before the EPA to require oil companies to reinject their treater-water. I am totally against the reinjection of this valuable community asset. I live in a very arid area of Wyoming where treater-water has become a necessity for maintaining the current economical and ecological conditions of the area. Treater-water provides stock water and irrigation water for ranching operations.

Probably of equal importance to the area is the fact that treater-water provides water and stream bank vegatation for wildlife habitat. This vegetation also prevents stream bank erosion such as the erosion found in seasonaly dry areas where there is not any natural vegatation to check water and hold the soil.

I have two pastures that depend almost entirely on treater-water from the Hamilton Dome oil field for stock water. I also have two pastures that depend souly on treater-water from the C. W. Webster Oil Field on Black Mountain and is used as a source for stock water. This treater-water is a dependable year around source of stock water. Due to its warm temperature, my livestock and the wildlife of the area thrive on it during the cold winter months.

I feel that this is an issue of great importance to this area and that hearings by the EPA on the reinjection of treater-water should be held in this area that will be affected.

The people affected by the EPA's decision on this ussue should have proper access to the hearing process.

Sincerely,

Matt M Brown

Matt M. Brown

Teresa H Brown

Teresa H. Brown

To Whom it may concern

Attn: Marvin Blakesley:
Marathon Oil Company
PO Box 2690
Cody, Wyo, 82414

Dear Mr. Blakesley:

It has been brought to our attention there is a move to put all treater water from the Hamilton Dome and Grass Creek oil fields back underground. We the users believe we should have a voice in a matter that will so drastically effect us.

It is our belief this would be a mistake, since that would create a fiancial burden on those depending on the water of Cottonwood and Grass Creek for stock water and water for irragation. This would causes a bigger water shortage, had there not been treater water this past summer, the creek would have been totaly dry. Since this water has been used for years, we the users cannot attribute any harmful effect to land or animals as some environmentalist groups would have the public believe.

Sincerely

Merle Ritz
Danny D. Reisinger (D&L M Inc.)

October 28, 1988

Marvin Blakesley
Marathon Oil Co.
P.O. Box 2690
Cody, WY 82414

To whom it may concern:

In regard to the beneficial use of the water in Cottonwood Creek that comes out of the Hamilton Dome oil field. I have lived here all of my life (47 yrs) and we have increased our crop production by 300% with the use of the oil field water in the last 20 years. The livestock do better on the water because there is more volume and it decreases the selenium content in the water. High selenium can cause death, abortions, and several other problems in livestock. With the constant flow of water in the creek there is improved vegetation for wildlife and the creek banks are more stable so there is less erosion. I've seen ducks live here on the creek year around. As far as the quality of the water, I've seen rainbow trout here along with minnows by the millions so it is not all that bad. If the water from the oil field is put back underground as proposed, it will cause a financial burden on both the stockmen and farmers who depend on it and the oil companies that are involved. As far as I'm concerned, the water out of Hamilton Dome is of more benefit to all people concerned left where it is coming down the creek.

Thank you,

Allan Baird

Allan Baird

Hamilton Dome, Wy.
Nov. 4, 1988

To Whom It May Concern:

As operator of one of the larger cattle ranches on Cottonwood Creek, in the vicinity of Hamilton Dome, Hot Springs County, Wyoming, we are requesting that the serious detriment to our operation and others in the area be considered if the discharges of fresh water from the local oil companies are suspended as planned.

We winter the cattle at the ranch headquarters each year. Water for the cattle was always a problem, being in short supply, and often freezing dry in the winter months. The addition of the discharged water not only assured us of adequate water for the cattle, but practically assured us of water that didn't freeze over, except in very extreme temperatures.

Irrigation water for summer use is always short, and in the dryer years some of our fields get very little water. Since we have had the use of the discharge water, we've been able to produce more hay, making wintering of the cattle easier.

Please consider these facts in making your decision.

Sincerely,

Rhodes Ranch, Inc.
Box 61,
Hamilton Dome, Wy. 82427

Frank P. Rhodes
President

Star Route
Worland, Wyoming
October 30, 1988

Marathon Oil Company
P. B. Box 2690
Cody, Wyoming

To Whom it may Concern:

I am writing in regard to the Hamilton Dome Oil Field water. We, as ranchers, would be in serious trouble without it. My folks have been on Cottonwood Creek for over fifty years. The last twenty-five years have been much more productive than the first twenty-five due to the extra water from the oil field. We own about 2,000 acres along the creek, of which we irrigate about 25%. This would be impossible without the water from the Hamilton Dome oil field.

There used to be a silinium problem in the water that caused alkali disease. This could result in abortions, paralysis, or blindness in the livestock. With the steady flow of the water in the creek now, these problems have nearly be eradicated.

The riparion habitat has improved immensely. The creek banks are much more stable with the water in the creek at all times. There are beavers and ducks on the creek all the time now. There is much more cover for the pheasants, other wild birds and wild game animals.

I think no matter where the water is in this arid western region of the United States, we are making a terrible mistake by putting it back under the ground. If the water is suitable for irrigation, wildlife, and livestock, us it!!

Respectfully submitted,

John Baird

John Baird

Thermopolis Wyo
82401
Oct 28, 1988

Marathon Oil Field
P.O. Box 2690
Cody, Wyo 82414
Re: Hamilton Dome Oil Field

Gentlemen:

We were notified by telephone, Oct 26, 1988 that the water from the Hamilton Dome Oil Field may be put under ground.

I have owned our ranch on Cottonwood since 1936. Before the water from the H.D. Field started running to the creek we had a serious problem with our cattle drinking the alkali water, causing alkali disease. Now that the water runs steady all of the time, we don't have that problem.

The Hamilton Dome Oil Field water is worth a small fortune to us, and the whole Cottonwood Creek Area, as stock water and irrigation water too.

We would miss it immensely if we lost it.

Please, Sir.

Yours truly
Laird & Sons, Inc
Thomas A. Laird, Pres.
Edna R. Laird, Sec-Treas

Hamilton Dome Wy
Nov 1, 1988

To whom it may concern

I very much object to the oil companies puting the treater water back into the ground.
As we have come to depend on it for livestock and wild game water also for irrigation for about 25 or 30 years.
It is the only water that has been flowing in Cottonwood creek at the ranch this year since August.
The only water on our B.L.M winter and spring allotment is what comes from the treaters at Hamilton Dome.

Ramul Zwarichka

Farmers and Ranchers
Cottonwood Creek
Worland, Wy 82401

November 7, 1988

EPA
C/O Pat Childers
Marathon Oil Company
P.O. Box 2690
Cody, Wy 82414

Dear EPA,

We are writing this letter concerning the Hamilton Dome and Grass Creek water. The water is checked every day to make sure there is no chemicals in it.

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Why spend all this money on something that is going to hurt the farmers, ranchers, livestock, wildlife, and water fowl? Without the water we would be hurting. The water has helped us the way it is right now.

In closing, we wish that you will reconsider and think about the wildlife, the land, and the livestock and leave the water as it is.

Sincerely,

Jerry L. Deromedi

Farmers and Ranchers
of Cottonwood Creek
Hamiltom Dome and
Grass Creek

Farmers and Ranchers
Cottonwood Creek
Worland, Wy 82401

November 7, 1988

EPA
C/O Pat Childers
Marathon Oil Company
P.O. Box 2690
Cody, Wy 82414

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Sincerely,

Jim Hilger
Box 524
Worland, Wyo

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Sincerely,

John F. Ashman
Worland, Wy.

James C Bach
Worland Wyo

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Hamiltom Dome and
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Farmers and Ranchers
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Sincerely,

Jerry [illegible] 1305 Coburn Worland Wy. 82401-073

[illegible] 200 S. 12th St. Worland

Farmers and Ranchers
of Cottonwood Creek
Hamiltom Dome and
Grass Creek

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Cottonwood Creek
Worland, Wy 82401

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Sincerely,

James Wolf - Amoco Prod. Co.
Worland, Wyo. - 82401
Robin [illegible] Worland Wy 82401

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of Cottonwood Creek
Hamiltom Dome and
Grass Creek

Farmers and Ranchers
Cottonwood Creek
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Sincerely,

Bob Busch
Pat E. Hartman

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Hamiltom Dome and
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Farmers and Ranchers
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Sincerely,

Gerry M Brown Construction
By Gerry M Brown

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of Cottonwood Creek
Hamiltom Dome and
Grass Creek

Farmers and Ranchers
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Sincerely,

Robert Pickard Manderson Wyo
Mark Lyman Ten Sleep Wyo
Bob Fawcett Worland, Wyo.

Farmers and Ranchers
of Cottonwood Creek
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Farmers and Ranchers
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In closing, we wish that you will reconsider and think about the wildlife, the land, and the livestock and leave the water as it is.

Sincerely,

Devon Beivens
Jo Beivens - I grew upon this water - and am a very healthy person - I think the water should should be left alone -
Lucille Williams

Farmers and Ranchers
of Cottonwood Creek
Hamiltom Dome and
Grass Creek

Farmers and Ranchers
Cottonwood Creek
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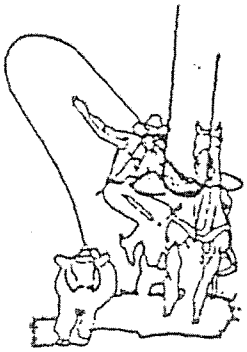
Sincerely,

Ray L Hamilton WORLAND WY
John R Mug 833 Park Ave. Worland Wy.

Farmers and Ranchers
of Cottonwood Creek
Hamiltom Dome and
Grass Creek



JIM WILSON
Box 31
Kirby, WY 82430
(307) 864-2009

October 21, 1988

To Whom It May Concern:

The usage of the water that is released from the Little Sand Draw oil field is a definite advantage to the livestock that is wintered in that area. Because the water runs for several miles through the range, it lets the cattle graze the forage in a much more even manner. Also since the water has been available, the wildlife has increased due to the improved habitat.

The loss of this water would hurt the cattle grazing as well as the wild life.

Thank you for you consideration.

Sincerely,

Jim Wilson

Jim Wilson

RECEIVED
Casper Operations Sup
OCT 21 1988
Marathon Oil Co.
Casper, Wyo.

RECEIVED
OCT 24 1988
Environmental
and Safety

Lance Creek Wyo 82222
Star Rte - Box 336
Oct 19 1988

Mr Jerry Skinner
Marathon Oil Co
P O Box 2690
Cody Wyo 82414

Sir

Your representative here, Mr Paul Petty, has asked me to contact you with regard to usage of surplus water from oil wells.

I have used it as the only source of water for my cattle in winter pasture and can assure anyone that cattle do very well on it, infact eat less salt and minerals than otherwise. We find many minnows living in it, bass I believe as well as bream and have seen some small turtles. I have seen my cattle fill up on that warm water on some bitter cold windy days and head for the ridge tops & start grazing while other ranchers cattle were bunched up behind a wind break. If you have any questions feel free to call me at 307-334-3506 or if I can be of any service.

J C Stratton

HOODOO RANCH
P.O. BOX 850 — CODY, WYOMING 82414

GEORGE BROWN
MANAGER

Half Moon Fe
Park Co, Wyo

October 20, 1988

Eugene Grant
Marathon Oil
P O Box 2690
Cody, Wy

Eugene,

Concerning you telephone call in regards to treater water made me realize how much we have come to rely onit as our major, and in come cases only source of water, not only for livestock but wildlife as well.

In a normal year treater water from Half Moon Oil Field furnishes ninety percent of the water for the whole drainage of Sulphor Creek and this year close to a hundred percent. This is also true of Oregon Basin in regards to the Dry Creek drainage.

If and when we lose this water it will not only have a tremendous impact on livestock and wildlife but will change the ecology of these areas, which amounts to thousands of acres.

This should be of great concern not only to us, but everyone in the state. If I can be of any help in this matter please let me know.

Sincerely,

George Brown

Box 556 82414

Half Moon Field
Park Co, Wyo

Marathon Oil Co.
P.O Box 2690
Cody, Wyoming
82414

Mr. Eugene Grant
Dear Sir ;
In refernce to your telephone call of this morning.
As far as i can tell the water running through our grazing land from the Half Moon oil field is perfectly good for livestock to drink.

I have been observing the cattle for years when they graze on the land that the Half Moon oil well waterthrough our land. There has never been any ill efects to the cattle from from the cattlebedrinking the oil well water.

I n fact the cattle will drink what ever water is closest to them. Either resivour water or oil well water.

It is of my opinon that this water is perfectly safe for any animial to drink.

This property is curently owned by myself and my two brothers Paul and Fred Zinn Adresses will be furnished opon demand.

Bert Bell is curently leasing the land for grazing.

If there is any further information necessery.
My name is Martin J Zinn Box 556 Cody, Wyo, Zip 82414 .

Thank You

Martin J. Zinn

To whom it may Concern:

Pilot Rock Fire Pack Co,

I have been advised that Marathon Oil Co. may be requested to pump all fresh water underground at the 4 feild.

This would be extremely detrimental to our winter grazing program as our cattle depend almost entirely on this water in the cold winter months as other sources are frozen beyond use.

This water is warm and never freezes.

I strongly urge that this policy not be implemented.

Thank You
Art Thomas
T Ranch

711 RANCH COMPANY
Route 1, Box 255 5555 Greybull Highway
Cody, Wyoming 82414

R. W. (Bert) Schultz, Pres.

October 19, 1988

Oregon Basin Field
Park Co, Wyo

Mr. Eugene Grant
Marathon Oil Company
P.O. Box 2690
Cody, Wyoming 82414

Dear Mr. Grant:

I received word, the Environmental Protection Agency will force Marathon Oil Company to cease producing water in Oregon Basin. This disturbs me for we have been using this water as a supplement to our own water system. Our main source of water in the Basin consists of a series of water tanks supplied by an electric pump. When our system breaks down we rely exclusively on the Marathon water for our livestock. Sometimes it takes many days to get the system working again, depending on the problem. It would be an exhausting and expensive ordeal to have to haul water from our ranch well.

Also, the E.P.A. is probably not aware that deer, antelope, small animals and birds use this water which they seem to prefer to our own water tanks. As you know, waterholes in Oregon Basin are few and far between.

I hope the E.P.A. will reverse its decision. In an area as arid as this one, every source of water is an asset.

Sincerely,

Irene Schultz

Irene Schultz

Oregon Basin Field
Park Co, Wyo

Grabbert Ranch
Emblem, Wyoming
October 19, 1988

Eugene Grant
Marathon Oil
Cody, Wyoming

Dear Mr. Grant:

I understand that the EPA is concerned about the water that Marathon is discharging into Dry Creek from the Oregon Basin oil field. If this water were to cease flowing, there are some significant down stream problems that will surely occur.

The purpose of this letter is to point out some of these problems of which the EPA may not be aware.

As back ground information, I would like to point out that the Oregon Basin area recieves less than 10 inches of average annual precipitation, and is somewhat arid country. Down stream to the northeast the average annual precipitation declines gradually to about 5 inches of average annual precipitation, where Dry Creek flows into the Big Horn River, about 50 miles from Oregon Basin. This is definitely arid country. Also, the annual precipitation is variable in this area. In some years only half of the average annual precipitation falls.

Water in all of this area is a precious commodity. Pronghorn antelope, mule deer, game birds, eagles, rabbits, coyotes, wild horses, beaver, ducks, and many other animals, as well as domestic livestock depend on the water and/or riparian habitat provided by Dry Creek. And Dry Creek in turn depends on the water discharged by Marathon from Oregon Basin. This discharged water in Oregon Basin provides half of the stream flow at the point it enters Dry Creek, I would roughly guess. Earlier this summer the water discharged by Marathon provided all of the stream flow. Dry Creek was dry above this point. There was no other water in Dry Creek between Oregon Basin and Emblem. The creek did go dry in places, but there were occasional pools where the stream bed and water table overlapped. If this water were no longer discharged I would expect the water table to drop and the creek to go dry for many miles. There is no doubt in my mind that the wildlife species and numbers have adjusted to this dependable flow of water over the many years since this water began to flow.

Grabbert Ranch has been grazing cattle and sheep in Oregon Basin for more than 40 years and our livestock have come to depend on this source of water. Our cattle spend more time in Oregon Basin than the sheep do and have been drinking this discharged water with no apparent bad effects. The cattle can drink from Dry Creek above where the oil field water enters the creek or from the stream of discharged water. They are free to choose. I know they prefer high quality water, but they find this discharged water convienient when they are grazing that area of the pasture. Conception rates, percent calf crop, weaning weights, and other measures of livestock preformance have been very good.

If this water were not available, we would be forced to develop another source of stock water to prevent overgrazing in other areas of the pasture. Stockwater development has the highest priority on this ranch, but money and time are both limiting factors. There is so much work and maintainance to be done that some other project would have to be put off.

Our early spring and winter range is located 30 miles on down Dry Creek near Emblem, Wyoming. The lack of stock water in Dry Creek at critical times would be both inconvienient and costly. The loss of trees and bushes in the creek bottom would mean less shelter for livestock and less habitat for wildlife.

Between Oregon Basin and Emblem there are other ranchers who also depend on the water discharged from the Oregon Basin oil field into Dry Creek. Deseret Ranch, Chris Renner Ranch, Hoodoo Ranch, YU Ranch, Don Schlaf Ranch, and the Don Schlenker Ranch would surely like to see more water in Dry Creek, not less.

In summary, if this water is no longer allowed to flow from Oregon Basin, some of the effects will be as follows:

1. Decline in wildlife numbers.
2. Loss of riparian habitat.
3. Loss of hunting and recreational opportunities.
4. Economic hardship to local ranches

I am not qualified to say how bad some of these chemicals in the water are. I am not aware of any bad effects. But water has such a wonderful effect on this land, I want all I can get.

Sincerely,

Dave Grabbert

Dave Grabbert

Hilight Field
Eng. Plant
Campbell Co.
110 130 PD F 2381 Bu

Oct 15, 1951

Union oil Co.
Box 1947
Gillette, Wyo. 82717
Att: H.C. Coon

Regarding our Conversation on discharging water from your water Plant located in Sec 29, T. 46 N, Range 71 west.

I would like to keep it like it is. The water discharge furnishes water for livestock on the west Fork of Coal Creek, also a resting area for Duck + Geese.

Sincerely,

Lionel E Edwards
2098 Hilights Road
Gillette, Wyo 82716

Jayson Unit
Hilight Field
Campbell Co.
10 BOPD + 50BWPD

TO WHOM IT MAY CONCERN:

Any water discharge from this facility will be used for stock water as long as it is good quality water which meets the National Pollutant Discharge Elimination System standards.

Dry Creek Ranch Mike Deaver

J.V. 9-12
J.V. Inj. Station

Gillette, Wyoming
October 11, 1983

Dear Sir

Of the water quality out of your 4-9 battery in the Jayson unit, Sec 27, T46N R70W continues good. All benefit from it being allowed to overflow into bad creek, as it has the past ten or so years. That water in the winter time allows my cattle another source of open water also for the few deer that are slowly increasing in numbers from past severe winters. They, the deer, like that portion of creek just south of the 4-9 battery. Few people except oilfield personnel go through the area, and there is plenty of grass and water, and it helps the deer graze. And when my domestic livestock water at the 4-9 overflow, they graze the north east part of that pasture, and better utilize the forage.

And the unit production manager, Union Oil, have plenty of pressure, wages, maintenance, roads, without having to haul good quality water out, water samples, etc.

As ever
Dale V. Olson

Jayson Unit #4-9
Hilight Field
Campbell Co.
~~B~~ 20 BOPD + 180 BWPD

Fremont Co
120 BOPD + 5700 BWP

ED F. MCKINNEY
Rawlins Route, Box 30
Lander, Wyoming 82520

October 6, 1988

Tim J. Noack
Union Oil Company of California
P.O. Box 79
Worland, Wyoming 82401

Dear Mr. Noack:

After a recent visit with your field foreman, Mr. Gerald B. Carr, I was informed that I may be losing the use of your oilfield produced water from your Derby Field in Fremont County, due to changes in federal law governing surface discharge waters. I would like to assure you that the waters I obtain from your Derby Field are put to beneficial use by me for my farming and ranching concerns. In the winter months I utilize the waters for watering of my cattle and horses. In the spring and summer this same water is used for irrigating my hay. The loss of this water source would severely impact my ranching operations and I would appreciate your efforts toward maintaining this source.

Sincerely,

Ed F. McKinney

Ed F. McKinney

November 15, 1988

To Whom It May Concern:

We need and use the produced water from Chevron, U.S.A.'s Steamboat Butte Field in Fremont County, Wyoming.

This water happens to be the only water available for our cattle in this area.

Sincerely,

James Barquin
Jolene Schur
Jim Barquin III

Worland, Wyoming
July 13, 1982

Mr. R. H. Elliott
Area Superintendent
Chevron U.S.A. Inc.
Box 599
Denver, Colorado 80201

Mr. Elliott:

I am interested in using the discharged water from Chevron U.S.A. Inc. Neiber Dome No. 8 well located in the NW¼, NE¼, Section 30, T45N, R91W, Washakie County, Wyoming. This water would be used for the beneficial purpose of watering livestock in the pasture I have leased from the BLM.

Sincerely,

Sam Hampton
Rt. 2
Worland, Wyoming 82401

April 1, 1982

Mr. Mike Schinfeld

Dear Sir;

Mr. Keller informed me that I should write you to request for water from the storage tanks from Chevron oil well S.E. of Warland.

I ~~want~~ tanks water samples to the B.L.M. Office in Warland and the results were that the water could be used for livestock.

Our B/M pasture is about ½ mile East of the well.

Mr. Keller said the water would have to go into a settling pond. The tanks is located on a hillside and if a pipeline could be laid on grade from there to an open reservoir for stock water we would appreciate it.

We can request B/M participation in the pipeline and we ~~will~~ would maintain the line.

thanks you.

Sam Hampton

Hilight Field
Eng. Plant
Campbell Co.
110 130 PD T0301 Bu

Oct 15, 1951

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Box 1947
Gillette, Wyo. 82717
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2098 Hilights Road
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Hilight Field
Campbell Co.
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Hilight Field
Campbell Co.
~~#~~ 20 BOPD + 180 BWPD

Fremont Co
120 180 FD 5700
SDP

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Sincerely,

Ed F. McKinney

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Box 599
Denver, Colorado 80201

Mr. Elliott:

I am interested in using the discharged water from Chevron U.S.A. Inc. Neiber Dome No. 8 well located in the NW¼, NE¼, Section 30, T45N, R91W, Washakie County, Wyoming. This water would be used for the beneficial purpose of watering livestock in the pasture I have leased from the BLM.

Sincerely,

Sam Hampton
Rt. 2
Worland, Wyoming 82401

April 1, 1982

Mr. Mike Schinfeld

Dear Sir;

Mr. Keller informed me that I should write you to request for water from the storage tank from Chevron oil well S.E. of Warland.

I took water samples to the B.L.M. Office in Warland and the results were that the water could be used for livestock.

Our B/M pasture is about ½ mile East of the well.

Mr. Keller said the water would have to go into a settling pond. The tank is located on a hillside and if a pipeline could be laid on grade from there to an open reservoir for stock water we would appreciate it.

We can request B/M participation in the pipeline and we would maintain the line.

thanks you.

Sam Hampton

March 15, 2002

Marvin Blakesley
Marathon Oil Company
1501 Stampede Avenue
Cody, Wyoming 82414

RE: Produced Water From Pitchfork Oilfield

Dear Mr. Blakesley

I am providing the following information concerning the beneficial uses of produced water from Marathon's Pitchfork Oilfield.

The produced water that is discharged from the Pitchfork Oilfield is beneficial to my ranching operation. The water flows from Marathon's facilities into Rawhide Creek, and then flows several miles before entering the Greybull River. The water is of good quality and is used by my cattle throughout most of the year. The water provides an important year round water source for several of my pastures. We also utilize the water for irrigation of our crop lands. Rawhide Creek, above the Pitchfork Field discharge, often goes dry during the summer. The produced water provides a steady flow throughout the year.

The water also provides many beneficial uses to wildlife, including deer, antelope, sage grouse, chukar, and Hungarian partridge. Some non-game species of fish and wildlife are also dependent on this discharged water.

Any loss of this water would be detrimental to my ranching operations and would create a negative environmental impact.

Sincerely,

Jack Turnell
Turnell Cattle Company

United States Department of the Interior

Fish and Wildlife Service
Lander Fish & Wildlife Management Office
Partners for Wildlife Branch
170 North First Street
Lander, WY 82520
307/332-8719 Fax:307/332-9857
Internet: R6FFA-LAN

Melvin Blakesley
Marathon Oil Company
1501 Stampede Ave.
Cody, WY 82414

November 18, 2003

Dear Melvin,

I had a conversation with Mike Quick the other day about Mission Pond project and any updates that we could provide. For starters, the dikes needed some rip-rap on the faces to protect from wind and wave action and that was accomplished last summer in coordination with the Tribe and High Country Construction Company. The structures are now all up to spec. and working fine. Outside of that, the birds have responded, especially shorebirds using the available exposed mud flats this summer. Several broods of waterfowl were seen on the ponds this past summer and overall I rate the project a success. The vegetative response has been quite remarkable, sedges and rushes pioneering the newly flooded uplands, which is encouraging considering the absence of vegetation on much of Mexican Flats. From past wetland studies, Mission Ponds should continue to increase in production for the next five to ten years then level off, having comparable flora and fauna of a natural wetland basin.

We thank you for your support on the Mission Pond habitat development and look forward to working with you on any new habitat projects in the near future.

Sincerely,

Mark Hogan

Mark Hogan
WY Private Lands Coordinator

Nov. 30,2003

Attn: Marvin Blakesly
Marathon Oil Company
1501 Stampede AveCody, Wyo. 82414

Dear Sir:

The Barquin family and their children and grandchildren have been using the produced water form the Marathon Steamboat field for sixty years or more to water the cattle. This water flows from the Mission Pond to the river.

We need this water because it is discharged year around and it is the only water available for the livestock and the wildlife.

For some of this area this produced water is the only water available and if not discharged, the range could not be fully utilized with out the cost of providing water. This is particularly true in drought years, when other sources of water are reduced or dry up.

Since the water is hot when discharged, it is available longer in the winter without having to break ice. Cattle may maintain their weight and survive cold weather better because they do not have to expend as much energy bringing the water they drink to body temperature.

Besides the livestock, the wildlife, which includes deer, elk, antelope, waterfowl, game birds and beaver also utilize this water year round.

We would certainly like to see this produced water flow year round. It is necessary for the continuation of our livestock operations.

Sincerely,

James Barquin Jr.
James D. Barquin Jr.

Jim Barquin III
Jim Barquin III

Jolene Scheer
Jolene A. Scheer

Ty Nicholls
Ty Nicholls

Brodie Nicholls
Brodie Nicholls

[redacted]

10929 Hwy 26
Kinnear, Wy. 82516

November 12, 2003

Marvin Blakeley, HES
Marathon Oil Company
1501 Stampede Ave.
Cody, Wy. 82414

Mr Blakeley,

I am writing in regards to the Steamboat field's discharged water. There is a stream that runs year around through our property that gets its water from this discharged water. We have cattle, horses, and goats that drink from it. There are also deer, coyotes, rabbits, pheasants, chuckers, eagles, and other wild animals that benefit from it.

Thank you for providing this benefit of the water to us.

Sincerely,

Doug and Linda Hill

Blakesley, Marvin E.

From: FLITNER@aol.com
Sent: Tuesday, August 01, 2006 10:49 AM
To: mmyetter@qwest.net
Cc: goflitner@tctwest.net; Blakesley, Marvin E.
Subject: Re: Water and Waste Advisory Board Meeting information (DRAFT)

Statement from Flitner Ranch
By David Flitner, Owner/operator
3208 Beaver Creek Road
Greybull, WY 82426

From: David Flitner

To **Wyoming Water and Waste Advisory Board**

Ladies and Gentlemen of the Advisory Board:

Thank you for the opportunity to comment on an issue of vital importance to our ranching operation.

My name is David Flitner. I am the owner of Flitner Ranch and Hideout Adventures located at Shell, Wyoming with grazing lands utilized by the ranch located in the Shell, Powell/Cody and Tensleep area as well as our historic homestead site on Shell Creek and the Big Horn Mountains. This year, the Flitner Ranch celebrated its' 100th year in the livestock and farming business.

We operate a commercial cattle range operation as well as a feedlot for finishing cattle. We also have a registered quarter horse business an extensive farming operation and a guest business, called The Hideout, with guests coming from all quarters of the globe.

We employ some fifty people in the various enterprises of Flitner Ranch which also includes a small construction company. The entire commercial cattle operation, the registered quarter horse operation and the Hideout guest operation are dependent on the use of both private and Federal lands.

Some 150,000 acres of the grazing enterprise are primarily dependent on water produced from wells emanating from the Oregon Basin oil field near Cody. The excess water that is not re injected has become the basis for a consistent water supply called Dry Creek.

Dry Creek supplies the water for hundreds of cattle from various livestock operations throughout its' full length from just south of Cody to Greybull. It is also the water source for a resident antelope and Wild Horse herd. If Marathon were to suddenly stop pumping the excess water from its' production wells at Oregon Basin, this entire water source would dry up and the economic as well as ecological consequences would be devastating to both the livestock industry in the area as well as the Wild Horse population and hundreds of antelope and deer.

As a result of the above information, it is our desire to suggest the Advisory Board take into consideration the following suggestions:

1. Any policy formulated should not interfere with landowners or pemittees on Federal and State leases who desire to use CBNG produced water to improve their property or sustain livestock operation

2. The policy should allow landowners to use and receive the water even if it does not meet DEQ's "standards." In the case of Dry Creek, which results from the Marathon Wells, our livestock and the wildlife have a long history of using this water with no negative consequences. The cattle from pastures adjacent to this water source have often exceeded the calving percentage and weight gains of competitive pastures within the scope of our overall ranching operation.

3. The landowner/ranch manager are in the best position to evaluate the impact on their livestock even if it does not meet DEQ standards and in a better position to evaluate whether water that exceeds "standards" is beneficial to his lands and livestock. Often *Big Brother* is not close enough to the situation to accurately evaluate all the physiological and economic factors that go into making a decision that is realistic.

4. One of the great challenges in the livestock industry in Western range grazing areas is the proper distribution of livestock and wildlife by utilizing water sources to allow uniform utilization of grazing in a given area. Historic water uses could easily be disrupted by imposing unrealistically rigorous water quality standards. This would be devastating to both livestock and wildlife populations.

Great caution should be exercised by any regulatory entity in the state to ensure that overly zealous regulations do not destroy the fragile balance that has taken over a hundred years to establish.

Thank you for the opportunity to comment. I would hope that the Board would consider a hearing in the Greybull/Cody area where there is major concerns relative to any potential regulations that may come from your investigation into this matter.

Sincerely,

David A. Flitner