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**RE: Expert Scientific Opinion on the Tier-2 Methodology: Report to the Wyoming Environmental Quality Council, May 2009**

Dear Members of the Environmental Quality Council,

I would like extend my sincere appreciation to the council for the great deal of the time and effort which you expend on behalf of the state of Wyoming, its citizens and resources. I sincerely thank the Environmental Quality Council for the opportunity to comment on the May 2009 *Expert Scientific Opinion on the Tier-2 Methodology: Report to the Wyoming Environmental Quality Council*. Given that the DEQ has not requested to withdraw Appendix H, I would simply like to share some information with the council.

Over the past four years, I have been fortunate to tour many areas of the Powder River Basin and have seen many areas where coalbed methane (CBM) natural gas produced water discharge is occurring and has occurred. I have completed coursework and done extensive reading on riparian area functioning, soils and the impacts of salts and flooding on soils and vegetation growth. I have done research in the Powder River Basin comparing the impacts of periodic CBM water flooding on three drainages to three drainages that had not yet seen discharge as of 2006 for my senior thesis. I found striking differences in soil quality with over 80% of soils with CBM discharge demonstrating textbook classifiable soil salinization.

I have been following Wyoming's lengthy and difficult struggle to establish a scientifically based, lawful management and regulation strategy for produced waters which will ensure continued beneficial use of the water for many across the state as well as protect the agricultural interests of downstream landowners.

The council has heard a great deal of testimony regarding this rulemaking from University of Wyoming soil experts, among many others, over the course of time. Most recently, the EQC solicited an objective expert scientific opinion from Drs. Jan Hendrickx and Bruce Buchanan on the Chapter I, Appendix H Tier II methodology to guide its pursuit of an effective regulatory solution regarding CBM water discharge.

I agree with the ultimate conclusions of Drs. Jan Hendrickx and Bruce Buchanan – that the Tier II policy is neither scientifically defensible nor reasonable. I also agree with the assertion on made on page 10 of the opinion that “[n]o evidence has been found in the peer-reviewed literature in support of the assumption on which Tier II is based.” I also whole-heartedly agree that Equation 2, found and discussed on pages 13 and 14 of the May 2009 opinion, is incorrect as it is used in the Teir II policy. While Equation 1 can be used as Ayers and Westcott intended to determine a favorable leaching fraction in a managed irrigation setting, it is not possible to invert the equation to solve for the EC of the soil when you know neither the concentration factor nor the EC of the irrigation water.

Hendrickx and Buchanan emphasize that management of the water is imperative and that quantity and quality are both important factors in proper irrigation management. I echo their conclusion.

Additionally, the scientists further strengthen and expand this opinion in their September 2009 May 2009 *Expert Scientific Opinion on the Tier-2 Methodology: Report to the Wyoming Department of Environmental Quality*.

We have presented scientific evidence that no unique relationship exists between irrigation water quality on the one hand and root zone soil salinity and crop productivity on the other. Therefore, we conclude that the **Tier 2 and Tier 1 methodology** as set forth in Appendix H section C(vi)(B) **is not reasonable nor scientifically valid for determining the EC of water that can be discharged into an ephemeral drainage in Wyoming so that degradation of the receiving water will not be of such an extent to cause a measurable decrease in crop production.**

In this September 2009 opinion, they also assert that the water table in some areas is being raised as a result of discharge. Likewise they observe that damages are being caused by this water in certain instances and that management is nearly impossible without knowledge of the timing of releases, quantity and quality of the discharge water is astute and undeniable.

“We have observed in the field (Clabaugh, Swartz, Rodgers) that the **Tier 2 and Tier 1 methodology has caused a rise of the ground water table that resulted in both “waterlogging and –most likely– increased soil salinity”**. Had a monitoring program be in place since the beginning of CBM water releases, it is almost certain that a decrease in crop production would have been measured due to waterlogging and/or increased soil salinity.”

I would like the council to be aware that at least *172 permits* have been issued by DEQ de facto under the ‘scientifically indefensible and unreasonable’ Tier II policy which, according to Hendrickx and Buchanan is causing a measurable decrease in crop production, had we only been measuring. Therefore action, and immediate action to create a lawful and scientifically valid rule is imperative.

The impacts of water quantity and quality of the produced water on soils and vegetation are inextricable intertwined and any valid rule or policy must address both. I respectfully point out to the council that the *volume* of wastewater is regulated by DEQ. Wastewater volume from water treatment plants is regulated by DEQ and every WYPDES permit issued for CBM discharge has a volume listed in cubic feet per second. The DEQ *is* already permitting the volume of water for these discharges. Therefore, it is unreasonable for the DEQ to assert that it does not have the ability or authority to regulate the volume of water discharged.

I would also like to take this opportunity to reiterate to the council that various management documents and Wyoming regulations already create a place for the DEQ and EQC to start construction of an effective agricultural protection rule with regard to CBM discharge water.

The following section appears in Chapter I, Section 20 of Wyoming Water Quality Rules and Regulations:

**Agricultural Water Supply.**

All Wyoming surface waters which have the natural water quality potential for use as an agricultural water supply shall be maintained at a quality which allows continued use of such waters for agricultural purposes. Degradation of such waters shall not be of such an extent to cause a measurable decrease in crop or livestock production. Unless otherwise demonstrated, all Wyoming surface waters have the natural water quality potential for use as an agricultural water supply. The procedures used to implement this section are described in the “Agricultural Use Protection Policy.”

Additionally, Table 1. found in Chapter VIII of the Wyoming Water Quality Rules and Regulations presents *an upper SAR limit of 8 for Class II agricultural use.*

Sections 55 and 56 of Chapter XI of the Wyoming Water Quality Rules and Regulations discusses water suitable for irrigation. Water shall have values that do not exceed 750 mmhos/cm and SAR not greater than 10. Further, Figure I of Section 55 shows that water with specific conductance values greater than 2,300 mmhos/cm and SAR exceeding 14 “are not usable under ordinary conditions” and “are generally unsuited for irrigation.”

I would ask the council to review the issued Tier II WYPDES permits, some of which have excessive SARs and ECs to become familiar with how permitted numbers differ from recommendations in our own state statutes.

The 2003 Powder River Basin Oil and Gas Final Environmental Impact Statement also lists discharge limits for various waterways and their sub watersheds, which would appear to apply to the ephemeral drainages being impacted by these unmanaged discharges.

Table 4–2 summarizes the highest and lowest standards *proposed for or applicable to the sub-watersheds addressed in this analysis*. (emphasis added)

**Table 4–2 Summary of Proposed Limits for Surface Water Impact Analysis**

Sub-Watershed	Most Restrictive Proposed Limit (MRPL)		Least Restrictive Proposed Limit (LRPL)	
	SAR	EC	SAR	EC
Tongue	0.5	500	10	2,500
Little Powder	3.0	1,000	10	3,000
Powder	2.0	1,000	10	3,200
Belle Fourche	10 <sup>1</sup>	2,000 <sup>1</sup>	10 <sup>2</sup>	2,500 <sup>2</sup>
Cheyenne	10 <sup>1</sup>	2,000 <sup>1</sup>	10 <sup>2</sup>	2,500 <sup>2</sup>

Notes:

1. WDEQ limit applied to waters that flow downstream into South Dakota.
2. South Dakota's existing water quality standard.

Construction of this table considered the full range of values proposed in the Montana (sic) standards process now underway, the adopted Northern Cheyenne standards, South Dakota's standards, and the limits applied by the WDEQ to waters that flow downstream into South Dakota. The proposed limits apply to individual sub-watersheds and have been suggested for seasons of the year. For example, different limits have been proposed for the irrigation season. However, because a single irrigation season has not been agreed upon, the limits have been lumped together. South Dakota applies water quality standards for EC and SAR year-round. The limits shown in Table 4–2 were incorporated into the discussion of impacts that follows. Because CBM discharges to the Upper Powder River, Clear Creek, Crazy Woman Creek, and Salt Creek sub-watersheds have the potential to flow into the Middle Powder River sub-watershed in Montana, Montana's proposed limits for the Powder River have also been applied to these sub-watersheds. WDEQ applies limits in the Upper Cheyenne (also applicable to Antelope Creek) and the Upper Belle Fourche sub-watersheds in authorizing discharge permits for CBM produced waters to protect the most sensitive crop (such as alfalfa) that may be grown downstream (Beach 2002).

PRB O & G FEIS, p. 4-73.

I hope that existing regulations, agricultural management expertise, the Clean Water Act and other states' policies to address similar issues all guide Wyoming toward the creation of a successful CBM water management policy. The integrity of these scientifically based opinions has helped create a distinct turning point in the years-long deliberation about the scientific validity of this rulemaking. While the way forward may not be entirely clear, at least Wyoming has finally acknowledged that it needs to move beyond this flawed policy.

As a result, I am hopeful that moving forward, Wyoming will quickly create a coalbed methane water management policy grounded in sound, peer reviewed science.

I am very glad that the Wyoming Department of Environmental Quality has seen the need to revisit Appendix H.

I respectfully urge the Council to:

1. Demand that DEQ cease issuance permits using this policy (over 170 permits have been issued de facto under Tier II).
2. Allow DEQ to retract the current version of Appendix H. Demand that DEQ scientists draft an entirely new agricultural protection policy based on valid science and in consultation with credible, soil and water management scientists and resubmit it to the EQC before the close of 2010. The policy must address baseline conditions, monitoring, and management along the entire path of waters discharged as well as the quantity and quality of water to be discharged. The policy must not contradict existing Wyoming statues or the Clean Water Act and should follow accepted, peer reviewed scientific methodology. The policy must use peer reviewed literature to determine livestock water limits, such as the Raisbeck study.
3. Direct DEQ to use information gathered through the working group to inform the creation of a better rule. However, this group should not be used to create a rule or policy based on consensus or politics.
4. Demand that the DEQ immediately address the instances of damage that have occurred under the current, flawed permitting scheme.

I again thank the Council for their continued work on this issue and look forward to the timely creation of a new management policy protective of agriculture, soils and water in the state of Wyoming.

Sincerely,

A handwritten signature in black ink that reads "Ashley Erin Roberts". The signature is written in a cursive, flowing style.

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