# COMMENTS – FEBRUARY 15 & 16, 2007

## PAW & Member Companies

## Environmental Quality Council Hearing

### CHAPTER 1 WATER QUALITY RULES AND REGULATIONS

*Resubmitted by*

PETROLEUM ASSOCIATION OF WYOMING

*August 26, 2008*

BEFORE THE ENVIRONMENTAL QUALITY COUNCIL
STATE OF WYOMING

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| IN RE: WATER QUALITY RULES | ) | |
| AND REGULATIONS, CHAPTER 1, | ) | Docket No. 06-3819 |
| SURFACE WATER QUALITY | ) | |
| (CHAPTER 1, APPENDIX H) | ) | |

# COMMENTS OF MARATHON OIL COMPANY

## Introduction and Summary

In accordance with the Notice of Intent to Adopt Rules and Regulations published by the DEQ on or about December 22, 2006, and the provisions therein for filing written statements "at the time of the hearing or prior thereto," Marathon Oil Company respectfully submits these comments for the record. Marathon urges the Council to reject the proposed Appendix H, "Agricultural Use Protection," for adoption as a rule. Although the text of Appendix H has been under consideration for well over a year as a "policy" to accompany Chapter 1, the December 22, 2006, notice was the first time that DEQ proposed the adoption of that text as an appendix to Chapter 1, i.e., as a "rule." Neither the Water and Waste Advisory Board nor DEQ has ever solicited public comment or conducted a public hearing on this "rule." On February 5, 2007, the Water and Waste Advisory Board held a hearing on the limited issue of whether the Agricultural Use Protection standard should go forward as a "rule" or as a "policy," but the hearing notice prepared by DEQ instructed the public not to comment on the substance of the proposed "rule." Even without holding a full hearing on the proposal, the Board recommended against adoption of Appendix H, precisely because the Board realized that the public had no adequate opportunity to comment on DEQ's abrupt conversion of the document to a rule.

Marathon believes the Advisory Board correctly determined that the Agricultural Use Protection standard should not be adopted as a rule at this time. As discussed below, the Council

could not lawfully adopt this proposed "rule" under the Environmental Quality Act without prior notice and comment. DEQ's failure, and the Advisory Board's inability, to seek and consider public comment on the substantive implications of adopting Appendix H as a rule means that the proposed rule has not undergone the comment and scrutiny that the EQA requires prior to any action by the Council. The Council must reject the proposed rule, or defer it pending consideration by the Advisory Board and DEQ of full public comment on the merits of Appendix H as a rule.

Marathon recognizes the utility to DEQ of having a clear policy statement to guide DEQ's implementation of Section 20's broad mandate when writing WYDES permits. However, as also explained below, in order to be workable -- even as a policy -- the proposed agricultural use protection standard would require substantial refinement. Marathon would be prepared to work with DEQ and other stakeholders to develop an effective policy for implementation of Section 20's mandate. But the current proposal must be rejected, regardless of whether it is a rule or a policy. As discussed below, there remain many significant technical and policy issues. First, the coverage of the policy is too broad and the policy lacks clear criteria to determine what lands are to be deemed "irrigated." Section 20 was never intended to protect illicit irrigation, nor so-called natural irrigation that does not inundate grazed pasture land outside a stream channel. Second, even if the criteria were clear, the policy should require downstream landowners to provide information to DEQ to confirm that their lands are "irrigated." Third, the default effluent limits on EC and SAR in Tier 1 can rationally be applied only at downstream locations where and when irrigation will actually occur, not as end-of-pipe limits. Fourth, Tier 3's procedures are vague and need supplementation. At a minimum, DEQ needs to make clearer that a landowner's failure to provide reasonable access to its property for purposes of acquiring

data necessary under Tier 3 will relieve the permit applicant from any requirements under Section 20 with regard to that property.

## Discussion

### 1. The Council Cannot Lawfully Adopt Appendix H As A Rule Because the Advisory Board Has Not Yet Considered It.

Major differences exist between a policy and a rule, even if they use the same words. If the proposed agricultural use protection document were a DEQ policy, DEQ would have some discretion to modify or tailor the standard to fit each particular situation in writing a WYPDES permit for a given discharge of CBNG water. If the proposed standard were a rule, DEQ would have little or no flexibility in setting effluent limits for different discharges and different situations. Until December 22, 2006, DEQ was repeatedly on record as opposing a Section 20 "rule." In DEQ's Analysis of Comments on the 4th Draft of the policy, DEQ stated:

> The proposed livestock watering and irrigation limits are based on the rule in Chapter I, Section 20. Section 20 provides general narrative criteria which require a consideration of site-specific circumstances to properly apply. We believe this is best accomplished through a procedure established **in policy** that allows the necessary flexibility to arrive at the most appropriate permit limits in each application. **Establishing the limits in the rules, either Chapter 1 or Chapter 2, would severely limit the necessary flexibility.**

Analysis of Comments at 3 (emphasis added). As the Petroleum Association of Wyoming noted in comments to the Water and Waste Advisory Board dated February 5, 2007, which Marathon hereby incorporates by reference, DEQ had long been on record as rejecting the suggestion that the policy instead be brought forward as a rule. At the Board's earlier hearing on August 2, 2006, in Buffalo, Wyoming, Bill DiRenzo of DEQ said that among a number of "basic issues" that DEQ had considered in developing the standard, "[t]he first one is rule versus policy." Transcript, p. 19, lines 11-17. Mr. DiRenzo advised the Board that, from the outset, DEQ had rejected making the standard a rule. As Mr. DiRenzo said:

- "Gary Beach, who was the administrator at that time, he put together a work group. I can't even remember. It was a rather large work group. It was pretty well represented from all facets of the community to take up that question, should we have numeric standards or stay with the narrative. . . . [T]he result of it all was a decision that it's probably best the numeric criteria -- well, **there was so many variables, we felt that an attempt to write numeric criteria to address agricultural protection across the state and all the circumstances that would be encountered, there would be many numeric criteria and there would be many exemptions, and there would be this -- this would apply in this circumstance and in this other circumstance another number would apply.** And in the end, we would have numeric criteria that really didn't work any differently than a narrative criteria that said, look, just the goal is to protect the use, and we would develop a policy that would explain what that means and how we would apply that concept in each circumstance." Transcript, p. 20, lines 22-25; p. 21, lines 1-20.

- "[T]here are some other considerations and . . . they all boil down to a concept of flexibility. And in defense of that previous decision to stay with a narrative criterion, the real thread that has run through all the comments from all sides of this issue is that one size doesn't fit all. **That whatever it is you do, how you do this, it has to be flexible, you have to be able to react, you have to be able to address all the many different situations that you're going to see and we believe that is better accomplished through a policy than a rule."** Transcript, p. 22, lines 3-14.

- "The policy -- we're sure we don't have all the answers. And as time goes on, we're going to learn more and more and we'll want to tweak, say, livestock limits or take a different approach here or there. As a policy, that can be done a little more efficiently than if it's hardwired into a rule where we have to go through this rulemaking process in order to make any change to it." Transcript, p. 22, lines 15-21.

- **"In this circumstance of ag protection, with all the variables, we think that it's -- it just -- it's better to be able to have that flexibility and to make those kind of decisions on more of a site-specific basis."** Transcript, p. 25, lines 3-6.

Not surprisingly, in light of these prior statements, the Advisory Board voted on February 5, 2007, not to recommend adoption of the policy as a "rule," and recommended that, prior to any

consideration by EQC of the policy as a rule, DEQ would need to hold a full public hearing on the substance of the standard and how it would operate as an inflexible rule.

This was the correct outcome, because, before the Section 20 implementation document could be considered for adoption as a rule, the Water Quality Division of DEQ must first consult with the Advisory Board and must seek public comment on the proposed rule. *See* W.S. § 35-11-302(a) ("The administrator, *after receiving public comment* and *after consultation with the advisory board*, shall recommend to the director rules, regulations, standards and permit systems to promote the purposes of this act.") (Emphasis added.) In this case, when the DEQ determined it wanted to change the agricultural use policy from a policy to a rule, it did so without public comment, and without first receiving the recommendation of the Advisory Board. In fact, DEQ published notice of its intent to convert the policy to a rule on December 22, 2006, and thus prejudged the issue before the Advisory Board had held even the truncated February 5 hearing.

DEQ's unilateral conversion of the Section 20 document to a rule short-circuited the rulemaking procedure required by the EQA. It is the Advisory Board's function to "recommend to the council through the administrator and director the adoption of rules, regulations and standards to implement and carry out the provisions and purposes of this act." W.S. § 35-11-114(b). "The advisory board *shall* consider all the facts and circumstances bearing upon the reasonableness of the pollution involved[,]" including certain specified factors, such as the technical practicability and economic reasonableness of reducing or eliminating the source of pollution. W.S. § 35-11-302(a)(vi). In order for the Advisory Board to meaningfully evaluate any proposed rule, the Board must solicit public comment on the substance of the proposed rule. Because the notice of the February 5 hearing instructed the public not to comment on the substance of the agricultural use protection document, the Advisory Board could not and did not

solicit comment on the substance of the proposed rule. In recommending rejection of the proposed rule, the Advisory Board recognized that, given the instruction to the public not to comment on the content of the policy as a rule, no meaningful opportunity to comment had yet been provided. It would be premature for the Council to adopt this "rule" where the Advisory Board has itself said that it has had no opportunity to consider the Section 20 implementation document as a rule.

**2. Appendix H Is Not Workable Even As A Policy and Needs Modifications.**

A number of substantive modifications would be necessary even if the Section 20 standard remains a "policy." However, the Council should not attempt to improvise modifications at the February 15-16, 2007 hearing, especially given that the Council must hear from interested parties and consider all oral and written comments before it makes any decision on the proposed rule.[1] These modifications would be properly the subject of additional hearings and, ideally, of a collaborative effort among all the stakeholders. Among these defects to be addressed are the following.

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[1] The Council's Rules of Practice and Procedure provide that "Before the adoption, issuance, amendment, or repeal of any rule, or the commencement of any hearing on such proposed rule-making, the Council shall cause notice to be given in accordance with the provisions of W.S. 9-4-103 [now 16-3-104]." Chapter III, Section 2(e). The referenced provision of the Administrative Procedure Act requires an agency to "[a]fford all interested persons reasonable opportunity to submit data, views or arguments, orally or in writing."

EQC's rules further require the Council to *consider* all comments, including written submissions: "All timely comments shall be considered by the Council before final action is taken on any proposal to promulgate, amend or repeal any rule." Ch. III, Section 6(a). In addition, under the Administrative Procedure Act, an agency must "consider fully all written and oral submissions respecting the proposed rule." Wyo. Stat. § 16-3-103(a)(ii)(B).

In light of these statutory requirements, it would seem that both proponents and opponents of proposed Appendix H would expect the Council to have demonstrably considered any written and oral submissions on the proposed Appendix H before deciding to reject it or to adopt it.

### A. The Definitions of "Irrigated Land" Are Overbroad and Ambiguous.

The agricultural use protection policy is overbroad with respect to its definitions of irrigated land that qualifies for protection. With respect to artificial irrigation, the document requires only that there be a "current irrigation structure or mechanism in place for diverting water from the stream channel." H-2, lines 7-8. The policy should protect only lawful use of irrigation water, conducted in accordance with a valid water right and with the rules and policies of the State Engineer. It would not be wise public policy to reward unauthorized irrigation at the expense of lawfully operating CBNG producers. The stated purpose of the policy is to "ensure that pre-existing crop production will not be diminished as a result of the lowering of water quality." This policy should apply to lawful irrigation only. The policy should not reward those who flout the water laws of the State through unlawful diversion.

With respect to "naturally irrigated lands," the policy's overarching intent is to protect irrigation water quality where there is "a substantial acreage of naturally sub-irrigated pasture within a stream floodplain." H-2, lines 9-10. However, the policy's more detailed discussion of coverage of "naturally irrigated lands" is highly ambiguous, referring first to areas along stream channels that have "enhanced vegetative production due to periodic natural flooding or sub-irrigation," but also to lands "on which the combination of stream flow and channel geometry provides for enhanced productivity of agriculturally significant plants." H-4, lines 1-5. Does "vegetative production" refer to growth of any plant, including noxious plants or those that supplant native vegetation, or only to plants that are in some unspecified way "productive"? How will DEQ determine whether plants that would receive discharged water are "agriculturally significant"? If a discharge will promote the growth of livestock forage plants that will supplant native plants, will the discharge be deemed to enhance or to decrease crop or livestock

production? The rule refers to "wetland mapping" as one method of determining naturally irrigated lands. Clearly, however, wetlands, while important for other reasons, do not necessarily provide "pasture" or forage for livestock.

Thus, while the rule may be aimed at the particular goal of protecting areas that comprise "a substantial acreage of naturally sub-irrigated pasture within a stream floodplain," the specific provisions that attempt to define naturally irrigated lands are not tailored to this objective. Instead, they speak in broad and ambiguous terms of "vegetative production" that, apparently, would include ungrazed bottomlands, ungrazable wetlands, and areas of native plants that are inferior as forage. Moreover, the plain meaning of the term "pasture" does not include vegetation within a stream channel; rather it appears clearly to mean grazed vegetation in the floodplain. Marathon is concerned that, because these terms are vague and contradictory, DEQ will tend to ignore them, and "natural irrigation" will be deemed to include any plants of any type – including insignificant, unwanted or unused ones -- that no one would consider "pasture" but which happen to receive water through sub-irrigation.

**B. Landowners Should Be A Primary Source of Information About Irrigated Lands and Irrigation Practices.**

Assuming that a coherent and consistent definition of natural irrigation could be developed, and artificial irrigation were properly limited, the policy would remain unworkable if the applicant for a WYPDES permit to discharge CBNG water is to have the burden of showing that the proposed discharge would *not* reach naturally or artificially irrigated lands. The proposed rule does not address access to downstream properties so that an applicant or DEQ can determine whether legal or illegal irrigation is occurring there and/or whether irrigated "pasture" of the requisite size exists there. The rule should require downstream landowners, upon receiving notice of a proposed discharge, to come forward with credible information

demonstrating that their lands qualify as artificially or naturally irrigated, properly construed. That is not too much to ask of landowners who wish to avail themselves of the protections of Section 20.

### C. Tier 1 Default Limits for EC and SAR Should Be Applied At the Location of Irrigation, Not as End-Of-Pipe Limits.

Marathon anticipates that others will provide expert testimony in this proceeding to explain why the Tier 1 default limits for EC and SAR should be retained in the policy at the numbers recommended by the Advisory Board. Those values, derived from research at Bridger Plant Materials Center on plant salinity tolerances and the effects of sodicity on soils in Montana, are more credible than the lower values advocated by DEQ. Marathon wishes to emphasize that, because these limits refer to EC and SAR levels that may have impacts on plants or soils, they should be applied at the location(s) where and when a proposed produced water discharge would be used for irrigation.

DEQ's apparent intent to apply the default Tier 1 limits for EC and SAR as end-of-pipe effluent limitations is unreasonably and arbitrarily conservative. Prediction of a discharge's impact on water quality in receiving water at the edge of a mixing zone is a routine part of setting effluent limits in a WYPDES permit. Predictive modeling should be no less capable of determining probable EC and SAR levels to which plants and soils would actually be exposed at the most upstream irrigation point for artificial withdrawals and at the most upstream point when flooding or migration outside a stream channel into artificially irrigated lands will occur. Such modeling would accurately account for dilution of EC and SAR in produced water by receiving waters under varying flow regimes, including the high-flow episodes when flow is sufficient for a stream to escape its channel and flood protected pasture lands. DEQ could appropriately

require monitoring the actual EC and SAR levels at the points of compliance to validate the predicted impacts of a given discharge.

### D. Tier 3 Procedures Should Make Clear That a No Harm Analysis Need Only Be Performed for Irrigated Lands to Which The Applicant Has Reasonable Access.

The procedures under which a permit applicant may seek alternative effluent limitations under a Tier 3 No Harm Analysis are extremely important and need to be carefully developed. Paradoxically, DEQ's description of Tier 3 is skeletal by comparison with other provisions of the policy, even though Tier 3 is likely to be the only route by which feasible permit limits can be established for many CBNG discharges.

In principle, Marathon agrees that, because of the site-specific nature of this approach, it may not be feasible for DEQ to specify a detailed protocol for no-harm analyses. However, Marathon strongly disagrees with the policy's inadequate "reasonable access requirement." DEQ recognizes that "in many applications," EC and SAR limits will have to be based on Tier 3 (or Tier 2) analyses because the Tier 1 default limits are unattainable. DEQ also appears to recognize that an applicant's ability to acquire data relevant to predicting impacts of the proposed discharged will require access to downstream properties where irrigation assertedly occurs. DEQ also appears to recognize that some landowners may simply deny access to their properties (perhaps to exert leverage to obtain compensation or other benefits). Yet, in that event, DEQ suggests the only sanction for such denial of access will be that Tier 3 limits for the permit will be based on "the best information that can reasonably be obtained." H-10, lines 20-27.

Section 20 is intended to prevent degradation of water quality to the extent that agricultural production from irrigated lands would be reduced. On its face, Section 20

contemplates a balancing of important interests. On the one hand, discharges of effluents are necessary for industrial, municipal and other economically valuable activities to occur. On the other hand, irrigation uses should be protected. This policy choice imposes reciprocal obligations both on industry and on agriculture. Where an irrigator is not prepared to provide information to confirm that his or her land is artificially or naturally irrigated (see above), or is unwilling to allow reasonable access to that land for purposes of assessing projected harm from a discharge and potential mitigation measures, then that irrigator should not be entitled to the benefits of Section 20. Certainly, that irrigator's recalcitrance should not impose additional burdens on the WYPDES applicant in the form of inability to make a no-harm showing, or more stringent effluent limits than would have been necessary if complete data about, e.g., the irrigated soils had been forthcoming. The just and reasonable result in that situation is that, if an irrigator wishes to ignore the reciprocal nature of Section 20 – as should be that individual's right -- then Section 20 should ignore that irrigator. In other words, the agricultural use protection policy must clearly state that a landowner's election not to provide reasonable access to its property for purposes of acquiring data reasonably necessary under Tier 3 will relieve the permit applicant from any requirements under Section 20 with regard to that property.

## Conclusion

For the foregoing reasons, Marathon respectfully requests that the EQC reject the proposed Appendix H for adoption as a rule or as a policy. Until December 22, 2006, Appendix H was a proposed policy, and DEQ consistently resisted converting it to a rule because to do so would make the policy's requirements too inflexible. The Water and Waste Advisory Board declined thereafter to recommend that this Council adopt the proposed rule unless the Advisory

Board were able to conduct the notice-and-comment procedure that is required in order for the Board and DEQ to carry out their duties under the EQA.

Nor should the Council consider approving Appendix H as a policy. The document has too many crucial ambiguities, as explained above, and it would be exceedingly difficult for the Council to make the necessary revisions. Appendix H should be rejected in both guises and DEQ should convene a collaborative working group of all interested stakeholders for the purpose of expeditiously developing a consensus policy that will enable DEQ to implement Section 20 efficiently and effectively.

Dated this 15th day of February, 2007.

Respectfully submitted,

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COUNSEL FOR MARATHON OIL COMPANY

February 13, 2007

Wyoming Environmental Quality Council
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Attention: Terri A. Lorenzon, Director

FILED

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Terri A. Lorenzon, Director
Environmental Quality Council

Re: Wyoming Water Quality Rules Docket No. 06-3819,
Surface Water Quality, Chapter 1, Appendix H

Thank you for the opportunity to provide comments to the Wyoming Environmental Quality Council regarding Wyoming Water Quality Rules, Chapter 1, Appendix H (the Agricultural Use Protection Rule) in accordance with the Notice of Intent to Adopt Rules and Regulations published by the DEQ in December, 2006. I am providing comments on behalf of Marathon Oil Company.

I have a Ph.D. in soil science from Montana State University and have worked in the field of environmental sciences and water quality protection for more than 30 years. At the beginning of my career, I worked with the Montana Cooperative Extension Service as a State Soil Scientist where one of my responsibilities was saline and sodic soil diagnosis and improvement and irrigation water quality. For the last 21 years I have worked as an environmental consultant. My resume is attached.



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**Appendix H, section (e)(i)**

Determination of EC and SAR limits is described in this section. A complex three-tiered methodology is outlined for identifying the site specific factors that together determine the permissible EC and SAR levels in produced water that will prevent impairment of crop yields. The introduction to Appendix H describes the complex interaction of site-specific factors that must be considered in assessing the suitability of produced water for direct discharge. Critical factors include the type of crops or forages grown, the irrigation management, other agronomic factors that can influence yield potential (e.g. fertilization, pest control), background water quality, soil texture, soil clay mineralogy, soil chemistry, and regional climate. Because of the site specific nature of these determinations, the Department procedures used to assess the suitability of produced water is likely to evolve rapidly through time. As a result, I believe the Agricultural Use Protection provisions are better administered as a policy, which naturally affords more flexibility, than as a rule, as proposed here.

**Appendix H, section (e)(i)(A & B)**

i. Tier I -Default EC and SAR limits. Default limits for EC and SAR may be used where the quality of the discharge water is relatively good or the irrigated crops are salt-tolerant. The default values shall be based upon the published soil EC tolerance values for the most sensitive crop and shall be calculated as follows:

A. Default EC limits will be based upon 100 percent yield threshold values for soil EC reported by the NRCS Bridger Plant Materials Center 1996 Technical Notes No. 26[1]. In the event that the species of interest is not included in the Bridger Plant Materials Center document, then the following alternative references can be consulted:

I. Hanson et al. 1999. Agricultural Salinity and Drainage. DANR Pub. 3375. Univ. of Calif. Davis;

II. Ayers and Westcot. 1985. Water Quality for Agriculture. UN FAO Irrigation and Drainage Paper 29 (revised); and

III. CPHA. 2002. Western Fertilizer Handbook. 9th Edition. Interstate Pub., Inc., Danville, IL.

B. The relationship between soil EC values and irrigation water EC values will be: EC (soil) = 1.5 EC (water), i.e., the published soil EC threshold obtained from the appropriate reference will be divided by the soil concentration factor of 1.5 to establish the discharge EC limit.

[1] The Water and Waste Advisory Board recommended using the Bridger Plant Materials Center document as the primary reference for soil salinity tolerance values based upon comments submitted by Kevin Harvey, an industry consultant. The DEQ/WQD disagrees with this recommendation and maintains that the Salt Tolerance Database published by the USDA Agricultural Research Service (ARS) National Salinity Laboratory is a more appropriate reference for this purpose.

The choice of which scientific reference or references to utilize for the determination of default EC is a critical issue that has the potential to determine whether most future discharges require Tier 1 analysis or the more detailed Tier 2 or 3 analysis. It is inappropriate for the Department to censure specific data sources by rule. This is especially egregious since no rationale was given for why the use of data from the USDA NRCS Bridger Plant Materials Center in south central Montana was less appropriate than data published by the ARS Salinity Lab located in Riverside, California.

If recommended references are provided by the Department, they should be contained in a footnote, or more appropriately in a guidance document rather than contained in the rule. Presumably, if relevant scientific data are collected in the future, the Department will also consider them. If so, this statement should be added to any citation of specific reference materials. Another alternative would be to replace this discussion of appropriate scientific references with an Agency guidance document that contains the default EC limits for common Wyoming crops and forages, which would be incorporated by reference.

The dilemma faced by the Department is that many of the references concerning salt tolerance are internally inconsistent. For example, the threshold soil ECe at which yield reduction occurs is listed as 2,000 uS/cm by ARS Salinity Lab references and as 4,000 uS/cm by the Bridger Plant Materials Center. Rather than rejecting one source of information as "wrong", a more credible and scientific approach is to embrace both data sets and try to determine why they provide different results. A few plausible reasons for the discrepancies were provided by Kevin Harvey in his written comments. Namely, when sulfate salts are predominant, the higher EC threshold applies, whereas 2,000 uS/cm is appropriate where chloride salts prevail. So which limits should be used if bicarbonate salts are dominant as in produced water from CBNG operations? Bicarbonate is more similar to sulfate in that it tends to be removed from solution as the soil dries (or may actually be removed from solution through off-gassing). Therefore, the 4,000 uS/cm limit is more appropriate for protection of alfalfa in the Powder River basin.

**Appendix H, section (e)(i)(C)**

C. Default SAR values will be extrapolated from the Hanson et al. (1999) Chart *(see Figure 1 attached)* based upon the default EC value in each circumstance up to a maximum default value of 16[2]. The effluent limit for SAR will be determined in conjunction with EC so that the relationship of SAR to EC remains within the "no reduction in rate of infiltration" zone of Figure 1. The maximum SAR limit is, therefore, set below the line separating the "no reduction in rate of infiltration" zone from the "slight to moderate reduction in infiltration" zone in the Hanson et al. diagram, which is represented by the following equation: $SAR < (7.10 \times EC) - 2.48$. It must be noted that SAR values are tied to the EC concentration and might need to be adjusted to correlate to the actual EC concentration rather than the theoretical maximum.

Use of the Hanson diagram to extrapolate default effluent limits for SAR is capped at a maximum SAR of 16[2] to minimize the potential for sodium build-up in poorly drained soils. This 16 SAR cap is only intended to apply when utilizing the default procedure and may be modified according to the provisions of section C.2 "Refining EC and SAR Limits", described below.

[2] The DEQ/WQD originally proposed setting a default SAR cap at 10. The Water and Waste Advisory Board raised the default SAR cap to 16 based upon industry comments. The DEQ disagrees with the Board's recommendation and believes that an SAR cap of 10 is more defensible as a statewide default.

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A sliding scale is proposed for the SAR limit, which would have a maximum cap at 16 (or 10 if you use the DEQ's recommendation contained in footnote 2). The use of SAR measurements to assess the suitability of irrigation water evolved as a means of predicting the exchangeable sodium percentage (ESP) that would develop in soil after several seasons of irrigation. Therefore, the soil ESP level is the factor that is most strongly correlated with soil permeability. The critical threshold ESP is usually understood to occur at 15 %. In soils with lower ESP levels, soil aggregates tend to be preserved and permeability remains high. Dispersion in soils with higher ESP levels may reduce permeability. Dispersion is favored in low EC waters and in expanding type clay soils. The correlation between SAR and ESP varies regionally, but generally the ESP can be approximated as SAR x 1.16 (at an SAR of 13) based on research published by the ARS Salinity Laboratory. Therefore, the critical ESP of 15 would correspond to an SAR of 13. Kevin Harvey developed a basin-specific correlation of SAR and ESP that suggests a SAR of 26 corresponds to an ESP of 15 % for the Powder River basin. The higher SAR level found in Powder River basin soils at a given ESP level may occur because of the more pervasive presence of calcium and magnesium salts found in Powder River basin soils. Dr. George Vance and Girisha Ganjegunte recently published results of a

Wyoming study showing that the traditional ESP-SAR equation tends to over-predict the ESP[1] in the Powder River basin.

For the above reasons, I feel the Hanson equation should apply up to a SAR cap of 16 or higher. The maximum SAR limit of 10 is inappropriately conservative for areas with naturally high EC surface waters such as the Powder River basin.

Additionally, the Hanson chart should not be used to extrapolate to very low SAR values if the ambient EC of surface water is below 800 to 1,000 uS/cm. The lowest applicable default SAR should be 3. At lower levels of salinity (e.g. below about 300 to 500 uS/cm), soils may disperse even at a SAR of 0. The low salt content rather than the excess sodium causes dispersion in these cases. There is no evidence in the literature of adverse effects of excess sodium when the SAR is at or below 3 to 5. As a final point of clarification, I agree with DEQ's caution that the actual EC rather than the default EC value (determined from crop tolerance data to protect crop yields) should be used to determine SAR using the Hanson chart. However, owing to the chronic nature of sodium effects, the long-term average ambient EC rather than an instantaneous ambient EC should be used to determine the default SAR.

**Appendix H – Section (e)(ii)(A)**

The Tier II determination allows the applicant to use background levels of EC and SAR instead of the default limits described in the Tier 1 analysis. Background water quality can either be measured, if data are available, or predicted using site-specific studies (Appendix H – Section (e)(ii)(A)(II)). The Tier II rule appears to suggest that detailed characterization of irrigated soils provides the only suitable means of estimating background water quality. The data requirements for soil studies are described in detail. I have two concerns with this rule. First, the rule appears to foreclose other means of establishing background water quality (like for example using synoptic surface water sampling on a mainstem to assess flow and load contributions from a watershed). Therefore, the Tier II rule should provide added procedural flexibility (another reason why this protocol would be better adopted and administered as a policy rather than a rule). Additionally, the methods used to interpret the soils data are not provided. Calculating background irrigation water quality from soil extract salinity is not straightforward, and requires multiple assumptions. As such, a single soils data set will not necessarily yield a unique determination of background water quality. Consequently, the Department's attempt to standardize the determination of the suitability of produced water has failed because a wide variety of techniques will likely be employed to derive background water quality. Again, owing to the complexity of Tier II and Tier III determinations, I believe that the Agricultural Use Policy is better managed as a policy than a rule.

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[1] Ganjegunte, G.K.; and G.F. Vance. 2006. Deviations From The Empirical Sodium Adsorption Ratio (Sar) And Exchangeable Sodium Percentage (Esp) Relationship. Soil Science. 171(5):364-373, May 2006.

# Resume

## Dr. William M. Schafer

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## Position Description

**Current Position:** 2001 to Present

Dr. Schafer formed Schafer Limited LLC in 2001 to work as an independent consultant in environmental consulting, expert testimony and forensic evaluations, and mediation of environmental disputes.

**Shepherd Miller Inc:** 1999 and 2000

Schafer & Associates merged their professional staff in Bozeman, Montana and Golden, Colorado with Shepherd Miller Inc in July 1999. Dr. Schafer served as Vice President of the Earth Sciences business unit for Shepherd Miller from August 1999 until December, 2000.

**Schafer & Associates:** 1985 to 1999

Founded by Dr. Schafer in 1985, Schafer & Associates provided environmental, engineering, and ecological services to a variety of Federal, State and private clients in mining and other industries. With a staff of 40 professionals, Schafer & Associates maintained offices in Montana, Colorado, and Arizona.

**Montana State University:** 1976 to 1985

Dr. Schafer was a research soil scientist specializing in land reclamation research on coal-mined lands in the Northern Great Plains from 1976 to 1980. From 1980 to 1985, he was a state soil scientist with the Montana Agricultural Experiment Station and the Extension Service. He provided expertise to Montana agriculture in the areas of irrigation water quality, improvement of saline and sodic soils, and soil fertility.

## Professional Experience

**Mining Services:** Dr. Schafer served as project manager or technical director for over 200 projects involving the environmental aspects of mining. His projects have included prediction, prevention, and control of acid rock drainage (ARD); mine closure including reclamation of waste rock, tailings, and spent ore piles; decommissioning of leach pads; prediction of pit lake chemistry; baseline studies in support of permit applications; and groundwater and vadose zone monitoring programs. He has extensive regulatory experience in the western US including Nevada, Montana, South Dakota, Colorado, New Mexico, Idaho, Utah, Washington and Arizona.

**Petroleum Development – Coalbed Natural Gas (CBNG):** Dr. Schafer worked closely with the Montana Coalbed Natural Gas Alliance during development of numeric water quality standards for electrical conductivity (EC) and sodium adsorption ratio (SAR) by the Montana Department of Environmental Quality. He has helped develop permits for discharge of CBNG production water, and helped evaluate other water management alternatives. Additionally, Dr. Schafer has served as an expert witness in litigation regarding alleged soil and water impacts associated with CBNG water.

**Expert Testimony:** Dr. Schafer served as an expert witness for several cases involving the Clean Water Act (especially Citizen's Suits) and environmental effects of mining; coalbed natural gas development, confined animal feeding operations, and alleged contamination of surface water or groundwater with acid rock drainage, metals, salinity, nutrients and organic compounds. He also provided expert reports, sworn testimony, and depositions in various administrative hearings in addition to litigation support.

**Services to State and Federal Clients:** Dr. Schafer has worked for numerous State and Federal agencies including the US Forest Service, Bureau of Land Management, Fish and Wildlife Service and Bureau of Mines. He has also contracted with State natural resource agencies in Montana, South Dakota, Arizona, Washington, Idaho, and other States.

**Solid and Hazardous Waste:** Managed or directed numerous CERCLA (Superfund) investigations including RI/FS (remedial investigation and feasibility study) activities at several mining sites. He developed and implemented numerous work plans and planning documents to support site characterization, treatability studies, and risk assessments and was responsible for development and evaluation of the performance of in-situ remediation techniques for inorganic mine waste at CERCLA sites. Dr. Schafer conducted fate and transport analyses of contaminant migration from a variety of sources. These analyses required numerous field investigations that employed a variety of field screening techniques including soil gas surveys and X-ray fluorescence determination of soil lead, arsenic, copper, zinc, and chromium levels.

**Soil Investigations:** Conducted a number of soil survey investigations in support of mine permitting and planning, major facility siting, irrigation development, basin-wide erosion prediction and control, and salinity control. Numerous small-scale soil investigations have been performed for on-site waste treatment system siting and design; for land application/ treatment of liquid and solid wastes; litigation support for industrial damage claims; and in support of archaeological investigations.

**Project Management:** Successfully managed over 300 projects in the environmental sciences concerning hazardous waste (under CERCLA, SARA, and RCRA); solid waste landfills; disturbed land reclamation; baseline studies for mine and facility permitting (NEPA); reclamation of abandoned mines (SMCRA); surface water, groundwater and vadose zone monitoring; soil investigations; contract R&D; delivery of educational short-courses; and services in support of litigation.

**Professional Education and Instruction:** While on faculty at Montana State University, Dr. Schafer's responsibilities included instruction of students and adults through on-campus teaching, and extension. Additionally, he has developed and delivered a number of professional short courses on mine closure, acid rock drainage prediction and control, vadose zone monitoring, cyanide heap leaching, underground storage system installer certification, groundwater impacts of petroleum exploration,

control of dryland salinity, fertilization of small grains and forages, and salinity and sodium control under irrigation.

## EDUCATION

**Montana State University** *1976 to 1979*
Bozeman, Montana
PH.D. IN SOIL SCIENCE

Dissertation Topic: Completed an evaluation of the land capability of soils on reclaimed surface coal-mined areas throughout the Northern Great Plains.

**University of California at Davis** *1974 to 1975*
Davis, California
M.S. IN SOIL SCIENCE

Thesis Topic: Developed a technique to measure the shrink-swell potential of soils in the Central Valley of California, and to predict the hazard for construction.

**Colorado State University** *1971 to 1974*
Fort Collins, Colorado
B.S. IN WATERSHED SCIENCE

### CONTINUING EDUCATION

- Mediation of Pubic Policy Disputes: 24-hour short course taught by CDR Associates in Boulder, Colorado.
- Introduction to Mediation 40-hour short course taught by CDR Associates.
- Clean Water Act and NPDES Permits 24 hour short course involving all aspects of water permits
- Groundwater Modeling 40 hour course in groundwater modeling taught by Dr. Robert Cleary and faculty from Princeton University

## ORGANIZATIONS

Professional improvement maintained through active involvement in professional societies (ASTM, Society of Mining Engineers, and Soil Science Society of America). More than 100 articles, papers, short courses and book chapters have been authored in professional publications, and in symposia proceedings

## PUBLICATIONS

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February 14, 2007

Wyoming Department of Environmental Quality
Water Quality Division – Attention Bill DiRienzo
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122 West 25th Street
Cheyenne, Wyoming 82002
Fax – 307-777-5973



Mr. Gordon and Mr. Direinzo ;

Please accept this letter as written comment on Chapter 1, Section 20 and Ag Use Protection rulemaking currently being proposed by WYDEQ and considered by the EQC. Thank you for the opportunity to provide comment and for your time spent in consideration of the comments.

I am employed as a regulatory professional by Yates Petroleum and work daily with project planning and produced water management issues. I would like to focus my comments on "on the ground" problems with the policy/rule – of which there are many.

1. The established "default limits" for SAR and EC that are being used in the policy and proposed for rulemaking are not appropriate for the drainages in which they have been applied for a number of reasons.

a. WYDEQ has large volumes of data showing ambient water quality in these ephemeral drainages, in addition to monitoring that USGS has done on various drainages. Due to the highly soluble nature of soils materials in the Powder River Basin, it is not uncommon for these drainages to have water running in them (during rain events) that has EC levels of 3000 to 8000 umhos/cm. This is the ambient water quality that exists and it is the water quality that has been used for either passive or active irrigation. CBM discharge (or any other discharge) should not be held responsible to provide higher quality water than ambient, though the policy/rule asks for discharge water to do just that. Further, it asks that of discharge water to be held in reservoirs that will only overtop during storm events.

b. The Bridger Plant Materials data (suggested for use by the Water and Waste Advisory Board) is better suited for use in Wyoming for determining default limits for EC than the information being used from California. Soils, elevation and plant hybrids used at Bridger are a better match. WYDEQ attempts to protect crops such as alfalfa at a level that there would be no reduction of yield. It is important to understand that at our elevation and with our soils that alfalfa does not likely ever yield 100% of its capability and therefore exhibits reduced yields from the theoretical under ambient conditions.

c. No opportunity is provided for within the policy / rule for a landowner that wants CBM water higher in EC or SAR than the default limits to be discharged into a reservoir that will not contain the 50 year

/ 24 hour event. Further, this landowner is prevented from having CBM discharge flow down onto his lands if there are identified naturally irrigation areas identified.

2. Water storage / containment is a valuable water management resource that this policy / rule is going to make ineffective or not practicable at wholesale levels.

a. DEQ is requiring containment of the 50 year / 24 hour event in addition to all produced water in order to get limits that are relaxed from the default limits. Many reservoir locations will not contain the 50 year event with no CBM water. This eliminates these sites all together for beneficial use of CBM produced water.

b. Sites (such as off channel Pits) that can contain the 50 year / 24 hour event in addition to all produced water have lower beneficial use values to ranches. While a tool that can be used in specific locations, they are rarely suggested by ranchers.

c. Effluent limits (default) are being set that most CBM water cannot meet for reservoirs that do not meet the 50 year containment requirement. This has the effect of taking away current Ag Use. Ranchers are interested in constructing reservoirs that can catch some runoff and use that water during times when no CBM water may be available to be put in the reservoir.

3. "Ag Use Protection" is a misnomer for Appendix H. This policy as it is currently being enacted, and the rule as it is proposed will clearly eliminate more Ag use than it could possibly protect. There are hundreds of outfalls that have been permitted and constructed where water is being used currently that will be put out of business as a result of regulatory changes. This policy as it exists now and the rule should it be promulgated should be more properly entitled the "Ag Use Prevention Policy" as that it more likely the result it will obtain.

4. EQC, should it further consider rulemaking, should conduct meetings physically located in Gillette, which would be the epicenter of the damage to Ag use of this policy/rulemaking. Ranchers there are anxious there to tell the story of the losses of Ag Use that they would suffer.

5. EQC and DEQ are required to consider economic impacts of decisions they make, not making them in a vacuum. EQC / DEQ should be required to do an assessment of the financial impacts to the ranchers for removing their current use of CBM produced waters.

Thank you for the opportunity to comment;

Tim Barber
1208 Willowbrook Lane
Gillette, WY 82718

KC HARVEY, INC.
SOIL AND WATER RESOURCE CONSULTANTS



February 15, 2007

Wyoming Environmental Quality Council
122 West 25th Street
Herschler Building, Room 1714
Cheyenne, Wyoming 82002

Subject: Written testimony pertaining to the proposed revisions to the Chapter 1 Water Quality Rules and Regulations – Section 20 Agricultural Use Protection Policy.

Dear Council Members:

I respectfully submit for your consideration the following comments regarding the draft Section 20 Agricultural Use Protection Policy as it pertains to the derivation of default effluent limits for electrical conductivity (EC) and sodium adsorption ratio (SAR) and the proposal to make it part of the Chapter 1 rules and regulations. On May 4, 2006, I submitted two letters to Mr. Bill DiRienzo of the Wyoming Department of Environmental Quality regarding the derivation of EC and SAR limits, respectively. I have attached them to this summary letter in the event you have not received them as part of the administrative record on this matter.

By way of introduction, I am a board-certified professional soil scientist having practiced as an environmental consultant in Montana and Wyoming, and throughout the world, for over 25 years. I have an M.S. degree in Land Rehabilitation (soil science emphasis) from Montana State University, and a B.S. in Resource Conservation (soil science emphasis) from the University of Montana. I am currently President of KC Harvey, Inc., a Wyoming corporation with nearly 20 employees specializing in the difficult problems associated with soil and water chemistry, water management and land reclamation. For the past eight years, my practice has focused on water management and soil and water salinity/sodicity issues associated with oil and gas development. I am credited as the first to research, develop, and apply managed irrigation techniques for the beneficial use of coalbed natural gas produced water in Wyoming. I have directed or participated in over 100 separate projects related to produced water management, WYPDES permitting, soil and water chemistry investigations, and reclamation for coalbed and conventional natural gas projects in Wyoming, Colorado, and Montana. Four years ago, I convinced the leading coalbed natural gas producer in Montana to fund an unprecedented soil, water and crop monitoring and landowner assistance program for the entire Tongue River drainage. I am an applied scientist; I use science, and the truth it yields, to prevent and solve problems, and alleviate fear.

I was invited by Mr. Bill DiRienzo of the WDEQ Water Quality Division to participate and contribute to the development of the Agricultural Use Protection policy over two years ago. Since then I have participated in committee meetings, draft review, public comment, and several hearings by the Water and Waste Advisory Board and others. My comments in this letter

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summarize my findings presented in the attached letters and to summarize what I have learned since submitting them last May.

I strongly urge you, and for you to urge your colleagues on the Council, to please read the attached letters that I submitted last May. I have been told that they are the most comprehensive science based comments to be submitted regarding the Agricultural Use Protection Policy. I spent over three months researching many dozens of research articles and other written material from the world-wide scientific literature. I interviewed leading scientists in the field. I compiled and analyzed actual soil, water and plant data collected by me and others in Wyoming to gain insight into the regional specific relationships between salinity, sodicity, soils, climate, crop production, hydrology, etc.

**General Comments**

Northeastern Wyoming is essentially a desert, or at most a semi-arid environment. This area is experiencing the worst long-term drought on record. Coalbed natural gas produced water is unaltered groundwater. It is not terribly salty; rather it is naturally enriched in sodium and low in calcium making it "soft." Similar and worse quality water is put to use around the world and in Wyoming to grow food for people and forage for livestock as well as livestock watering. We should view the availability of this water as a resource that has many opportunities for use and is, in fact, being used beneficially by many landowners in Wyoming. Somewhere along the line we allowed fear, not science, to dictate policy and management of this water. We should not be so afraid of this water. Because the interaction between soil and all water is complex, regulating discharges of produced water should be based on well-reasoned and scientifically supported information and not on a "one-size fits all" mentality. We should respect it and put it to beneficial use through flexible policies that recognize the complex interactions of soil and water through science- and risk-based mitigation, monitoring and, if necessary, remediation programs. Yes, it is a technical and complex set of issues; therefore, it is the obligation of us all to learn as much about them as possible before we regulate them.

While soil and water interactions are complex, we can make predictions regarding the outcome of these interactions based on the available information. Predictions regarding the potential impacts associated with soil and water salinity/sodicity and the potential for a measurable decrease in forage and livestock production can be separate; i.e., just because there is an incremental increase in soil salinity and/or sodicity, there will not necessarily be a measurable decrease in agricultural production. In addition, any potential decrease in forage production brought on by the presence of water in a watershed must be weighed against the potential increase in livestock production due to the availability of the same water for stock watering. This relationship has been left out of the WYPDES permitting and Section 20 evaluation process. Often, there are positive impacts to be considered.

**Comments Regarding the Derivation of Effluent Limits for EC**

The Water Quality Division has historically taken the position that the default effluent limits for EC should be based on the USDA Agricultural Research Service (ARS) Salt Tolerance Database (USDA ARS, 2006). The ARS Salt Tolerance Database relies on California-based salinity

thresholds developed to approximate the specific plant, soil and environmental variables associated with that region. Regional differences in soil chemistry, climate and agricultural practices have a profound influence on the effects of salinity on soil. Therefore, the applicability of California-based salinity threshold data to crops is questionable, at best, when attempting to apply them to crops growing in Wyoming. The extreme climate, lack of soil development, lack of moisture, lack of soil nutrients, high altitude and cropping practices, among other things, in Wyoming will limit a plant's ability to reach its 100 percent physiological yield potential before an incremental increase in soil salinity will. I confirmed this simple principle with leading soil and crop scientists from California. These are the same experts relied upon by the Water Quality Division and invited to Wyoming by Director Corra.

Because it focuses on soils more typical of Wyoming soils, I urge the Council to maintain the use of the USDA Bridger Plant Materials Center guidelines for plant salinity thresholds. These guidelines were developed by the USDA for use in Montana and Wyoming. They correspond to similar guidelines coming from Alberta and Saskatchewan, which are very similar with respect to climate, soils, etc. to that of northeastern Wyoming. These guidelines are confirmed every day in Wyoming where forage yields for plants such as alfalfa do not vary due to variations in soil salinity.

As an example of the difference between California soils versus Wyoming soils, I reviewed literature and evidence concerning the effects of salinity on alfalfa (considered the most salt sensitive plant irrigated in northeastern Wyoming). The California database lists alfalfa as having a 100 percent yield threshold due to soil EC of 2 dS/m (in other words, in California, if the average soil EC increases above 2 dS/m, then alfalfa yield will theoretically decrease). Sources of research and field guidance outside of California suggest alfalfa has a higher relative 100 percent yield threshold for soil EC, perhaps as high as 4 to 8 dS/m. In Wyoming, identical yields for alfalfa were reported in fields with soil EC values ranging from 1.8 dS/m to as high as 6.5 dS/m (see the attached letter to Bill DiRienzo regarding EC limits). In other words, under Wyoming conditions, I have reviewed publicly available data which demonstrate that no measurable decrease in alfalfa production occurred with soil salinities of up to 6.5 dS/m. In addition, I have reviewed data available to the public that demonstrates alfalfa yields from California and Wyoming were independent of soil salinity (i.e., the yield did not correlate with soil salinity). These findings demonstrate that the impact of the other Wyoming factors on crop and forage production (extreme climate, lack of soil development, lack of moisture, lack of soil nutrients, high altitude, and cropping practices), reduce the utility of the California database for Wyoming conditions.

**Comments Regarding the Derivation of Effluent Limits for SAR**

Plant growth problems associated with excess sodium adsorption are in response to negative changes in soil structure resulting in reduced air exchange, water infiltration and hydraulic conductivity. Excess sodium adsorption by the clay minerals in soils can lead to dispersion of soil particles, plugging of soil pores and sealing of the soil. SAR is a measure of the sodicity risk in irrigation water. The higher the salinity of irrigation water, the higher the SAR can be without impacting soil structure and impairing soil infiltration and permeability. Excess sodium adsorption is caused by the long-term application of water with a high SAR. The universally

applied sodic soil threshold is an exchangeable sodium percentage (ESP) greater than 15. This definition does not mean that degradation of soil structure will occur in all soils once the ESP exceeds 15. This phenomenon is dependent on a multitude of physical and chemical variables.

I agree that a cap on the Tier 1 default SAR limit should be established. In an effort to obtain the most credible data, rather than rely on SAR water quality thresholds based on dated information from another region with soils that are not representative of Wyoming soils, I looked at actual soil data from the Powder River Basin of Wyoming. This region-specific analysis is based on 382 soil samples. Based on the statistical relationship between ESP and SAR in the 382 soil samples, an SAR effluent limit of 16 would correspond to an ESP of 10 in the soil. On average, this would provide a 33% margin of safety against the formation of sodic soil conditions (i.e., that the SAR of the water would cause the ESP of the soil to exceed 15% leading to soil structure degradation and soil sealing). I would expect this relationship to be relatively the same throughout Wyoming based on field experience.

The Agricultural Use Protection Policy recommended by the Water and Waste Advisory Board (Board) sets forth default limits for SAR that are extrapolated from the Hanson et al. (1999) chart relating the established EC effluent limit to SAR, up to a maximum of 16. The Board's determination that the appropriate cap for SAR is 16 (and not 10, as argued by the WQD) is based on the fact that scientific research and evidence indicates that a higher cap is appropriate in Wyoming due to the difference in Wyoming soils versus California soils. The effluent limit for SAR will be determined in conjunction with EC so that the relationship of SAR to EC remains within the "no reduction in rate of infiltration" zone of the Hanson et al. (1999) diagram.

Based on the available science and when soil characteristics typically found in Wyoming are taken into account, if Appendix H is to be adopted, the Tier 1 default effluent limitation for SAR should be capped at 16, not 10 as recommended by the Water Quality Division. This corresponds to an EC effluent limitation of 2.7 dS/m based on the widely-accepted Hansen diagram. Interestingly, based on the USDA Bridger Plant Materials Center guidelines, an EC of 2.7 dS/m is also the proposed EC limit when protection of alfalfa is the goal.

* * * * *

Thank you very much for your time and consideration of these comments. If I can be of service to the EQC in any way, or if you have any questions, please do not hesitate to contact me.

Sincerely,

Kevin C. Harvey, M.Sc., CPSSc.

Principal Soil Scientist

Copy

KC HARVEY, LLC
SOIL AND WATER RESOURCE CONSULTANTS

May 4, 2006

Mr. Bill DiRienzo
Wyoming Department of Environmental Quality
Water Quality Division
Herschler Building, 4th Floor West
122 West 25th Street
Cheyenne, Wyoming 82002

Subject: Comments pertaining to the derivation of default effluent limits for EC in the Draft Section 20 Agricultural Use Protection Policy.

Dear Mr. DiRienzo:

I respectfully submit for your consideration the following comments regarding the fourth draft of the Section 20 Agricultural Use Protection Policy as it pertains to the derivation of default effluent limits for electrical conductivity (EC). These comments are being submitted on behalf of Yates Petroleum Company, Williams Production RMT Company, Petro-Canada Resources (USA) Inc., Marathon Oil Company, Lance Oil & Gas Company, Inc., Fidelity Exploration & Production Company, Devon Energy Production Company L.P., Bill Barrett Corporation, and Anadarko Petroleum Corporation. I have submitted additional comments regarding the derivation of sodium adsorption ratio (SAR) limits and the proposed SAR cap to you in a separate letter.

By way of introduction, I am a board-certified professional soil scientist having practiced as an environmental consultant in Montana and Wyoming, and throughout the world, for nearly 25 years. For the past seven years, my practice has focused on water management and soil and water salinity/sodicity issues associated with oil and gas development. I am credited as the first to research, develop, and apply managed irrigation techniques for the beneficial use of coalbed natural gas produced water. I have directed or participated in over 100 separate projects related to produced water management, WPDES permitting, soil and water chemistry investigations, and reclamation for coalbed and conventional natural gas projects in Wyoming, Colorado, and Montana. I have a M.S. degree in land rehabilitation (soil science emphasis) from Montana State University, and a B.S. in Resource Conservation (soil science emphasis) from the University of Montana.

I would like to comment on the proposed changes made to the Agricultural Use Protection Policy by the WDEQ subsequent to the January 26, 2006 meeting of the Water and Waste Advisory Board. My comments will focus on the comments provided by Dr. Larry Munn in his letter to the DEQ dated December 5, 2005. It is my understanding that Dr. Munn's comments resulted in the changes made to the proposed Policy. Specifically, I comment on Dr. Munn's request that

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the California-based soil salinity tolerance thresholds be used to establish default effluent limits for electrical conductivity (EC) under the Tier 1 process.

**Summary of Findings**

The fourth draft of the Agricultural Use Protection Policy describes a 3-tiered decision making process for deriving appropriate effluent limits for EC and SAR whenever a proposed discharge may reach irrigated lands. The Tier 1 process would be followed for deriving "default" limits, and as such, this procedure would require a minimum of background information from the applicant. Specifically, the default EC limits would be based on the species-specific 100 percent yield potential values for soil EC reported by the USDA Agricultural Research Service (ARS) Salt Tolerance Database (USDA ARS, 2006).

Alfalfa is considered to be the most salt sensitive plant irrigated in northeastern Wyoming. Given this, my comments focus on the relevant information regarding alfalfa salinity tolerance. The ramifications of the concepts and data discussed herein for alfalfa can be applied to the more tolerant irrigated forage species commonly found in northeastern Wyoming, for example, western wheatgrass and smooth brome.

A considerable amount of research went into preparing these comments, including three months searching and reviewing the relevant scientific literature, and compiling and analyzing available and relevant soil, plant, and water data. The key conclusions of the literature review and data analysis are presented below and will be substantiated by the discussion that follows.

<u>California Based Salinity Thresholds</u>

- The ARS Salt tolerance database relies on California based salinity thresholds developed to approximate the specific plant, soil and environmental variables associated with that region.

- Regional differences in soil chemistry, climate and agricultural practices are likely to have a profound effect on the applicability of California based salinity threshold data to alfalfa growing in Wyoming.

<u>Chloridic Versus Sulfatic Soils</u>

- The natural soil salinity in the Powder River Basin is dominated by the sulfate ion; California soils are dominated by chloride. This conclusion is supported herein by the literature and by an evaluation of actual soil chemistry data provided by the USDA National Soil Survey Center.

- The term "gypsiferous" refers to sulfatic soils and is applicable to the Powder River Basin of Wyoming. Numerous documents, including the ARS Salt Tolerance Database, indicate that in sulfatic (or "gypsiferous") soils, plants will tolerate about 2 dS/m higher salinity than indicated.

The Influence of Soil Salinity on Alfalfa Yield

- Alfalfa is considered the most salt sensitive plant irrigated in northeastern Wyoming. Conditions required for the growth of alfalfa at 100 percent of its physiological yield potential probably do not exist anywhere in northeastern Wyoming and place doubt on the application of this benchmark value there.

- Sources of research and field guidance outside of California suggest alfalfa has a higher relative 100 percent yield soil EC tolerance than 2 dS/m, perhaps as high as 4 to 8 dS/m.

- Alfalfa yield comparisons between California and Wyoming show actual harvest values independent of soil salinity. Identical yields were reported in Wyoming for soil EC values ranging from 1.8 dS/m to 6.5 dS/m.

Based on the review summarized herein, we respectfully suggest that the WDEQ consider adopting an acceptable average root zone EC threshold of 4 dS/m for protection of alfalfa. This would equate to a default (Tier 1) effluent limit of 2.7 dS/m based on the 1.5 concentration factor cited by the draft Agricultural Use Protection Policy. The EC limits for protecting other species of concern in the Powder River Basin, e.g., western wheatgrass, should also be adjusted accordingly, based on the inherent differences in soil chemistry and climate between the northern Great Plans and the California agricultural areas. These conclusions and recommendations are substantiated by the discussion below.

**California-based Salinity Thresholds**

The majority of salinity tolerance data generated in the United States have been a product of field and laboratory trials conducted by the U.S. Salinity Laboratory (USSL) in Riverside, California. The salinity tolerance data generated by the USSL were prompted in response to agricultural production in the areas of the San Joaquin and Imperial Valleys of California. In 1977, Maas and Hoffman compiled the California research in a seminal article titled "Crop Salt Tolerance -- Current Assessment," listing salt tolerance levels for various crops. The subsequent year, Francois and Maas (1978) published an indexed bibliography of plant responses to salinity from 1900 to 1977 with 2,357 references to about 1,400 species. These articles serve as the primary references regarding crop tolerance and yield potential of selected crops as influenced by irrigation water ($EC_w$) or the average root zone soil salinity level ($EC_e$). This information was updated by Mass (1990). The ARS Salt Tolerance Database relies entirely on the Mass (1990) summary as the primary source of relative salt tolerance levels among crops. With respect to alfalfa, the original salt tolerance listings remain unchanged from the original Mass and Hoffman (1977) article.

The Mass and Hoffman (1977) and Mass (1990) listings of salt tolerance levels include the establishment of the 100 percent yield threshold for soil salinity. This value refers to the maximum allowable average root zone salinity level ($EC_e$) that results in no yield reduction for crops grown in chloritic soils. The term chloritic soil refers to the dominant salt type found in California soils (see below). For alfalfa, Mass and Hoffman (1977) and Mass (1990) list the 100 percent yield potential for alfalfa grown in chloritic soils as 2.0 dS/m ($EC_e$). The Mass and

Hoffman (1977) and Mass (1990) assessments also contain a disclaimer that the yield potentials listed should only serve as a guide to relative tolerances among crops, and that the absolute salt tolerance of crops is not simply a function of soil EC but is dependent on "many plant, soil, water, and environmental variables."

Six studies conducted at the US Salinity Laboratory in Riverside, California, served as the foundation for the determination of Maas and Hoffman's 2.0 dS/m threshold value (Gauch and Magistad, 1943; Brown and Hayward, 1956; Bernstein and Ogata, 1966; Bower et al., 1969; Bernstein and Francois, 1973; Hoffman et al., 1975). These studies vary in their methodology, including greenhouse and field experiments, different growth mediums (sand, gravel and soil), various watering regimes (automatic watering, tension-based watering), and multiple sources of chloritic salinity (NaCl, $CaCl_2$, and $MgCl_2$). These studies were designed to assess relative yield values, irrigation leaching fractions, root zone salt profiles, or salinity-ozone interactions. They were not specifically designed to determine a threshold salinity value for alfalfa. Usually, only four salinity levels were tested, with data used to produce a crop yield reduction line.

Furthermore, the source of salinity in the six studies was consistently chloride dominated, with either NaCl or a blend of NaCl, $CaCl_2$, and $MgCl_2$ added to the irrigation water. In Southern California, where these studies occurred, salts found in the soils are largely chloride-dominated. None of these studies were conducted using sulfate-dominated salts, such as are found in Wyoming soils (see below). Such regional differences in soil salinity are likely to have a profound effect on the application of existing salinity threshold data to alfalfa growing in the Northern Great Plains. Recognizing this, Mass (1990), Ayers and Westcot (1985), Hanson et al. (1999), as well as the ARS Salt Tolerance Database, all indicate that plants grown in sulfatic soils will tolerate average root zone $EC_e$ values about 2 dS/m higher than indicated by each of these references. For alfalfa, this would equate to a 100 percent yield threshold of approximately 4 dS/m. This fact is discussed in detail below.

**Chloridic Versus Sulfatic Soils**

Research efforts of the USSL in California identified adjustments in effective plant salinity tolerance expressed or repressed in the field by physiological responses to climate, cultural practices, soil fertility, irrigation methods, physical condition of the soils and the distribution and speciation of salts within soil profiles. A critical difference between the environmental conditions in California and the northern Great Plains (including northeastern Wyoming) is soil chemistry and the primary salt constituents found in these soils. It is widely accepted that the soils of the agricultural areas of California are dominated by salts where chloride is the dominant anion, and that the soils of the northern Great Plains are dominated by salts where sulfate is the dominant anion. In earlier publications, sulfatic soils are sometimes termed "gypsiferous," referring to the most common sulfate salt found in semi-arid soils -- gypsum (calcium sulfate dehydrate). The correct term used today is sulfatic soils.

To incorporate the variation of salinity tolerance exhibited by plant response to different salt distributions and dominant salt species, the authors of salt tolerance research included a provision for sulfatic soils. Soils may contain amounts of sparingly soluble salts, such as gypsum and other sulfate salts, many times greater than can be held in solution in the field water-

content range. Sulfatic soils may appear to be saline when exhaustively extracted in the lab (i.e., in a saturated paste extract), but the in-situ soil solution may be nonsaline because of the limited solubility of gypsum and other sulfate salts (Bernstein, 1975). Thus, the EC measured in a saturated paste extract is higher than the actual concentration of salts seen by plants in sulfatic soils. It was suggested originally by Bernstein (1962) that plants will tolerate about 2 dS/m higher soil salinity ($EC_e$) than indicated in sulfatic soils due to this solubility effect. Since calcium sulfate is disproportionately dissolved in preparing saturated-soil extracts, the $EC_e$ of sulfatic soils will range an average of 2 dS/m higher than that of chloritic soils with the same water conductivity at field capacity (Bernstein 1962). Therefore, plants grown in sulfatic soils will tolerate an $EC_e$ of approximately 2 dS/m higher than those grown where chloride is the predominant ion (Maas, 1990). This narrative provision for sulfatic soils is included in the ARS Salt Tolerance Database, and the classic irrigation guidelines presented in Ayers and Wescot (1985).

Sulfatic soils are the rule not the exception in Wyoming and the northern Great Plains. Sulfatic soils identified by salinity tolerance references are characterized by the presence and influence of gypsum, or calcium sulfate dihydrate ($CaSO_4 \cdot 2H_20$), within the soil profile, as well as the geological and climactic prerequisites for sulfatic soil conditions. Soil gypsum may stem from one of several sources. Soils formed from geologic material containing anhydrite or gypsum often contains gypsum. The amount of rainfall and the topographic setting will strongly influence the amount and location of gypsum in the soil (Dixon and Weed, 1989). Accumulations of soluble salts, including sulfates in the surface layers, are characteristic of saline soils of arid and semiarid regions (Brady, 1974), including Wyoming. Research conducted by the U.S. Geological Survey confirms the presence of gypsiferous parent materials in the Powder River Basin (Johnson, 1993). At this point, it is important to differentiate between the soil taxonomic terms "gypsic" or "petrogypsic," which are used to describe significant gypsum accumulation within soil horizons, from the terms "gypsiferous" or "sulfatic" soils which refer to the dominate salt type in soils of Wyoming and the northern Great Plains.

Published research has addressed the issue of prevailing salt distribution and climate influenced salt dominance. In Springer et al. (1999), Curtin et al. (1993) and Trooien (2001), northern Great Plains prairie soil chemistry is comparatively summarized and/or contrasted to soils of California. Research suggests that recommendations developed for the western United States, where chloride is the major anion in soil and water chemistry, may not be appropriate for sulfatic soils (Springer et al., 1999). Trooien (2001) notes that most plant salinity tolerance information is developed in California and that the chemistry of salinity is different in the northern Great Plains (i.e., sulfate dominated salinity). Therefore, Trooien (2001) indicates that salinity thresholds are greater and yield losses are somewhat smaller in the Northern Great Plains compared to those of California (i.e., chloride dominated salinity). Research in Canadian prairie soils by Curtin et al. (1993) and Wentz (2001) suggest that salt tolerance testing at the Swift Current, Saskatchewan, salinity laboratory (and also at the US Salinity Laboratory) has mostly involved the determination of crop responses to chloride salinity. However, there is reason to suspect that responses to sulfate salinity, which is the predominant form of salinity in prairie soils, may differ from those observed in chloride salt systems. Wentz (2001) summarizes that crop tolerances developed for chloride dominated soils, such as those in California, may not be applicable to crops grown on the sulfate dominated soils typically found in western Canada.

Comparison of actual soil analytical data from the NSSC Soil Survey Laboratory, Lincoln, Nebraska, supports the chloride and sulfate salt dominance designations suggested by Springer et al. (1999), Curtin et al. (1993), Trooien (2001), and Wentz (2001). Analyses from the U.S. Soil Survey Laboratory are available online at http://ssldata.nrcs.usda.gov/ and organized by soil pedon. Data from selected counties in Wyoming and California were obtained from the NSSC Soil Survey Laboratory Research Database in order to determine the dominance of chloride or sulfate soil chemistry in the respective regions. Soil chemistry data were downloaded for use in this study for counties of the Powder River Basin in Wyoming (Sheridan, Campbell and Johnson Counties). Soil chemistry data were also downloaded for counties in California where intensive agricultural production takes place (Imperial, Fresno, Kern, Kings and Tulare).

Data pertaining to soil chloride and sulfate in the saturated paste extract are arranged and averaged by county and state in Table 1 below. These values are based on all of the available data provided by the U.S. Soil Survey Laboratory.

**Table 1**
**A Comparison of Average Soil Saturated Paste Extract Sulfate and Chloride Levels from Counties in Wyoming and California.**

| County | Average Soil Sulfate Level (meq/L) | Average Soil Chloride Level (meq/L) |
|---|---|---|
| Sheridan, WY | 14.9 | 4.1 |
| Campbell, WY | 130.4 | 3.0 |
| Johnson, WY | 30.9 | 1.8 |
| **Wyoming Average** | **58.7** | **2.9** |
| Imperial, CA | 48.4 | 295.7 |
| Fresno, CA | 98.6 | 26.3 |
| Kern, CA | 44.3 | 73.0 |
| Kings, CA | 110.7 | 23.9 |
| Tulare, CA | 9.3 | 21.6 |
| **California Average** | **62.3** | **88.1** |

The summary data suggest that the relative proportion of chloride salts in the selected California counties outweigh the proportion of sulfate salts and verify the chloride dominance suggested by the literature summarized above. In northeastern Wyoming, the relative proportion of sulfate salts in selected counties outweigh the proportion of chloride by an order of magnitude and verify the sulfate dominance and sulfatic conditions implied by the literature. Therefore, the recommendation by the ARS Salt Tolerance Database signifying that plants grown in sulfatic soils will tolerate average root zone $EC_e$ values about 2 dS/m higher than indicated, is valid for the Powder River Basin, and probably all of Wyoming. For alfalfa, this would equate to a 100 percent yield threshold of 4 dS/m.

**The Influence of Soil Salinity on Alfalfa Yield**

As indicated above, the *relative* 100 percent yield potential reported for alfalfa in the ARS Salt Tolerance Database is 2 dS/m ($EC_e$). As such, alfalfa is regarded in the California-based literature as "moderately sensitive" to salinity. An *absolute* salinity tolerance would reflect predictable inherent physiological responses by plants, but cannot be determined because interactions among plant, salt, water and environmental factors influence the plant's ability to tolerate salt. *Relative* salt tolerance is a value based on the climatic and cultural conditions under which a crop is grown (Maas and Hoffman, 1977). Research generated outside the U.S. Salinity Laboratory in the U.S. and Canada has introduced alternative salinity tolerance values for alfalfa influenced by these climatic and cultural conditions.

In a study based on field trials in western Canada, McKenzie (1988) reported the "relative maximum salinity crops will tolerate when combined with intermittent moisture stress throughout the growing season." McKenzie (1988) places alfalfa within a moderate tolerance category, as opposed to moderate sensitivity, and extends alfalfa's 100 percent yield tolerance to an EC range of 4-8 dS/m, as opposed to 2 dS/m. Similar tolerance descriptors and EC values for alfalfa can be found associated with Britton et al. (1977), who supports moderate salt tolerance and an EC range of 5-10 dS/m for alfalfa. Likewise, Milne and Rapp (1968) present alfalfa with a moderate tolerance and an EC range of 4-8 dS/m. Cavers (2002); Wentz (2001); Schafer (1983); Holzworth and Wiesner (1990) and Dodds and Vasey (1985) also contribute to a departure from the established Maas classification of alfalfa salinity tolerance and threshold values. Bower et al., suggests an alfalfa tolerance somewhat between the previous authors and Maas (1990), suggesting maximum alfalfa yield is obtained when the average $EC_e$ value for the root zone is 3 dS/m. Using salinized field plots in southern Saskatchewan, Holm (1983) reported a small, 0.037 ton/acre, reduction in alfalfa yields resulting from an increase in the surface $EC_e$ (0 to 15 cm sample) from a 0 to 4 dS/m range to a 4 to 8 dS/m range. Holm presented these scales as representative of low and medium EC levels.

Relative salinity tolerances reported outside of peer reviewed literature stem from professional observations and judgments, roundtable discussions, experience in the field, and experience with the region, culture and climate; not from experimental data. Incorporation of field experience, observation, and limited data into supporting documents of the Salt Tolerance Database is acknowledged in Ayers and Wescot (1985). Alternative sources listed herein do not always report EC values in terms of 100 percent yield thresholds for alfalfa, but should not be discounted, as they pertain to what is realistic in the field. As an example, the Montana Salinity Control Association reports forage salt tolerances in terms of marginal establishment levels, not 100 percent yield potentials. Conditions allowing alfalfa to produce at 100 percent of its physiochemical yield potential probably do not exist anywhere within the northern Great Plains.

A suggested field-yield value corresponding to the 100 percent yield of alfalfa has never been reported by authors of salinity literature. Specifically, what yield of alfalfa, in tons per acre, could one expect if it was grown under conditions supporting 100 percent yield? Conditions supporting 100 percent alfalfa yields recommended by the ARS Salt Tolerance Database and its supporting documents would be: a soil $EC_e$ of 2 dS/m or less, an irrigation water $EC_w$ less than or equal to 1.3 dS/m, water contents maintained at field capacity, available N, P and K nutrient

levels maximized for alfalfa growth, a sufficiently long growing season, no associated phytotoxicity or pest issues, etc. This data limitation precludes the direct comparison of alfalfa yields generated in an agricultural area to the potential yields theoretically available under optimized conditions. The only available analysis is to compare an alfalfa yield to the average yield generated in its area, or generated between areas.

Using data available from the National Agricultural Statistics Service, selected county agricultural commissioner's data, and the U.S. Census of Agriculture (2002, 1997), irrigated alfalfa yield data were obtained for periods of interest. Alfalfa yield data for Wyoming counties are available from 1959 through 2005, but were averaged from 1970-2005 to reflect the integration of new irrigation technologies. Alfalfa yield data were summarized for the area encompassing the Powder River Basin: Sheridan, Johnson and Campbell counties. Alfalfa yield data for California counties are available from 1980-2004 so the entire dataset was averaged. Alfalfa data were summarized for counties in California related to intensive agriculture: Imperial, Fresno, Kern, Kings and Tulare counties.

Soil salinity data (as measured by EC) collected by the USDA National Soil Survey and analyzed by the National Soil Survey Center (NSSC) Soil Survey Laboratory were also obtained and summarized for the aforementioned counties. Average root zone EC values were calculated to a maximum depth of five feet. The county alfalfa yield and average root zone EC summaries are presented in Table 2 below.

**Table 2**
**Comparison of Average Root Zone Soil Salinity (EC) Values with Historical Alfalfa Yields for Selected Counties in Wyoming and California.**

| County | Average Root Zone Soil Salinity (EC as dS/m) | Historical Average Alfalfa Yield (tons/acre) |
|---|---|---|
| Sheridan, WY | 1.5 | 2.7 |
| Johnson, WY | 1.9 | 2.4 |
| Campbell, WY | 2.0 | 2.4 |
| **Wyoming Average** | **1.8** | **2.5** |
| Tulare, CA | 2.8 | 8.4 |
| Kings, CA | 6.9 | 6.9 |
| Kern, CA | 4.6 | 8.0 |
| Fresno, CA | 6.7 | 7.9 |
| Imperial, CA | 6.7 | 7.8 |
| **California Average** | **5.5** | **8.0** |

Values expressed in Table 2 show substantially higher average root zone salinities in California than in Wyoming. Alfalfa yields reported in California are three times greater than those in Wyoming, even though, on average, the soil salinity values are nearly three times higher than those reported for the Wyoming counties. The values generated in this exercise suggest that environmental factors other than salinity, e.g., climate, may be dictating the obtainable degree of alfalfa yield produced. However, the data also suggest that the California-based 100 percent yield threshold of 2 dS/m may not be appropriate for even the chloritic soils of California. For

example, the historical average yield of alfalfa in Tulare County is 8.4 tons per acre with a corresponding average root zone EC of 2.8 dS/m. The yield from Tulare County is actually slightly greater than the yields from Fresno and Imperial Counties where the corresponding average root zone EC values are substantially higher at 6.7 and 6.7 dS/m, respectively. Regardless, there does not appear to be a substantial difference in yields reported by the California counties with soil EC values ranging from 2.8 to 6.7 dS/m.

Other field data from Wyoming have been reviewed that also suggest an alternative to the California-based salinity tolerance values. The Use Attainability Analysis (UAA) report for Cottonwood Creek (SWWRC et al., 2002) was downloaded from the Wyoming Department of Quality, Water Quality Division webpage. Cottonwood Creek is located in Hot Springs County within the Bighorn Basin of Wyoming. This is an area of extensive conventional oil and gas production. According to the UAA report, discharge of produced water from the Hamilton Dome oil field to Cottonwood Creek constitutes the majority of flow to the ephemeral stream and constitutes the only irrigation water source for approximately 35 ranching operations. The waters of Cottonwood Creek exhibit an $EC_w$ between 4.1 and 4.5 dS/m. At an average $EC_w$ of 4.3 dS/m, an average root zone soil $EC_e$ value can be calculated using the widely accepted relationship: $EC_e = 1.5\ EC_w$ (Ayers and Wescot, 1985). This relationship is expressed in the draft Section 20 Agricultural Use Protection Policy. From this relationship, an average root zone soil EC value of 6.5 is estimated for the fields irrigated long-term with water from Cottonwood Creek. Average alfalfa hay yields reported in the UAA amount to 2.5 tons per acre. This yield is identical to the average of the three Wyoming counties reported in Table 2 above. This is compelling given that the average soil EC value for the three other Wyoming counties is 1.8 dS/m, while the estimated soil EC for the fields irrigated with water from Cottonwood Creek is 6.5.

**Closing Statement**

Based on the review summarized herein, we respectfully suggest that the WDEQ consider adopting an acceptable average root zone EC threshold of 4 dS/m for protection of alfalfa. This would equate to a default (Tier 1) effluent limit of 2.7 dS/m based on the 1.5 concentration factor cited by the draft Agricultural Use Protection Policy. Other species of concern, including western wheatgrass, should be given equal consideration due to the inherent differences in soil chemistry between the northern Great Plains and the California agricultural areas for which the ARS Salt Tolerance Database is based. Factors such as extreme climate, periodic drought, soil moisture regime, duration of growing season, soil depth, and fertility limitations can collectively exert an overriding regional influence on the yield potential of forage crops. Based on this, we ask that the WDEQ exercise caution interpreting the applicability of specific salinity tolerances outlined by the ARS Salt Tolerance Database and thoughtfully consider the difficulty in detecting a "measurable" change in plant production due to soil salinity alone.

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* * * * *

Thank you very much for your time and consideration of this review and the recommendations stemming from it. If you, your WDEQ colleagues, or the members of the Water and Waste Advisory Board have any questions or comments regarding our findings, please contact me.

Sincerely,

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February 12, 2007

**Via Facsimile & U.S. Mail**

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Re: Proposed Section 20, Appendix H - Agricultural Use Protection

Dear Mr. DiRienzo:

Yates Petroleum Corporation (Yates) would like to take this opportunity to comment on the Wyoming Department of Environmental Quality's (WDEQ) proposed Chapter 1, Wyoming Water Quality Rules and Regulations (WWQRR), Appendix H – Agricultural Use Protection (Appendix H).

In brief, Appendix H would prohibit the use of produced water for livestock watering and/or wildlife propagation and, in essence, cause more harm to existing uses and the environment than it would prevent. Yates urges the Water Quality Division (WQD or Division) and the Environmental Quality Council (EQC) to evaluate these impacts more carefully prior to implementing Appendix H as a rule or policy. Additionally, the proposed language in Appendix H is not suitable for implementation as a rule. The language fails to provide WQD with needed flexibility in administration of the provisions and fails to provide both the WQD and the regulated public with notice concerning the interpretation of many aspects of the provisions. These comments are in addition to comments submitted by Yates on earlier drafts of Appendix H and those comments are incorporated herein.

**Appendix H Will Eliminate a Needed Source of Water for Agriculture**

As proposed, Appendix H will interfere with the livelihoods of many ranchers who currently rely on the produced water for livestock watering and adversely affect livestock and wildlife use of the water. As Appendix H will effectively prohibit the use of produced water for livestock watering, will result in a measurable decrease in production for existing uses, is *not* protective of agricultural use, and violates Section 20 in its own right, Appendix H should not be implemented.

First, the Environmental Quality Act and, more specifically, Section 20 are intended to protect *agricultural* use. The Department has extended Section 20 to include "naturally irrigated lands" which is an unallowable extension of both the Act and the regulations. Section 3(a) of the Wyoming Water Quality Rules & Regulations (WWQRR) defines agriculture uses as "irrigation or stock watering." The term "irrigate," in turn, is defined as "to supply (land) with water by means of ditches or artificial channels." (Webster's New World College Dictionary, 4th Ed.) Clearly, irrigation is intended to mean some form of active management of water more than the passive passing of water in its natural channel(s). Hence, Appendix H should only impose effluent limitations on areas that are irrigated by means of ditches or artificial channels or that are otherwise actively irrigated. As currently written, Appendix H extends agricultural protection far beyond that envisioned by the Legislature or Chapter 1 and, in effect, becomes a "native plant" protection policy that, indeed, may protect noxious weeds as much as anything else.

Second, because Appendix H extends the agricultural protection of Section 20 to non-agricultural "naturally irrigated lands," which WQD's infrared map suggests are present on most drainages, it will essentially prohibit all discharges of produced water down any drainage in which it is alleged that "naturally irrigated lands" exist. As Mr. DiRienzo candidly stated before the Water and Waste Advisory Board meeting on August 2, 2006, virtually no produced water can meet the Tier 1 effluent limitations. Prospective dischargers will be required to conduct a Tier 2 or Tier 3 evaluation and seek approval from the Division. The Division has consistently shown that it has been unable to timely administer similar tiered programs. As a result, all produced water discharges effectively will either be prohibited under Appendix H or will result in appeals that the EQC will have to resolve on a case-by-case basis. In essence, the EQC will be mandating a "permit by evidentiary hearing" procedure for all CBNG produced water discharges.

Third, because of Appendix H's extension to "naturally irrigated lands," produced water of quality suitable for livestock watering would not be allowed to discharge down such drainages *even if the downstream landowner desires the water for his use*. This situation is made worse by the fact that any person, not just a landowner on the drainage, can allege that there are "naturally irrigated lands." As a result, one landowner in the drainage or *any other third party not located on the drainage* may interfere with every other landowners' use of the water by refusing to allow such water to flow anywhere along the drainage under the pretense that the drainage may affect "naturally irrigated lands."

Fourth, by effectively prohibiting discharges of produced water down drainages where it is alleged that "naturally irrigated lands" exist, Appendix H will deprive livestock and wildlife of good quality water along these drainages. Many landowners currently rely on produced water to water livestock and for wildlife propagation. By eliminating discharge across alleged "naturally irrigated lands," Appendix H will prohibit all future discharges of water and eliminate its use for livestock watering and wildlife propagation. Appendix H will also eliminate discharges which are currently authorized under the WYPDES program in any drainages where someone alleges

"naturally irrigated lands" are present once the permit is renewed. Furthermore, many landowners have already established uses of produced water for both livestock and wildlife. In the event Appendix H is implemented, no produced water will be available to continue these uses in the future. This will result in a net loss of both livestock production and wildlife propagation which is, in itself, a violation of Section 20.

Fifth, water quality in gaining stretches (areas where the shallow water table pools and stagnates) of ephemeral drainages generally does not meet Appendix H effluent limitations and is, in fact, of poorer quality than produced water. Appendix H, if implemented as currently written, will deprive landowners of good quality water which is better than water quality in gaining stretches.

**The Proposed Appendix H Language is Not Suitable as a Rule**

Appendix H, as currently drafted, fails to provide either the WDEQ or the regulated community with notice concerning how Appendix H will be administered. Because of its failure to provide notice, promulgation of Appendix H as a rule, rather than as a flexible policy, will likely lead to significant legal and technical challenges once WDEQ attempts to administer the proposed "rule."

Simply stated, if the proposed language is promulgated as a rule, WDEQ will have no flexibility in enforcing the standard even where the requirements of the rule are not justified. In other words, if the proposal is drafted as a policy, rather than a rule, WDEQ would have the ability to deviate from the provisions where the facts and circumstances dictate. In fact, flexibility was advocated by WQD when it originally issued the proposal as a policy. WQD's Bill DiRienzo stated that developing a numeric standard for constituents was not practicable. *See* Transcript of Hearing, Buffalo, Wyoming, August 2, 2006, pp. 20-22. Mr. DiRienzo also stated that it would be better to make decisions on a site-specific basis. *See* Transcript, p. 25. Finally, Mr. DiRienzo stated that developing a flexible policy versus a rigid rule is more advantageous given that WQD intends to "tweak" the policy from time-to-time once WQD has gained experience in implementing this policy. *See*, Transcript, p. 22. Mr. DiRienzo stated, correctly, that this would be easier if the proposal were instituted as a policy rather than as a rule. Transcript, p. 22.

An example of the inflexible nature of Appendix H, as currently written, is the fact that a Tier 2 analysis must be conducted with specific sample collection requirements (i.e., four depths at 12-inch intervals). If, for some practical reason, such sampling cannot be conducted, the Tier 2 evaluation is not available as an option. This leads to unjust results, not just to the operator, but also to landowners who may wish to use the water for stock watering or other beneficial uses.

As currently written, Appendix H fails to provide sufficient guidance and notice to both the regulators and the regulated community. It is well settled that an agency must always provide "fair notice" of its regulatory interpretations to the regulated public. *General Electric v. U.S. EPA*, 53 F.3d 1324, 1329 (D.C. Cir., 1994). However, given that Appendix H was drafted

as a policy and the language has not been changed in this eleventh hour conversion to a "rule," the loose language appropriate to a policy provides no notice to the regulated community as to what it will be required to do in order to comply with the requirements of the "rule." Below are several, but not all, examples of just how the proposed language fails to provide notice to the regulated community.

1) Essentially, the proposed "rule" sets forth effluent limits for "naturally irrigated lands." The proposed language in Appendix H defines "naturally irrigated lands" as "those lands are those lands where a stream flow and channel geometry provides for enhanced productivity of agriculturally significant plants." Appendix H, H-4. Unfortunately, Appendix H fails to provide any definition or guidance concerning what the terms "channel geometry" and "agriculturally significant plants" mean. For example, does the term "naturally irrigated lands" include plants not used for livestock consumption? Does the term include exotic species?

2) The Appendix H language also provides that when calculating the 20-acre threshold, "small drainage bottoms *may* be excluded from consideration." Appendix H, H-4 (italics added). It is unclear what is meant by this provision as it provides no guidance concerning when a drainage bottom should be excluded.

3) The proposal states that "though not necessary for the estimation of background water conductivity, it is advisable to also analyze the soil samples for pH, SAR, soil texture and exchangeable sodium percentage (ESP) to avoid having to duplicate the sampling if the results indicate that a 'no harm analysis' needs to be completed." Appendix H, H-9. What does this mean if the proposal is adopted as a rule? Does the "rule" require sampling of pH, SAR, soil texture and ESP? Loose language such as "it is advisable" indicates that the current version of Appendix H is not suitable for promulgation as a rule.

4) Tier 3 allows for establishing EC and SAR limits based upon a "scientifically defensible site specific study that examines local soil characteristics, natural water quality, expected crop yield, irrigation practices and/or any other relevant factor related to crop production." Appendix H, H-9. Again, this language is too ambiguous to be used universally. Who determines whether the analysis constitutes a "scientifically defensible site specific study?" What may be defensible in one set of circumstances may not be defensible in another.

5) The language of proposed Appendix H itself warns against application as a rule. In reference to the Tier 3 analysis, Appendix H states "because of the very site-specific nature of this [the Tier 3] approach and the number and complexity of variables that may need to be considered, *it is not very useful to specify any particular type of analysis in this policy.*" Appendix H, H-10 (italics added).

Because Appendix H is currently written to provide guidance and to allow flexibility is its administration, it is not suitable for use as a rule. Similarly, Appendix H does not provide notice to either the regulators or the regulated public with enough specificity to be enforceable as a rule. For these reasons, Yates respectfully requests that Appendix H not move forward in rule-making but, rather, remain as a policy. If the EQC does determine that Appendix H should be promulgated as a rule, Yates respectfully requests that the proposed language be re-drafted re-noticed for public comment period to allow fixing the many problems with the existing language before final promulgation into rule form.

**Evidence Demonstrates Effluent Limits for EC of 2700 µmhos and SAR of 16**

In the event the EQC decides to proceed in promulgating Appendix H as either a rule or a policy, the default limits for specific conductance (EC) and sodium adsorption ratio (SAR) should be 2700 µmhos and 16, respectively. Kevin Harvey, a soil scientist with 25 years of experience, summarized the current state of the science and Petitioners' concerns when he provided the WQD and the Water & Waste Advisory Board with an extensive scientific literature review regarding EC and SAR limits proposed in the Chapter 20 rule-making process. Mr. Harvey studied the default effluent limits (EC of 2000 and SAR cap of 10) proposed in the rule-making and compared them with soil salinity in Wyoming to determine whether the default limits were justifiable given natural conditions. Mr. Harvey concluded that the default limits were not justified and were, in fact, too low given the natural soil conditions throughout Wyoming. Based on the available science, Mr. Harvey determined that EC should be 2700 µmhos and SAR should be 16. *The Water and Waste Advisory Board accepted this suggestion and has included them in the proposed language.* DEQ/WQD has stated that they are not in favor of Mr. Harvey's limits but have failed to produce *any* evidence to support lower effluent limits. Copies of Mr. Harvey's submissions to the Water and Waste Advisory Board are attached as Exhibit "A."

WQD does not support the Tier 1 default values for EC and SAR supported by Mr. Harvey's research and accepted by the Water and Waste Advisory Board. WQD apparently believes that default levels based on the USDA Agricultural Research Service Salt Tolerance Database are appropriate. This is simply not supported by the evidence or the facts. The more appropriate levels are the values established by the Bridger Plant Material Center (the Bridger Study). The Bridger Study was conducted in soil types more similar to those found in Wyoming, and was developed for plants grown in Wyoming and Montana. Hence, the Bridger Study takes into account soil types typically found in Wyoming. The effluent limits urged by WQD reflect tolerances of plants grown in California soils which do not have characteristics representative of typical Wyoming soils. Again, the Water and Waste Advisory Board, in its October meeting, agreed with Mr. Harvey that the Bridger Study and, hence, effluent limits derived from the Bridger Study were more appropriate than relying on a study conducted in California.

**There is No Legal or Factual Basis for 50-Year Containment Option**

Under the requirements set forth in Appendix H, an operator must either gain downstream access and conduct extensive vegetation, soils and background water quality analysis in order to demonstrate that the default effluent limits are inappropriate or comply with the overly-conservative effluent limitations. If an operator cannot comply with either of these requirements, which is likely due to landowner reluctance to allow operators on their property and the fact that the proposed effluent limits are impossible to meet, WDEQ has established the practice of requiring an operator provide enough containment for the amount of produced water and a 50-year precipitation event.

Although WDEQ asserts that this requirement provides a viable option for those who cannot gain access or meet the limits, realistically it provides no option to operators. Under the Environmental Quality Act (EQA), "in recommending any standards, rules, regulations, or permits the administrator shall consider all the facts and circumstances bearing upon the reasonableness of the pollution involved including... the *technical practicability and economic reasonableness* of reducing or eliminating the source of the pollution." W.S. 35-11-302(a)(vi)(D) (italics added). WQD has failed to consider the technical practicability and economic reasonableness of requiring 50-year containment.

First, the 50-year containment requirements will simply render many already-permitted on-channel reservoirs useless and will unnecessarily reduce the number of reservoirs that could be constructed in the future due to constraints on the amount of land available to build the reservoirs and landowner requests. WQD has failed to consider this important fact in promulgating the permit.[1] WQD's failure to follow its own rules (here, considering the technical feasibility and economic reasonableness of the containment requirement) is arbitrary and capricious and requires remand. *See Bowen v. Wyoming Real Estate Comm'n*, 900 P.2d 1140, 1142 (Wyo. 1995).

Second, as stated above, the WQD must consider technical feasibility and economic reasonableness when promulgating conditions in a permit and WQD has failed to consider the technical feasibility of the proposed containment requirement. The 50-year containment requirement places operators in the position of having to construct overly-large reservoirs at the expense of otherwise open land. The large reservoirs would necessarily inundate otherwise ephemeral streams. Also, in many places on the watersheds, construction of reservoirs of this size simply is not possible due to characteristics of the stream in which the reservoirs are to be constructed. The WQD simply failed to weigh and properly consider the technical feasibility

[1] In other proceedings, WQD allegedly considered similar objections to a 50-year containment requirement and stated that the "great majority" of the reservoirs subject to the requirement were less than 20 acre-feet in size and required only an additional 5 acre feet of freeboard to contain a 50-year storm event. WQD's assertion fails to address the fact that, in most cases, reservoirs simply cannot be constructed with the additional 5 acre feet of capacity and WQD simply failed to provide any support for its conclusion.

and economic reasonableness in contravention of its rules. This requires remand. *See Bowen*, 900 F.2d at 1142.

Third, the WQD has failed to provide *any* support to justify a 50-year containment requirement or show how the requirement is related to the protection of water quality. In determining whether an agency's actions are valid, the decision must be supported in the record. *See Id.* Operators have consistently and repeatedly documented that the contribution of CBNG water is minimal when compared with even a 2-year storm event and that the characteristics of CBNG water are lost when mixed with the much larger amount of precipitation runoff from the 2-year event. This demonstration has gone unheeded and undisputed by WQD.

**Comments Aimed at Improving Appendix H**

As outlined above, Yates does not believe that the current draft of Appendix H is workable as either a policy statement or as a binding rule. Experience with the Tier 2 and Tier 3 approach, as presently implemented by WQD, demonstrates that the Division is rarely able to proceed in the face of a conflict between a dissenting landowner and the operator and other landowner(s) who may wish to use water. Yates hopes that the EQC will remand Appendix H back to the WDEQ and WQD for further consideration. If such remand should occur, Yates recommend the following changes:

*Comment 1. The policy should address how to determine whether a discharge will "reach" irrigated lands.* Unless this issue is clearly identified, it leaves WQD, landowners, operators and the public at a loss of how to evaluate when the protections stated by the proposed policy should be implemented. Yates recommends the following wording to be added to Section III.A under "Identification and Protection of Irrigation Uses":

> *For purposes of this policy, a discharge will not reach irrigated lands if it is: (a) downstream from the lands; (b) contained in an off-channel reservoir; (c) contained in an on-channel reservoir and the discharge constitutes less than 5% of the total flow during the design event that would cause overflow from the reservoir; (d) if only naturally-irrigated lands are present below the discharge, and the discharge and all other pre-existing discharges do not exceed 75% of channel capacity; or (e) if irrigated lands are present, the applicant presents letters from all downstream irrigators either agreeding that the discharge will not reach the irrigated lands or consenting to it reaching the lands.*

Clauses (a) and (b) are self-explanatory. Clause (c) addresses *de minimis* risks. At this design capacity, the total quantity of CBNG produced water will be a small part of the total volume of water flowing in the wash. Natural conditions will predominate and natural systems (e.g., flushing of higher salts at the beginning) should play their typical role. Clause (d) allows discharge where the operator can demonstrate that the water will be confined to the channel. As in the case of clasue (c), storm events should provide adequate dilution water. Clause (e) allows

landowners and operators to work together cooperatively to deliver water where several landowners on the drainage desire such water.

*Comment 2. Artificially irrigated lands should only include legally irrigated lands.* Any other approach places the EQC and WDEQ in the position of condoning and protecting a violation of state law.

*Comment 3. Naturally irrigated lands should be more concisely defined to avoid future disputes.* The definition of naturally irrigated lands is important, but is essentially undefined in the proposed policy/rule. Yates recommends the following changes:

> *Naturally irrigated lands are lands (a) within the annual flood plain where the stream channel is underlain by unconsolidated material, (b) which are (i) cropped and/or (ii) actively managed by fertilization, cultivation or other mechanized means and (c) as a result have enhanced vegetative production of agriculturally significant plants over adjoining areas. Naturally irrigated lands may be identified by an evaluation of infra-red aerial photography, surficial geologic maps, wetland mapping, landowner or survey testimony, or any combination.*

The rationale for the suggested changes is simple:

- The policy/rule is supposed to protect "irrigated" lands. Land which is not, on average, irrigated at least once a year is not "irrigated" land as that term is used in the Wyoming community. Frequencies of less than once a year, on average, suggest that dry-land agriculture is actually what is being practiced.
- Irrigated lands are distinguished from livestock raising, which typically relies upon native plant species. Agriculture generally suggests that materials are cropped or otherwise managed to improve yields of agriculturally desirable species. The definition should include these concepts by requiring the lands to either be cropped or else fertilized or cultivated by mechanical means. Lands which are not managed with some degree of intensity are simply "the environment" and not agricultural use protected under the Environmental Quality Act.

*Comment 4. Agriculturally significant plants should be defined.* Yates recommends the following definition, after consultation with soil scientists and agronomic experts:

> *"Agriculturally significant" means typically cultivated crops (including, but not limited to alfalfa) or native and non-native forage plants (including, but not limited to wheatgrasses, bromes and wildryes) present in such quantity as to provide, in the aggregate, significant economic value if cropped or significant animal nutritive value if left in place.*

This definition is necessary to prevent an individual from seeking to protect non-significant plants under the policy. An example might be the decision to grow exotic fruits, vegetables or flowers.

*Comment 5. Yates supports the 20 acre size limit.* The 20 acre limit provides a good method of determining when a planting area becomes "agriculturally significant."

*Comment 6. The policy/rule must address situations where background soil quality shows soil ECs higher than the default limit.* The default limits are predicated upon high quality soils not typically found in Wyoming. It is inappropriate to require the default limits be met when the soils clearly demonstrate that default limit quality water has not historically been applied. Therefore, Yates recommends a new III.C.1.d, to read as follows:

> *Where soil data from areas unaffected by existing discharges show soil ECs in excess of 4 dS/m, either (i) the mean plus standard deviation of those soil data or (ii) the tier 2 or 3 approach must be used in lieu of the Tier 1 standards.*

**Conclusions**

As currently drafted, Appendix H would effectively eliminate a needed source of water which a great many landowners rely on for livestock watering and irrigation. In eliminating this source of water, Appendix H would ultimately have the effect of causing more damage to the agricultural community than it WQD alleges it would prevent. Because Appendix H expands protection beyond agricultural uses, in direct conflict with Chapter 1, Section 20, it would eliminate the vast majority, if not all, produced water discharges; even where produced water is of better quality than background water quality.

The language of Appendix H is not suitable for promulgation as a rule. There are simply too many provisions in Appendix H which are not specific enough to provide any meaningful guidance to either WQD or the regulated community concerning the interpretation and administration if Appendix H is promulgated as an inflexible rule.

If Appendix H is to be promulgated either as a rule or a policy, the provisions concerning effluent limits for EC of 2000 and SAR of 10 are not supported by science. If Appendix H is promulgated, it must be issued with the effluent limits recommended by the Water and Waste Advisory Board (EC of 2700 and SAR of 16). In addition, there is no support for WQD's proposed "option" of 50-year containment in lieu of the more stringent effluent limits. WQD, in developing Appendix H, has failed to consider technical and economic factors, as required under the EQA.

Based on the foregoing, Yates requests that Appendix H not be approved in any form and that it be remanded to WQD and WDEQ with instruction to redraft Appendix H accordingly. In any remand, Yates requests that the comments on improving the proposed policy/rule be given

serious consideration. Again, Yates appreciates this opportunity to comment on Appendix H. Please contact me at (480) 505-3928 if you have any questions.

Sincerely,

Matthew Joy
Attorney for Yates Petroleum Corporation

Cc: Environmental Quality Council

# Exhibit A

KC HARVEY, LLC
SOIL AND WATER RESOURCE CONSULTANTS

May 4, 2006

Mr. Bill DiRienzo
Wyoming Department of Environmental Quality
Water Quality Division
Herschler Building, 4th Floor West
122 West 25th Street
Cheyenne, Wyoming 82002

Subject: Comments pertaining to the proposed default SAR effluent limit cap of 10 in the Draft Section 20 Agricultural Use Protection Policy.

Dear Mr. DiRienzo:

I respectfully submit for your consideration the following comments regarding the fourth draft of the Section 20 Agricultural Use Protection Policy as it pertains to the derivation of effluent limits for SAR, particularly the proposed SAR cap of 10. These comments are being submitted on behalf of Yates Petroleum Company, Williams Production RMT Company, Petro-Canada Resources (USA) Inc., Marathon Oil Company, Lance Oil & Gas Company, Inc., Fidelity Exploration & Production Company, Devon Energy Production Company L.P., Bill Barrett Corporation, and Anadarko Petroleum Corporation. I have submitted additional comments regarding the derivation of EC limits in a separate letter.

By way of introduction, I am a board-certified professional soil scientist having practiced as an environmental consultant in Montana and Wyoming, and throughout the world, for nearly 25 years. For the past seven years, my practice has focused on water management and soil and water salinity/sodicity issues associated with oil and gas development. I am credited as the first to research, develop, and apply managed irrigation techniques for the beneficial use of coalbed natural gas produced water. I have directed or participated in over 75 separate projects related to produced water management, WPDES permitting, soil and water chemistry investigations, and reclamation for coalbed and conventional natural gas projects in Wyoming, Colorado, and Montana. I have a M.S. degree in land rehabilitation (soil science emphasis) from Montana State University and a B.S. in Resource Conservation (soil science emphasis) from the University of Montana.

I would like to comment on the proposed changes made to the Agricultural Use Protection Policy by the WDEQ subsequent to the January 26, 2006 meeting of the Water and Waste Advisory Board. My comments will focus on the comments provided by Dr. Larry Munn in his letter to the DEQ dated December 5, 2005. It is my understanding that Dr. Munn's comments resulted in the changes made to the proposed Policy. Specifically, I comment on Dr. Munn's proposal that all WPDES default effluent limits for SAR be capped at 10 under the Tier 1 process.

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**Summary of Findings**

The fourth draft of the Agricultural Use Protection Policy describes a 3-tiered decision making process for deriving appropriate effluent limits for EC and SAR whenever a proposed discharge may reach irrigated lands. The Tier 1 process would be followed for deriving "default" limits, and as such, this procedure would require a minimum of background information from the applicant. The default SAR limits would be extrapolated from the Hanson et al. (1999) chart relating the established EC effluent limit to SAR, up to a maximum default value of 10. The effluent limit for SAR will be determined in conjunction with EC so that the relationship of SAR to EC remains within the "no reduction in rate of infiltration" zone of the Hanson et al. (1999) diagram.

Two key concerns arise from Dr. Munn's letter regarding sodicity and the discharge of CBNG produced water in the Powder River Basin: (1) the potential impacts on the hydraulic function of irrigated soils during produced water discharge; and (2) the potential impacts of residual adsorbed sodium on the hydraulic function of irrigated fields after produced water discharge has ceased and rainfall/snowmelt leaches salts from the upper root zone. It is assumed that these concerns led Dr. Munn and the WDEQ to propose the SAR effluent limit cap of 10 under the Tier 1 process.

In addressing these concerns, I performed a considerable amount of research, including three months searching and reviewing the relevant scientific literature, and compiling and analyzing available and relevant soil, plant, and water data. The key conclusions of the literature review and data analysis are presented below and will be substantiated by the discussion that follows.

Review of Soil Sodicity

- Plant growth problems associated with excess sodium adsorption are in response to negative changes in soil structure resulting in reduced air exchange, water infiltration and hydraulic conductivity.

- The universally applied sodic soil threshold is an exchangeable sodium percentage (ESP) greater than 15.

- SAR is a measure of the sodicity risk in irrigation water. The higher the salinity of irrigation water, the higher the SAR can be without impacting soil structure and impairing soil infiltration and permeability.

The ESP-SAR Relationship for Soils in Northeastern Wyoming

- Using regression analysis, the relationship between ESP and soil SAR was determined for the Powder River Basin (n=382, $R^2$=.74).

- A 1:1 relationship of soil SAR to water SAR exists for soils in equilibrium with irrigation water. This relationship is widely accepted and confirmed by recent research led by Dr.

James Bauder at Montana State University. The relationship of ESP to soil SAR is therefore equivalent to the relationship of ESP to water SAR.

- Based on the regional specific relationship of ESP and SAR, an effluent limit of SAR = 16 corresponds to an ESP of 10, and provides a 33% margin of safety against the formation of sodic conditions (i.e., exceeding an ESP of 15). The proposed default SAR cap of 10 is, therefore, unnecessarily conservative.

The Effect of Rainwater Leaching on Soils Irrigated with Produced Water

- Concern has been raised that subsequent rainfall/snowmelt leaching of residual soil salinity may lower the electrolyte concentration and naturally raise the ESP past the dispersive sodic soil threshold.

- Research demonstrates that arid land soils can release 0.3 to 0.5 dS/m of Ca and Mg to solution as a result of the dissolution of primary minerals and the inherent calcium carbonate content of surface soils. Shainberg et al. (1981) indicates that these concentrations are sufficient to counter the deleterious effects of exchangeable sodium, even when the soil is leached with rainwater.

**A Review of Soil Sodicity**

The physical and chemical phenomena associated with soil sodicity are complex. Therefore, a brief summary is provided regarding the soil and water chemistry associated with the physical affects of soil sodicity.

A large body of research concerning sodic, or "black alkali" soils has been generated in response to the negative effects of high sodium concentrations on soils. Toxicity effects of sodium are rarely expressed in forage and grass crops, but do cause injury to selected woody plants (Lilleand et al., 1945; Ayers et al., 1951; Brown et al., 1953). Plant growth problems associated with high concentrations of sodium are generally a response to negative changes in soil structure. Sodic soils are "nonsaline soils containing sufficient exchangeable sodium to adversely affect crop production and soil structure (Soil Science Society of America, 2001)." High levels of adsorbed sodium tend to disperse soil particles thereby sealing the soil. The result can produce clogged soil pores, hard surface crusts, reduced infiltration, reduced permeability, and reduced oxygen diffusion rates, all of which interfere with or prevent plant growth. By definition, sodic soils are those that have an exchangeable sodium percentage (ESP) greater than 15. The universally applied ESP threshold of 15 percent is acknowledged in numerous publications, including Levy et al. (1998), Abrol et al., (1988), Evangelou (1998), McNeal and Coleman (1966), Sparks (1995), Sumner et al. (1998), Shainberg et al. (1971), the Soil Improvement Committee (2002), university extension publications, etc.

Clay minerals are the most physically and chemically reactive components of the sand, silt, and clay matrix in soil. The structural arrangement of clay minerals in soil is akin to a deck of cards; the clay mineral itself can be thought of as the deck, and the cards as individual layers. The

properties of the deck depend upon the arrangement of the cards and the electrochemical interlayer forces holding the cards together.

Clay minerals in soils are negatively charged and consequently attract ions with a positive charge such as calcium, magnesium, potassium, and sodium. Positively charged ions are called cations. Each cation competes with others in the soil solution for access to the bonding sites based on its valence and hydrated size. Every soil has a definite capacity to adsorb the positively charged cations. This is termed the cation exchange capacity (CEC). The various adsorbed cations (such as calcium and sodium) can be exchanged one for another and the extent of exchange depends upon their relative concentrations in the soil solution (dissolved), the ionic charge (valence), the nature and amount of other cations, etc. ESP is, accordingly, the amount of adsorbed sodium on the soil exchange complex expressed in percent of the cation exchange capacity in milliequivalents per 100 grams of soil (meq/100 g). Thus,

$$\text{ESP} = (\text{exchangeable sodium} / \text{cation exchange capacity}) \times 100.$$

Sodic soil conditions arise when greater than 15 percent of the ions bonded to the deck are sodium, which has a +1 valence and a large hydrated radius. When the ESP exceeds 15, the large hydrated sodium ions can wedge in-between the individual cards and cause "swelling" of the deck (Levy et al., 1998). This causes negative effects on the physical structure of the soil. Upon re-wetting, the individual decks may disperse and settle into soil pores, effectively clogging them and reducing the efficiency of air exchange, water infiltration, and permeability (i.e., hydraulic conductivity). In general, soils with moderately high, to high, clay contents are at higher risk.

Excessive adsorbed or exchangeable sodium can result from sustained use of irrigation water that is high in sodium and low in calcium and magnesium. Consequently, the ratio of sodium to calcium and magnesium ions in water is an important property affecting the infiltration and permeability hazard. The water quality index used to measure the hazard related to sodium abundance or sodicity in irrigation water is the sodium adsorption ratio or SAR.

The SAR is the ratio of the dissolved sodium concentration in water divided by the square root of the average calcium plus magnesium concentration. The SAR can be calculated from the sodium, calcium and magnesium concentrations via the formula:

$$\text{SAR} = [\text{sodium}] / (([\text{calcium}] + [\text{magnesium}])/2)^{1/2}$$

where the concentrations are in milliequivalents per liter (meq/L).

What is not apparent from the SAR formula is the fact that the higher the salinity of the water, the higher the SAR can be without impacting soil structure and impairing soil infiltration and permeability. Put another way, for a given SAR, infiltration rates generally increase as salinity (measured by the EC) increases. The changes in soil infiltration and permeability occur at varying SAR levels, higher if the salinity is high, and lower if the salinity is low. Therefore, in order to evaluate the sodicity risk of irrigation water, the EC must be considered. To this end,

the SAR-EC guidelines presented in Ayers and Westcot (1985) and Hanson et al. (1999) are used to assess the potential sodicity risk of irrigation water.

**The ESP-SAR Relationship for Soils in Northeastern Wyoming**

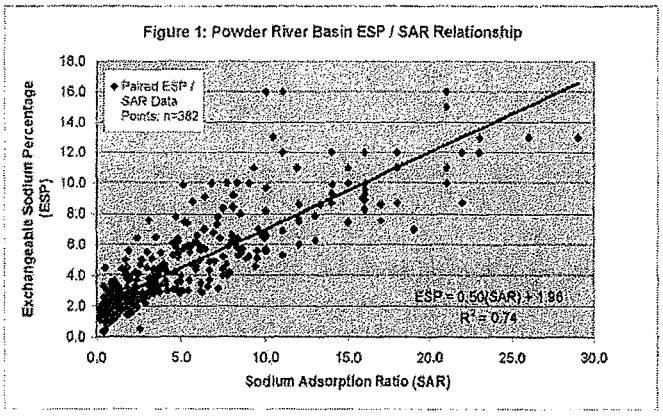
In addition to measuring the SAR of irrigation water, one can also measure the SAR of the soil solution via a saturated paste extract (i.e., the dissolved concentrations of sodium, calcium, and magnesium are measured in a saturated paste extract and applied via the SAR formula presented above). The soil SAR was developed to serve as a rapid and relatively inexpensive index of ESP. It is widely accepted that the SAR of the soil in equilibrium with the SAR of the irrigation water is equal to the long-term average SAR of the irrigation water.

The fourth draft of the Agricultural Use Protection Policy includes a proposed SAR cap of 10 for Tier 1 default effluent limits. To evaluate the appropriateness of the proposed cap, an analysis was performed using 382 ESP-SAR data pairs generated from ongoing soils assessment work in the Powder River Basin of Wyoming (KC Harvey LLC, 2006). This database represents flood plain soils associated with tributaries to the Powder River and the Tongue River, including spreader dike irrigated fields. This database represents baseline soil chemical conditions. In no case were any of these soils irrigated with or influenced by coalbed natural gas produced water. The soil samples from which the analyses were made were collected during soil profile descriptions to five feet, and with a Giddings hydraulic probe up to eight feet in depth. The numerous soil investigations involved were required for various coalbed natural gas water management planning, permitting, and design purposes.

The ESP-SAR data pairs were graphed in Microsoft Excel using simple scatter-plot and trend line analysis. The best fit line resulted in a linear regression which yielded the equation:

$$ESP = 0.5(SAR) + 1.96, \text{ with an } R^2 \text{ value of } 0.74.$$

The regional-specific "Powder River Basin" relationship, based on 382 soil samples, is shown on Figure 1. According to the Powder River Basin equation, a soil SAR of 26 corresponds to the critical ESP threshold of 15 percent.




It is widely accepted that the SAR of soil in equilibrium with irrigation water equals the long-term average SAR of irrigation water. Recent Department of Energy funded research directed by Dr. James Bauder at Montana State University (Robinson and Bauder, 2003) confirms this relationship. Their research, which is related to the potential effects of coalbed natural gas produced water on soils, reports that in general, soil solution SAR

represents the SAR of the applied water. The 1:1 soil SAR to water SAR relationship allows one to relate the SAR of discharge water to the SAR of the soil in the Powder River Basin ESP-SAR graph and equation described above. For example, after long-term irrigation with water exhibiting an SAR of 15, the equilibrated ESP of the irrigated soil would be approximately 9.5 percent. The proposed SAR cap of 10 would equate to a corresponding ESP of 7. An ESP cap of 7 appears to be unnecessarily conservative given the regional specific relationship of ESP and SAR. While an ESP threshold of 15 is widely accepted to be the point at which clay swelling and dispersion occurs, we respectfully suggest that the WDEQ consider establishing a Tier 1 default SAR effluent limit cap of 16, which corresponds to an ESP of 10. An ESP value of 10 provides a 33 percent margin of safety.

**The Effect of Rainwater Leaching on Soils Irrigated with Produced Water**

In his December 5, 2005 letter, Dr. Munn indicates his concern about the potential effects of rainwater leaching of fields that had received produced water due to upstream permitted discharges. In particular, what is the effect of leaching on the sodicity status and hydraulic function of soils after discharge and irrigation with produced water ceases? Fortunately, the considerable research on this subject has been well documented in the scientific literature.

Discontinuation of produced water discharge in the Powder River Basin will effectively reduce the EC and SAR of irrigation waters from tributaries and mainstems so long as the surface water is of higher quality than the produced water. In the case of fields that are irrigated opportunistically (e.g., in response to runoff events that are captured behind spreader dike systems), there can be three sources of water supplying soil moisture: (1) meteoric water (rain and snowmelt); (2) natural runoff water; and (3) subirrigation from a shallow aquifer. In the case of rainfall and snowmelt, the EC of these waters will be similar to that of distilled water, i.e., they will exhibit very low dissolved solids. Owing to the dissolution of soluble constituents within the watershed, natural runoff EC values can range up to 5 dS/m or higher. Regarding subirrigation, shallow aquifers can be relatively saline due to the entrainment of dissolved minerals along the groundwater flowpath.

The concern arises from leaching of residual surface soil salinity with rainfall and snowmelt. Intermittent rainfall and snowmelt may lower the electrolyte concentration (i.e., EC) sufficiently to promote clay dispersion, depending on soil properties (Levy et al., 1998). Conversely, when the electrolyte concentration in the soil solution reaches a moderate level (1-2 dS/m), high sodicity levels (ESP between 10 and 30) cause only small to moderate changes in the physical and hydraulic properties of the soils, which are mostly reversible (Levy et al., 1998). Shainberg et al. (1981) showed that a major factor causing differences among various sodic soils in their susceptibility to hydraulic failure when leached with low electrolyte concentrations (i.e., a low EC) was their rate of salt release from mineral dissolution.

Arid land soils can release 0.3 to 0.5 dS/m of calcium and magnesium to solution as a result of the dissolution of plagioclase, feldspars, hornblends and other sparingly soluble minerals within the soil matrix (Rhoades et al. 1968). The solution composition of a calcareous soil at a given ESP in contact with distilled water (i.e., rainwater or snowmelt) can be calculated (Shainberg et al., 1981). As calcium carbonate ($CaCO_3$) dissolves, the EC of the soil solution increases and

calcium replaces sodium on exchange sites until the solution is in equilibrium with the cation exchange system and the $CaCO_3$ solid phase. Shainberg et al. (1981) calculated that the EC values of solutions in equilibrium with soils having ESP values of 5, 10, and 20 are 0.4, 0.6, and 1.2 dS/m, respectively. Shainberg et al. (1981) indicates that these concentrations are sufficient to counter the deleterious effects of exchangeable sodium, even when the soil is leached with rainwater.

It is evident that water equilibrated with a calcareous soil can never be a very low salinity (Shainberg et al., 1981). Using the same database discussed above for evaluation of the ESP-SAR relationship in 382 soil samples from the Powder River Basin, we can compute an average percent lime ($CaCO_3$) content in surface soil samples (n=81), which is 5.1 percent. This represents a considerable reserve of calcium. Other sources of calcium include residual gypsum ($CaSO_4$) which we know to be prevalent in Wyoming soils.

Various soil SAR-EC relationships (not to be confused with irrigation water SAR-EC relationships) have been reported in the literature by introducing low electrolyte concentration waters to sodic soils. Felhendler et al. (1974) measured the hydraulic conductivity of two montmorillonitic soils as a function of the SAR and found that both were only slightly affected by the SAR of the percolating solution up to a SAR of 20 as long as the concentration of the percolating solution exceeded 1 dS/m. Shainberg et al. (1981) studied the effects of leaching a 1:1 sand-soil column with distilled water and increasing concentrations of a weak electrolyte solution. His findings concluded that an electrolyte concentration of 0.3 dS/m in the percolating solution was adequate to prevent the adverse effects of a SAR of 15 on the hydraulic conductivity of the soil-sand mixture. These findings are very similar to the conclusions of the U.S. Salinity Laboratory Staff (1954) who used electrolyte concentrations equal to or greater than 0.3 dS/m in their regression analysis to determine the sodic soils threshold of ESP = 15.

As a review, an electrolyte concentration of 0.3 dS/m is the minimum value of calcium and magnesium contributions to soil solution associated solely to arid soil weathering. This suggests that an arid Powder River Basin soil with a SAR of 16 (ESP = 10), will have no sodicity related impacts to the hydraulic conductivity, even when the salt concentration of the irrigation or rainwater is equal to that of distilled water.

Of course, irrigation water in the Powder River Basin has an intrinsic electrical conductivity greater than that of distilled water. Use of surface water for irrigation will actually supplement the inputs of calcium and magnesium from weathering and carbonate dissolution alone.

Using the aforementioned Powder River Basin soils assessment database (KC Harvey LLC, 2006), an average surface soil ECe of 1.64 dS/m was calculated from 81 individual surface soil samples. This value suggests that electrolyte concentrations in surface soils of the Powder River Basin, in equilibrium with mineral dissolution, the salinity of runoff irrigation water, and rainwater/snowmelt, is about 1.6 dS/m, or five times (1.6 dS/m divided by 0.3 dS/m) the concentration required to maintain the hydraulic conductivity of a soil at an ESP of 16.

**Closing Statement**

Results of the Powder River Basin regression analysis indicates that a relationship between ESP and soil/water SAR exists, which allows the calculation of one parameter from the other. Using the proposed, default ESP cap of 10 percent, the scientific literature indicates that water with a SAR of 16 can be effectively used for irrigation without adverse effects on the physical structure or hydraulic conductivity of Powder River Basin soils during irrigation. Furthermore, it has been shown that inputs of Ca and Mg from the natural dissolution of plagioclase, feldspars, hornblends and other sparingly soluble minerals, especially calcium carbonate and gypsum, will provide an effective buffer to residual soil sodicity after the discontinuation of produced water discharge and the transition back to native irrigation, precipitation, and runoff regimes.

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* * * * *

Thank you very much for your time and consideration of this review and the recommendations stemming from it. If you, your WDEQ colleagues, or the members of the Water and Waste Advisory Board have any questions or comments regarding our findings, please contact me.

Sincerely,

Kevin C. Harvey, M.Sc., CPSSc.
Principal Soil Scientist

KC HARVEY, LLC
SOIL AND WATER RESOURCE CONSULTANTS

May 4, 2006

Mr. Bill DiRienzo
Wyoming Department of Environmental Quality
Water Quality Division
Herschler Building, 4th Floor West
122 West 25th Street
Cheyenne, Wyoming 82002

Subject: Comments pertaining to the derivation of default effluent limits for EC in the Draft Section 20 Agricultural Use Protection Policy.

Dear Mr. DiRienzo:

I respectfully submit for your consideration the following comments regarding the fourth draft of the Section 20 Agricultural Use Protection Policy as it pertains to the derivation of default effluent limits for EC. These comments are being submitted on behalf of Yates Petroleum Company, Williams Production RMT Company, Petro-Canada Resources (USA) Inc., Marathon Oil Company, Lance Oil & Gas Company, Inc., Fidelity Exploration & Production Company, Devon Energy Production Company L.P., Bill Barrett Corporation, and Anadarko Petroleum Corporation. I have submitted additional comments regarding the derivation of SAR limits and the proposed SAR cap to you in a separate letter.

By way of introduction, I am a board-certified professional soil scientist having practiced as an environmental consultant in Montana and Wyoming, and throughout the world, for nearly 25 years. For the past seven years, my practice has focused on water management and soil and water salinity/sodicity issues associated with oil and gas development. I am credited as the first to research, develop, and apply managed irrigation techniques for the beneficial use of coalbed natural gas produced water. I have directed or participated in over 75 separate projects related to produced water management, WPDES permitting, soil and water chemistry investigations, and reclamation for coalbed and conventional natural gas projects in Wyoming, Colorado, and Montana. I have a M.S. degree in land rehabilitation (soil science emphasis) from Montana State University, and a B.S. in Resource Conservation (soil science emphasis) from the University of Montana.

I would like to comment on the proposed changes made to the Agricultural Use Protection Policy by the WDEQ subsequent to the January 26, 2006 meeting of the Water and Waste Advisory Board. My comments will focus on the comments provided by Dr. Larry Munn in his letter to the DEQ dated December 5, 2005. It is my understanding that Dr. Munn's comments resulted in the changes made to the proposed Policy. Specifically, I comment on Dr. Munn's request that the California-based soil salinity tolerance thresholds be used to establish default effluent limits for electrical conductivity (EC) under the Tier 1 process.

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**Summary of Findings**

The fourth draft of the Agricultural Use Protection Policy describes a 3-tiered decision making process for deriving appropriate effluent limits for EC and SAR whenever a proposed discharge may reach irrigated lands. The Tier 1 process would be followed for deriving "default" limits, and as such, this procedure would require a minimum of background information from the applicant. Specifically, the default EC limits would be based on the species-specific 100 percent yield potential values for soil EC reported by the USDA Agricultural Research Service (ARS) Salt Tolerance Database (USDA ARS, 2006).

Alfalfa is considered to be the most salt sensitive plant irrigated in northeastern Wyoming. Given this, my comments focus on the relevant information regarding alfalfa salinity tolerance. The ramifications of the concepts and data discussed herein for alfalfa can be applied to the more tolerant irrigated forage species commonly found in northeastern Wyoming, for example, western wheatgrass and smooth brome.

A considerable amount of research went into preparing these comments, including three months searching and reviewing the relevant scientific literature, and compiling and analyzing available and relevant soil, plant, and water data. The key conclusions of the literature review and data analysis are presented below and will be substantiated by the discussion that follows.

<u>California Based Salinity Thresholds</u>

- The ARS Salt tolerance database relies on California based salinity thresholds developed to approximate the specific plant, soil and environmental variables associated with that region.

- Regional differences in soil chemistry, climate and agricultural practices are likely to have a profound effect on the applicability of California based salinity threshold data to alfalfa growing in Wyoming.

<u>Chloridic Versus Sulfatic Soils</u>

- The natural soil salinity in the Powder River Basin is dominated by the sulfate ion; California soils are dominated by chloride. This conclusion is supported herein by the literature and by an evaluation of actual soil chemistry data provided by the USDA National Soil Survey Center.

- The term "gypsiferous" refers to sulfatic soils and is applicable to the Powder River Basin of Wyoming. Numerous documents, including the ARS Salt Tolerance Database, indicate that in sulfatic (or "gypsiferous") soils, plants will tolerate about 2 dS/m higher salinity than indicated.

The Influence of Soil Salinity on Alfalfa Yield

- Alfalfa is considered the most salt sensitive plant irrigated in northeastern Wyoming. Conditions required for the growth of alfalfa at 100 percent of its physiological yield potential probably do not exist anywhere in northeastern Wyoming and place doubt on the application of this benchmark value there.

- Sources of research and field guidance outside of California suggest alfalfa has a higher relative 100 percent yield soil EC tolerance than 2 dS/m, perhaps as high as 4 to 8 dS/m.

- Alfalfa yield comparisons between California and Wyoming show actual harvest values independent of soil salinity. Identical yields were reported in Wyoming for soil EC values ranging from 1.8 dS/m to 6.5 dS/m.

Based on the review summarized herein, we respectfully suggest that the WDEQ consider adopting an acceptable average root zone EC threshold of 4 dS/m for protection of alfalfa. This would equate to a default (Tier 1) effluent limit of 2.7 dS/m based on the 1.5 concentration factor cited by the draft Agricultural Use Protection Policy. The EC limits for protecting other species of concern in the Powder River Basin, e.g., western wheatgrass, should also be adjusted accordingly, based on the inherent differences in soil chemistry and climate between the northern Great Plans and the California agricultural areas. These conclusions and recommendations are substantiated by the discussion below.

**California-based Salinity Thresholds**

The majority of salinity tolerance data generated in the United States have been a product of field and laboratory trials conducted by the U.S. Salinity Laboratory (USSL) in Riverside, California. The salinity tolerance data generated by the USSL were prompted in response to agricultural production in the areas of the San Joaquin and Imperial Valleys of California. In 1977, Maas and Hoffman compiled the California research in a seminal article titled "Crop Salt Tolerance -- Current Assessment," listing salt tolerance levels for various crops. The subsequent year, Francois and Maas (1978) published an indexed bibliography of plant responses to salinity from 1900 to 1977 with 2,357 references to about 1,400 species. These articles serve as the primary references regarding crop tolerance and yield potential of selected crops as influenced by irrigation water ($EC_w$) or the average root zone soil salinity level ($EC_e$). This information was updated by Mass (1990). The ARS Salt Tolerance Database relies entirely on the Mass (1990) summary as the primary source of relative salt tolerance levels among crops. With respect to alfalfa, the original salt tolerance listings remain unchanged from the original Mass and Hoffman (1977) article.

The Mass and Hoffman (1977) and Mass (1990) listings of salt tolerance levels include the establishment of the 100 percent yield threshold for soil salinity. This value refers to the maximum allowable average root zone salinity level ($EC_e$) that results in no yield reduction for crops grown in chloritic soils. The term chloritic soil refers to the dominant salt type found in California soils (see below). For alfalfa, Mass and Hoffman (1977) and Mass (1990) list the 100 percent yield potential for alfalfa grown in chloritic soils as 2.0 dS/m ($EC_e$). The Mass and

Hoffman (1977) and Mass (1990) assessments also contain a disclaimer that the yield potentials listed should only serve as a guide to relative tolerances among crops, and that the absolute salt tolerance of crops is not simply a function of soil EC but is dependent on "many plant, soil, water, and environmental variables."

Six studies conducted at the US Salinity Laboratory in Riverside, California, served as the foundation for the determination of Maas and Hoffman's 2.0 dS/m threshold value (Gauch and Magistad, 1943; Brown and Hayward, 1956; Bernstein and Ogata, 1966; Bower et al., 1969; Bernstein and Francois, 1973; Hoffman et al., 1975). These studies vary in their methodology, including greenhouse and field experiments, different growth mediums (sand, gravel and soil), various watering regimes (automatic watering, tension-based watering), and multiple sources of chloritic salinity (NaCl, $CaCl_2$, and $MgCl_2$). These studies were designed to assess relative yield values, irrigation leaching fractions, root zone salt profiles, or salinity-ozone interactions. They were not specifically designed to determine a threshold salinity value for alfalfa. Usually, only four salinity levels were tested, with data used to produce a crop yield reduction line.

Furthermore, the source of salinity in the six studies was consistently chloride dominated, with either NaCl or a blend of NaCl, $CaCl_2$, and $MgCl_2$ added to the irrigation water. In Southern California, where these studies occurred, salts found in the soils are largely chloride-dominated. None of these studies were conducted using sulfate-dominated salts, such as are found in Wyoming soils (see below). Such regional differences in soil salinity are likely to have a profound effect on the application of existing salinity threshold data to alfalfa growing in the Northern Great Plains. Recognizing this, Mass (1990), Ayers and Westcot (1985), Hanson et al. (1999), as well as the ARS Salt Tolerance Database, all indicate that plants grown in sulfatic soils will tolerate average root zone $EC_e$ values about 2 dS/m higher than indicated by each of these references. For alfalfa, this would equate to a 100 percent yield threshold of approximately 4 dS/m. This fact is discussed in detail below.

**Chloridic Versus Sulfatic Soils**

Research efforts of the USSL in California identified adjustments in effective plant salinity tolerance expressed or repressed in the field by physiological responses to climate, cultural practices, soil fertility, irrigation methods, physical condition of the soils and the distribution and speciation of salts within soil profiles. A critical difference between the environmental conditions in California and the northern Great Plains (including northeastern Wyoming) is soil chemistry and the primary salt constituents found in these soils. It is widely accepted that the soils of the agricultural areas of California are dominated by salts where chloride is the dominant anion, and that the soils of the northern Great Plains are dominated by salts where sulfate is the dominant anion. In earlier publications, sulfatic soils are sometimes termed "gypsiferous," referring to the most common sulfate salt found in semi-arid soils -- gypsum (calcium sulfate dehydrate). The correct term used today is sulfatic soils.

To incorporate the variation of salinity tolerance exhibited by plant response to different salt distributions and dominant salt species, the authors of salt tolerance research included a provision for sulfatic soils. Soils may contain amounts of sparingly soluble salts, such as gypsum and other sulfate salts, many times greater than can be held in solution in the field water-

content range. Sulfatic soils may appear to be saline when exhaustively extracted in the lab (i.e., saturated paste extract), but the in-situ soil solution may be nonsaline because of the limited solubility of gypsum and other sulfate salts (Bernstein, 1975). Thus, the EC measured in a saturated paste extract is higher than the actual concentration of salts seen by plants in sulfatic soils. It was suggested originally by Bernstein (1962) that plants will tolerate about 2 dS/m higher soil salinity ($EC_e$) than indicated in sulfatic soils due to this solubility effect. Since calcium sulfate is disproportionately dissolved in preparing saturated-soil extracts, the $EC_e$ of sulfatic soils will range an average of 2 dS/m higher than that of chloritic soils with the same water conductivity at field capacity (Bernstein 1962). Therefore, plants grown in sulfatic soils will tolerate an $EC_e$ of approximately 2 dS/m higher than those grown where chloride is the predominant ion (Maas, 1990). This narrative provision for sulfatic soils is included in the ARS Salt Tolerance Database, and the classic irrigation guidelines presented in Ayers and Wescot (1985).

Sulfatic soils are the rule not the exception in Wyoming and the northern Great Plains. Sulfatic soils identified by salinity tolerance references are characterized by the presence and influence of gypsum, or calcium sulfate dihydrate ($CaSO_4 \cdot 2H_20$), within the soil profile, as well as the geological and climactic prerequisites for sulfatic soil conditions. Soil gypsum may stem from one of several sources. Soils formed from geologic material containing anhydrite or gypsum often contains gypsum. The amount of rainfall and the topographic setting will strongly influence the amount and location of gypsum in the soil (Dixon and Weed, 1989). Accumulations of soluble salts, including sulfates in the surface layers, are characteristic of saline soils of arid and semiarid regions (Brady, 1974), including Wyoming. Research conducted by the U.S. Geological Survey confirms the presence of gypsiferous parent materials in the Powder River Basin (Johnson, 1993). At this point, it is important to differentiate between the soil taxonomic terms "gypsic" or "petrogypsic," which are used to describe significant gypsum accumulation within soil horizons, from the terms "gypsiferous" or "sulfatic" soils which refer to the dominate salt type in soils of Wyoming and the northern Great Plains.

Published research has addressed the issue of prevailing salt distribution and climate influenced salt dominance. In Springer et al. (1999), Curtin et al. (1993) and Trooien (2001), northern Great Plains prairie soil chemistry is comparatively summarized and/or contrasted to soils of California. Research suggests that recommendations developed for the western United States, where chloride is the major anion in soil and water chemistry, may not be appropriate for sulfatic soils (Springer et al., 1999). Trooien (2001) notes that most plant salinity tolerance information is developed in California and that the chemistry of salinity is different in the northern Great Plains (i.e., sulfate dominated salinity). Therefore, Trooien (2001) indicates that salinity thresholds are greater and yield losses are somewhat smaller in the Northern Great Plains compared to those of California (i.e., chloride dominated salinity). Research in Canadian prairie soils by Curtin et al. (1993) and Wentz (2001) suggest that salt tolerance testing at the Swift Current, Saskatchewan, salinity laboratory (and also at the US Salinity Laboratory) has mostly involved the determination of crop responses to chloride salinity. However, there is reason to suspect that responses to sulfate salinity, which is the predominant form of salinity in prairie soils, may differ from those observed in chloride salt systems. Wentz (2001) summarizes that crop tolerances developed for chloride dominated soils, such as those in California, may not be applicable to crops grown on the sulfate dominated soils typically found in western Canada.

Comparison of actual soil analytical data from the NSSC Soil Survey Laboratory, Lincoln, Nebraska, supports the chloride and sulfate salt dominance designations suggested by Springer et al. (1999), Curtin et al. (1993), Trooien (2001), and Wentz (2001). Analyses from the U.S. Soil Survey Laboratory are available online at http://ssldata.nrcs.usda.gov/ and organized by soil pedon. Data from selected counties in Wyoming and California were obtained from the NSSC Soil Survey Laboratory Research Database in order to determine the dominance of chloride or sulfate soil chemistry in the respective regions. Soil chemistry data were downloaded for use in this study for counties of the Powder River Basin in Wyoming (Sheridan, Campbell and Johnson Counties). Soil chemistry data were also downloaded for counties in California where intensive agricultural production takes place (Imperial, Fresno, Kern, Kings and Tulare).

Data pertaining to soil chloride and sulfate in the saturated paste extract are arranged and averaged by county and state in Table 1 below. These values are based on all of the available data provided by the U.S. Soil Survey Laboratory.

**Table 1**
**A Comparison of Average Soil Saturated Paste Extract Sulfate and Chloride Levels from Counties in Wyoming and California.**

| County | Average Soil Sulfate Level (meq/L) | Average Soil Chloride Level (meq/L) |
|---|---|---|
| Sheridan, WY | 14.9 | 4.1 |
| Campbell, WY | 130.4 | 3.0 |
| Johnson, WY | 30.9 | 1.8 |
| **Wyoming Average** | **58.7** | **2.9** |
| Imperial, CA | 48.4 | 295.7 |
| Fresno, CA | 98.6 | 26.3 |
| Kern, CA | 44.3 | 73.0 |
| Kings, CA | 110.7 | 23.9 |
| Tulare, CA | 9.3 | 21.6 |
| **California Average** | **62.3** | **88.1** |

The summary data suggest that the relative proportion of chloride salts in the selected California counties outweigh the proportion of sulfate salts and verify the chloride dominance suggested by the literature summarized above. In northeastern Wyoming, the relative proportion of sulfate salts in selected counties outweigh the proportion of chloride by an order of magnitude and verify the sulfate dominance and sulfatic conditions implied by the literature. Therefore, the recommendation by the ARS Salt Tolerance Database signifying that plants grown in sulfatic soils will tolerate average root zone $EC_e$ values about 2 dS/m higher than indicated, is valid for the Powder River Basin, and probably all of Wyoming. For alfalfa, this would equate to a 100 percent yield threshold of 4 dS/m.

**The Influence of Soil Salinity on Alfalfa Yield**

As indicated above, the *relative* 100 percent yield potential reported for alfalfa in the ARS Salt Tolerance Database is 2 dS/m ($EC_e$). As such, alfalfa is regarded in the California-based literature as "moderately sensitive" to salinity. An *absolute* salinity tolerance would reflect predictable inherent physiological responses by plants, but cannot be determined because interactions among plant, salt, water and environmental factors influence the plant's ability to tolerate salt. *Relative* salt tolerance is a value based on the climatic and cultural conditions under which a crop is grown (Maas and Hoffman, 1977). Research generated outside the U.S. Salinity Laboratory in the U.S. and Canada has introduced alternative salinity tolerance values for alfalfa influenced by these climatic and cultural conditions.

In a study based on field trials in western Canada, McKenzie (1988) reported the "relative maximum salinity crops will tolerate when combined with intermittent moisture stress throughout the growing season." McKenzie (1988) places alfalfa within a moderate tolerance category, as opposed to moderate sensitivity, and extends alfalfa's 100 percent yield tolerance to an EC range of 4-8 dS/m, as opposed to 2 dS/m. Similar tolerance descriptors and EC values for alfalfa can be found associated with Britton et al. (1977), who supports moderate salt tolerance and an EC range of 5-10 dS/m for alfalfa. Likewise, Milne and Rapp (1968) present alfalfa with a moderate tolerance and an EC range of 4-8 dS/m. Cavers (2002); Wentz (2001); Schafer (1983); Holzworth and Wiesner (1990) and Dodds and Vasey (1985) also contribute to a departure from the established Maas classification of alfalfa salinity tolerance and threshold values. Bower et al., suggests an alfalfa tolerance somewhat between the previous authors and Maas (1990), suggesting maximum alfalfa yield is obtained when the average $EC_e$ value for the root zone is 3 dS/m. Using salinized field plots in southern Saskatchewan, Holm (1983) reported a small, 0.037 ton/acre, reduction in alfalfa yields resulting from an increase in the surface $EC_e$ (0 to 15 cm sample) from a 0 to 4 dS/m range to a 4 to 8 dS/m range. Holm presented these scales as representative of low and medium EC levels.

Relative salinity tolerances reported outside of peer reviewed literature stem from professional observations and judgments, roundtable discussions, experience in the field, and experience with the region, culture and climate; not from experimental data. Incorporation of field experience, observation, and limited data into supporting documents of the Salt Tolerance Database is acknowledged in Ayers and Wescot (1985). Alternative sources listed herein do not always report EC values in terms of 100 percent yield thresholds for alfalfa, but should not be discounted, as they pertain to what is realistic in the field. As an example, the Montana Salinity Control Association reports forage salt tolerances in terms of marginal establishment levels, not 100 percent yield potentials. Conditions allowing alfalfa to produce at 100 percent of its physiochemical yield potential probably do not exist anywhere within the northern Great Plains.

A suggested field-yield value corresponding to the 100 percent yield of alfalfa has never been reported by authors of salinity literature. Specifically, what yield of alfalfa, in tons per acre, could one expect if it was grown under conditions supporting 100 percent yield? Conditions supporting 100 percent alfalfa yields recommended by the ARS Salt Tolerance Database and its supporting documents would be: a soil $EC_e$ of 2 dS/m or less, an irrigation water $EC_w$ less than or equal to 1.3 dS/m, water contents maintained at field capacity, available N, P and K nutrient

levels maximized for alfalfa growth, a sufficiently long growing season, no associated phytotoxicity or pest issues, etc. This data limitation precludes the direct comparison of alfalfa yields generated in an agricultural area to the potential yields theoretically available under optimized conditions. The only available analysis is to compare an alfalfa yield to the average yield generated in its area, or generated between areas.

Using data available from the National Agricultural Statistics Service, selected county agricultural commissioner's data, and the U.S. Census of Agriculture (2002, 1997), irrigated alfalfa yield data were obtained for periods of interest. Alfalfa yield data for Wyoming counties are available from 1959 through 2005, but were averaged from 1970-2005 to reflect the integration of new irrigation technologies. Alfalfa yield data were summarized for the area encompassing the Powder River Basin: Sheridan, Johnson and Campbell counties. Alfalfa yield data for California counties are available from 1980-2004 so the entire dataset was averaged. Alfalfa data were summarized for counties in California related to intensive agriculture: Imperial, Fresno, Kern, Kings and Tulare counties.

Soil salinity data (as measured by EC) collected by the USDA National Soil Survey and analyzed by the National Soil Survey Center (NSSC) Soil Survey Laboratory were also obtained and summarized for the aforementioned counties. Average root zone EC values were calculated to a maximum depth of five feet. The county alfalfa yield and average root zone EC summaries are presented in Table 2 below.

**Table 2**
**Comparison of Average Root Zone Soil Salinity (EC) Values with Historical Alfalfa Yields for Selected Counties in Wyoming and California.**

| County | Average Root Zone Soil Salinity (EC as dS/m) | Historical Average Alfalfa Yield (tons/acre) |
|---|---|---|
| Sheridan, WY | 1.5 | 2.7 |
| Johnson, WY | 1.9 | 2.4 |
| Campbell, WY | 2.0 | 2.4 |
| **Wyoming Average** | **1.8** | **2.5** |
| Tulare, CA | 2.8 | 8.4 |
| Kings, CA | 6.9 | 6.9 |
| Kern, CA | 4.6 | 8.0 |
| Fresno, CA | 6.7 | 7.9 |
| Imperial, CA | 6.7 | 7.8 |
| **California Average** | **5.5** | **8.0** |

Values expressed in Table 2 show substantially higher average root zone salinities in California than in Wyoming. Alfalfa yields reported in California are three times greater than those in Wyoming, even though, on average, the soil salinity values are nearly three times higher than those reported for the Wyoming counties. The values generated in this exercise suggest that environmental factors other than salinity, e.g., climate, may be dictating the obtainable degree of alfalfa yield produced. However, the data also suggest that the California-based 100 percent yield threshold of 2 dS/m may not be appropriate for even the chloritic soils of California. For

example, the historical average yield of alfalfa in Tulare County is 8.4 tons per acre with a corresponding average root zone EC of 2.8 dS/m. The yield from Tulare County is actually slightly greater than the yields from Fresno and Imperial Counties where the corresponding average root zone EC values are substantially higher at 6.7 and 6.7 dS/m, respectively. Regardless, there does not appear to be a substantial difference in yields reported by the California counties with soil EC values ranging from 2.8 to 6.7 dS/m.

Other field data from Wyoming have been reviewed that also suggest an alternative to the California-based salinity tolerance values. The Use Attainability Analysis (UAA) report for Cottonwood Creek (SWWRC et al., 2002) was downloaded from the Wyoming Department of Quality, Water Quality Division webpage. Cottonwood Creek is located in Hot Springs County within the Bighorn Basin of Wyoming. This is an area of extensive conventional oil and gas production. According to the UAA report, discharge of produced water from the Hamilton Dome oil field to Cottonwood Creek constitutes the majority of flow to the ephemeral stream and constitutes the only irrigation water source for approximately 35 ranching operations. The waters of Cottonwood Creek exhibit an $EC_w$ between 4.1 and 4.5 dS/m. At an average $EC_w$ of 4.3 dS/m, an average root zone soil $EC_e$ value can be calculated using the widely accepted relationship: $EC_e = 1.5\ EC_w$ (Ayers and Wescot, 1985). This relationship is expressed in the draft Section 20 Agricultural Use Protection Policy. From this relationship, an average root zone soil EC value of 6.5 is estimated for the fields irrigated long-term with water from Cottonwood Creek. Average alfalfa hay yields reported in the UAA amount to 2.5 tons per acre. This yield is identical to the average of the three Wyoming counties reported in Table 2 above. This is compelling given that the average soil EC value for the three other Wyoming counties is 1.8 dS/m, while the estimated soil EC for the fields irrigated with water from Cottonwood Creek is 6.5.

**Closing Statement**

Based on the review summarized herein, we respectfully suggest that the WDEQ consider adopting an acceptable average root zone EC threshold of 4 dS/m for protection of alfalfa. This would equate to a default (Tier 1) effluent limit of 2.7 dS/m based on the 1.5 concentration factor cited by the draft Agricultural Use Protection Policy. Other species of concern, including western wheatgrass, should be given equal consideration due to the inherent differences in soil chemistry between the northern Great Plains and the California agricultural areas for which the ARS Salt Tolerance Database is based. Factors such as extreme climate, periodic drought, soil moisture regime, duration of growing season, soil depth, and fertility limitations can collectively exert an overriding regional influence on the yield potential of forage crops. Based on this, we ask that the WDEQ exercise caution interpreting the applicability of specific salinity tolerances outlined by the ARS Salt Tolerance Database and thoughtfully consider the difficulty in detecting a "measurable" change in plant production due to soil salinity alone.

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Thank you very much for your time and consideration of this review and the recommendations stemming from it. If you, your WDEQ colleagues, or the members of the Water and Waste Advisory Board have any questions or comments regarding our findings, please contact me.

Sincerely,

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**BEFORE THE ENVIRONMENTAL QUALITY COUNCIL**
**STATE OF WYOMING**

| | | |
|---|---|---|
| IN RE: WATER QUALITY RULES AND REGULATIONS, CHAPTER 1, SURFACE WATER QUALITY (CHAPTER 1, APPENDIX H) | ) ) ) ) | Docket No. 06-3819 |

## COMMENTS OF MERIT ENERGY COMPANY

**COMES NOW** Merit Energy Company, by and through its counsel, Sundahl, Powers, Kapp & Martin, and respectfully submits the following comments to the Environmental Quality Council in the above-captioned matter. Merit appreciates the opportunity to submit comments on this important matter. For the reasons set forth below, Merit is opposed to Proposed Appendix H of the Water Quality Rules and Regulations, Chapter 1, Agricultural Use Protection.

Merit Energy Company holds NPDES and WYPDES permits in the Powder River Basin for CBM produced water. Merit also has a major production facility at Hamilton Dome in the Big Horn Basin that produces roughly 270,000 barrels of water each day. This water has been extensively put to beneficial use for both livestock and irrigation and provides economic benefits for Hot Springs County, as well as environmental benefits for Wyoming's wildlife. As such, it is imperative, in order to protect both the economy and the agricultural interests of this state, that the continued discharge of produced water be fully considered and protected. The proposed Agricultural Use Protection language jeopardizes the continued discharge of produced water in this state and all but bans any future discharges. Indeed, though it purports to be a necessary addition to Chapter 1 in order to protect agricultural uses, as a practical matter, Proposed

Appendix H will likely result in the cessation of produced water discharges and in turn, a net loss to the agriculture industry and the economy of Wyoming.

## ARGUMENT

### A. Proposed Appendix H Cannot Be Properly Adopted as a Rule at this Time

Merit has been following the development of this issue since the outset and is very concerned about the recent changes that have been encouraged by the Department of Environmental Quality. Namely, DEQ has determined, literally at the eleventh hour, that rather than proceeding with the adoption of the Agriculture Use Protection language as a policy, as it was developed for nearly two years, they wish to adopt it as a rule. This is not only contrary to the position that has been expressed since the policy was first presented for public comment, but would result in an inflexible and overly stringent approach to the permitting process, which by statute, is to be flexible and adaptive. For these reasons, Merit is opposed to the adoption of the Ag Use Protection language as a rule.

Throughout its development, including solicitation of public comment and recommendations from the Water and Waste Advisory Board, the proposed language of Chapter 1, Appendix H, was not considered as a rule. Rather, it has always been treated as a policy. Indeed, at the Advisory Board meeting on October 18, 2006, the issue of rule versus policy was brought up and discussed briefly. There, DEQ reiterated its position that they were merely proposing a policy to be used in guiding internal decisions of the Department when engaged in the permitting process. The Board responded favorably to this characterization and proceeded to consider the merits without further discussion. *See Minutes*. In December 2006, the DEQ did an about face, completely reversing its prior position and promoting Appendix H as a rule. Though the Board's recommendation to the Environmental Quality Council was to approve the Ag Use

Protection Policy, as amended to include the higher default limits for EC and SAR as proposed by Kevin Harvey, it was never considered as a rule and was not proposed as such for public comment.

On February 5, 2007, the Water and Waste Advisory Board again met to discuss the Agricultural Use Protection language. However, despite allowing public comment on the matter, the DEQ arbitrarily limited comments to the issue of whether the language should be continued as a policy or as a rule. Indeed, DEQ clearly indicated in its public notice that it would not consider comments as to the substantive issues of the proposed rule, but only with respect to the policy versus rule analysis. Following the public comments, the Water and Waste Advisory Board voted unanimously to recommend the Agricultural Use Protection language as a policy. Nevertheless, it appears that DEQ has chosen to ignore the Board's recommendation and proceed with the Chapter 1 rulemaking including Appendix H as a rule. Not only is this contrary to the recommendation of the statutorily created advisory board's recommendation, it is an improper attempt at rulemaking. As the public has not been given the proper opportunity to comment on the Ag Use Protection language as a rule, adoption of the language as such would violate the Wyoming Environmental Quality Act and the Wyoming Administrative Procedure Act.

Pursuant to W.S. § 35-11-114(b), the Water and Waste Advisory Board has the responsibility to "recommend to the council through the administrator and director the adoption of rules, regulations and standards to implement and carry out the provisions and purposes of the act." This role is reiterated by W.S. § 35-11-302(a), which details that the administrator of Water Quality Division cannot recommend to the Director of DEQ any rule, regulation, standard or permit system without first consulting with the Advisory Board. There is also very clear direction as to what the Board must consider in making its recommendations. Under W.S. § 35-

11-302(a)(vi), "the advisory board shall consider all facts and circumstances bearing upon the reasonableness of the pollution involved." This includes certain factors such as the practicability and the economic reasonableness of the regulation. The Board did not properly fulfill these responsibilities in the present case. Appendix H was never properly noticed and open for public comment as a rule, and any attempt to adopt it as such would be contrary to statute. The nature and effect of proposed Appendix H has completely changed by virtue of DEQ's decision to pursue it as a rule. Merit objects to the attempts by DEQ to avoid the requirements of the EQA and the WAPA by changing its position at this late date. Merit respectfully requests that the Council deny these attempts, and remand Appendix H to DEQ for proper rulemaking as a proposed rule, together with all its substantive portions.

Merit Energy Company is strongly opposed to the adoption of the Ag Use Protection language as a rule. The language in Proposed Appendix H is so vague and ambiguous that it precludes any attempt at consistent interpretation and application as a rule. In addition, its application is so completely shrouded by the Department's discretion that it is impossible to assess its full impact if adopted. Implementation of the recommendations of Appendix H as a rule would jeopardize the flexibility of the permitting process and would result in an overly restrictive regulatory scheme. Indeed, DEQ has recognized and even championed the importance of flexibility in this area in the comments it made to the Advisory Board. Adoption of Appendix H as a rule would require the Department to implement the language on a statewide basis and would not permit them to address different circumstances of agricultural use protection on a more localized, or specialized, level. Rather than protecting agricultural use, such an approach would be detrimental and would run afoul of the statutory powers of the DEQ. By

statute, the Administrator of Water Quality is to make recommendations to the Director as to how to address differing circumstances and areas of the state within the regulatory framework.

> (a) The administrators of the air quality, land quality and water quality divisions, under the control and supervision of the director, shall enforce and administer this act and the rules, regulations and standards promulgated hereunder. Each administrator shall have the following powers:
>
> ... (ix) To recommend to the director, after consultation with the appropriate advisory board, that any rule, regulation or standard or any amendment adopted hereunder may differ in its terms and provisions as between particular types, characteristics, quantities, conditions and circumstances of air, water or land pollution and its duration, as between particular air, water and land pollution services and as between particular areas of the state;

W.S. § 35-11-110(a)(ix). Adoption of the Ag Use Protection language as a rule would curtail this important power and would unnecessarily limit the Department's ability to apply the principles it contains in a flexible and effective manner. Considering the amount of time and effort that has been expended in promoting Appendix H as a policy, and in light of the inflexible and overly stringent effects it would have as a rule, it makes no sense to adopt it as a rule.

Merit wishes to reiterate that by encouraging the adoption of Appendix H as a policy and not a rule, it does not in any way waive any of its opposition to the Ag Use Protection language. Merit continues to oppose the changes and expansion of Chapter 1 Section 20 in its current form. However, faced with choosing the better of two evils, Merit Energy Company recommends that any attempt to apply Appendix H as a rule be summarily rejected. The Water and Waste Advisory Board has recommended that the Agricultural Use Protection language be pursued as a policy. In the alternative, the Board recognized that attempts to pursue the language as a rule should be subjected to a full notice and comment rulemaking period as such. It behooves this Council and the DEQ to seriously consider and apply the recommendations of the Board. Not only does adoption of the language as a rule divest the DEQ of the flexibility necessary to adapt

its principles to the various circumstances of the state, but the rulemaking provisions of the EQA and the WAPA have not been properly followed and any such rule would not be enforceable. For the reasons set out herein, Merit Energy Company respectfully requests that DEQ's proposal to adopt Appendix H as a rule be denied.

**B. Existing and Historic Discharges are not Adequately Protected**

As noted, Merit opposes the adoption of the Proposed Appendix H as a rule. In addition, there are specific issues created by the proposed language to which Merit is opposed regardless of the policy/rule distinction. One such issue is the attempt to provide for the continued use of existing discharges. While Merit desires that existing discharges be allowed to continue, the proposed language does not adequately provide such protection. The proposed language purports to protect historic discharges.

> Effluent limits on historic discharges of produced water will not be affected by this Appendix in relation to the protection of agricultural uses. Where discharges have been occurring for many years, the permitted quality of those discharges shall be considered to the "background" conditions and be fully protective of the agricultural uses that have developed around them. Therefore, it is not necessary to modify those discharges in order to achieve the goal of no measurable decrease in crop or livestock production. It would only be necessary to maintain the existing quality of the discharge. It is important to note, however, that effluent limits on historic discharges may be made where the quality of the discharge is shown to constitute a hazard to humans, livestock or wildlife.

Proposed Appendix H, pg H-2, lines 20-23. While this language appears, on its face, to be protective of historic discharges, the language is vague and may not be sufficiently protective. For example, nowhere is the term "historic discharges" defined. It is questionable at best how long a discharge must be in existence before it would be considered "historic." It is conceivable, indeed likely, that some discharges will be put to beneficial use immediately, thus developing agricultural uses around them as conceived in the language. However, when does a discharge become "historic" and subject to the protections of this section? Also questionable is the effluent

limits on historic discharges. How does one establish what the water quality of a historic discharge is? Does it mean average water quality over the life of the discharge? If so, then by definition one half of the discharge in the future will not meet the effluent limits.

One could also argue that the effluent limits on the historic discharge should be the best water quality, or perhaps the worst, over the life of the discharge. Suffice to say that the proposed language is open to wide interpretation and is far from clear. This section is also unclear with respect to the agricultural uses that will be protected. For example, one could argue that the historic discharges will only be considered protective of the specific uses that have utilized the water. If one were to commence a different agricultural use of the water, they could conceivably insist on more stringent effluent limitations. The attempt to provide some clarity and security for existing, "historic discharges," while a vitally important component of the Agricultural Use Protection language, falls short of being effective. Merit suggests that the language be modified in order to avoid the ambiguity that exists. For example, the term "historic discharge" needs to be clearly defined. Merit would propose a definition that would encompass existing discharges where the water has been put to beneficial use in agriculture regardless of the duration. In this way, the proposed policy will indeed serve to protect those existing uses. The language should also make clear that effluent limits on historic discharges will be considered as "background" regardless of the specific agricultural uses that have been developed, or may develop around it in the future. If such changes to the language are not adopted, it is clear that the effect of the proposed policy will be detrimental to historic discharges and the important agricultural uses that have been developed in reliance on the produced water. In other words, the practical effect of the substantive terms found in the policy will render the admirable goal of preserving historic discharges meaningless.

### C. Protection of Naturally Irrigated Lands is Unnecessary and Ill Advised

One of the stated goals of the proposed policy is to "ensure that pre-existing irrigated crop production will not be diminished as a result of the lowering of water quality." Appendix H, H-3, Lines 12-13. While this is merely a restatement of the Chapter 1 Section 20 purpose, the proposed policy goes well beyond simply protecting pre-existing irrigated crop production and significantly expands the scope of irrigated lands. Such an expansion is neither necessary nor helpful. The practical application of the terms of the policy will result in a finding that nearly every drainage in the state contains significant portions of naturally irrigated lands. Naturally irrigated land is so broadly defined in the proposal that it would be nearly impossible to find, by either landowner testimony or infrared photography, land that does not meet the definition. The result is clear, nearly all drainages in the state will be subject to the proposed effluent limits, whether there was pre-existing artificial irrigation or not. Naturally irrigated lands have flourished in Wyoming under the current regulatory framework and there is no need to add this new protection. It makes no sense to burden the proposed regulation with this unwieldy language when the real concern, existing artificially irrigated lands, can be adequately protected without it.

Put simply, the proposed language is overbroad with respect to its definition of irrigated land that qualifies for protection. With respect to "naturally irrigated lands," the policy's overarching intent is to protect irrigation water quality where there is "a substantial acreage of naturally sub-irrigated pasture within a stream floodplain." H-2, lines 9-10. However, the policy's more detailed discussion of coverage of "naturally irrigated lands" is highly ambiguous, referring first to areas along stream channels that have "enhanced vegetative production due to periodic natural flooding or sub-irrigation," but also to lands "on which the combination of

stream flow and channel geometry provides for enhanced productivity of agriculturally significant plants." H-4, lines 1-5. Does "vegetative production" refer to growth of any plant, including noxious plants or those that supplant native vegetation, or only to plants that are in some unspecified way "productive?" How will DEQ determine whether plants that would receive discharged water are "agriculturally significant?" If a discharge will promote the growth of livestock forage plants that will supplant native plants, will the discharge be deemed to enhance or to decrease crop or livestock production?

Thus, while the rule may be aimed at the particular goal of protecting areas that comprise "a substantial acreage of naturally sub-irrigated pasture within a stream floodplain," the specific provisions that attempt to define naturally irrigated lands are not tailored to this objective. Instead, they speak in broad and ambiguous terms of "vegetative production" that, apparently, would include ungrazed bottomlands, ungrazable wetlands, and areas of native plants that are inferior as forage. Moreover, the plain meaning of the term "pasture" does not include vegetation within a stream channel; rather it appears clearly to mean grazed vegetation in the floodplain. This language is unnecessary and serves only to confuse the protection of artificially irrigated lands. Merit respectfully asks the Council to remove the confusing and ambiguous language referring to naturally irrigated lands from the Agriculture Use Protection document.

### D. The Policy Could Allow a Single Landowner to Unconstitutionally Control the Entire Drainage

It is well established that any water found within a natural stream is property of the state. Further, it is undisputed that the state exercises an easement to flow waters down the natural streams. Despite these recognized and established principles, the proposed policy purports to vest the authority in individual landowners to prevent the flow of produced water in natural streams. DEQ admits that the policy as written would grant the authority of one landowner on

the drainage to prevent the discharge even if every other owner on the drainage requested the water. This is completely contrary to the Constitution and Wyoming Statutes and must not be permitted.

"The water of all natural streams, springs, lakes or other collections of still water, within the boundaries of the state, are hereby declared to be the property of the state." Wyoming Constitution, Article 1, Section 31. This is true regardless of the source of the water, whether it be rainfall or other precipitation, snowmelt, seepage, irrigation waste, sewage, pumped groundwater, or any other source. *Wyoming Hereford Ranch v. Hammond Packing Co.*, 236 P. 764 (Wyo. 1925); *Fuss v. Franks*, 610 P.2d 17(Wyo. 1980); *Bower v. Big Horn Canal Assc.*, 307 P.2d 593 (Wyo. 1957). Recent Wyoming decisions reiterate these principles and confirm that produced water in a natural stream is also property of the state. "Water legally placed in natural watercourses, even water produced from CBM, is water belonging to the state." *Decision Letter* dated October 11, 2005, *Williams Production RMT Company v. William P. Maycock, II*, Campbell County Civil Action No. 26099, Sixth Judicial District Court, a copy of which is attached hereto as **"Exhibit A."**

In addition to having a property right in the waters, the state also has a right of way for its waters to flow through natural watercourses. *Day v. Armstrong*, 362 P.2d 137, 145 (Wyo. 1961). This is an important right and is critical to the effectiveness of the prior appropriation system. "Such a right of way is essential to our system of prior appropriation. Water users can count on water flowing down watercourses to diversion points only because the state has such an easement. The state's easement applies to all of its water in watercourses, whether from CBM development or otherwise." Decision Letter at pg. 5. The *Maycock* decision also stated that "the state's easement for its water flowing down watercourses necessarily extends to the normal

carrying capacity of the watercourse. and extends to all seasons. Any other rule would negate development and us of water." *Id.* These are well-established principles of Wyoming law and have been applied for over one hundred years of water law.

The proposed Agricultural Use Protection document ignores these recognized principles of law and is internally opposed. On the one hand, the proposed language purports to grant landowners the right to accept water that does not meet the proposed water quality limits. Such a right is important, as it would allow produced waters to be legally discharged, thus becoming waters of the state subject to the easement to flow in the watercourse. On the other hand, the proposed language also vests power in a single landowner to preclude any discharges that do not meet the effluent limits. Vesting such broad rights in an individual landowner will completely negate the purpose of the proposed policy, namely, to protect agricultural uses. If one owner can prevent the flow of water, which would otherwise be beneficially used in the drainage, then the public policy of protecting agricultural uses will be thwarted.

Finally, this Council is statutorily precluded from acting in a manner that would restrict the state's rights in any way. Pursuant to W.S. § 35-11-102, the policy and purpose of the EQA includes: "to preserve and exercise the primary responsibilities and rights of the state of Wyoming; [and] to retain for the state the control over its air, land and water[.]" Therefore, DEQ and this Council should not be encouraging a rule or policy that concedes that a downstream landowner has the authority to dictate the parameters governing the flow of a stream through his property. As long as the flow does not exceed the scope of the state's easement to flow its waters, individual landowners cannot interfere with that right. Nor should DEQ be permitted to enforce a rule that jeopardizes the state's important rights and powers in this regard.

### E. DEQ's Recommended Tier 1 Default Effluent Limits Are Unsupported

Merit is aware of disagreement between the DEQ and the Water and Waste Advisory Board with respect to the default effluent limits of Tier 1 in the proposed policy. Indeed, the dispute is acknowledged in the current draft of the Agricultural Use Protection document, which sets forth the differing default effluent limits under Tier 1. Merit is opposed to the more conservative limits proposed by DEQ. It is illogical to impose effluent limits as a default when such limits are impossible to achieve. In application, such restrictive defaults render Tier 1 meaningless in its entirety. Inability to attain the default limits leads to the logical conclusion that Tier 2 will become the *de facto* default. The scientific evidence in the record clearly demonstrates that the default limits recommended by the Water and Waste Advisory Board are more applicable and scientifically supported. Merit requests that the default effluent limits proposed by the DEQ be rejected.

## CONCLUSION

Merit Energy Company is opposed to any attempt to apply the Agricultural Use Protection document as a rule. It has long been advanced as a policy and any attempt to apply its terms in the form of a rule would run afoul of the Wyoming Administrative Procedure Act and the Environmental Quality Act. Further, even if this Council should choose to follow the recommendation of the Water and Waste Advisory Board and adopt the proposed document as a policy, Merit is opposed to the language in its current draft. While the document purports to allow the continued discharge of historic discharges, its terms are ambiguous and unclear. In addition, the proposed protection of naturally irrigated lands is cumbersome, unhelpful, and completely contrary to the stated purpose of protecting agricultural uses. The proposed document is also contrary to law in that it vests the authority in individual landowners to control

the flow of the state's water in natural watercourses. Finally, the DEQ's proposed default effluent limits for Tier 1 are overly conservative, not supported by valid scientific evidence, and would render the Tier 1 option meaningless. For the reasons stated above, Merit Energy Company respectfully requests that the Council refuse to adopt the Agricultural Use Protection document in its current draft.

**DATED** this 14th day of February, 2007.

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EXHIBIT
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A

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RE: *Williams Production RMT Company v. William P. Maycock, II*
Campbell County Civil Action No. 26099
**DECISION LETTER**

Dear Counsel:

Plaintiff (Williams) is a mineral production company. It holds leases or operating rights for minerals in Campbell County, Wyoming. Defendant (Maycock) owns the surface of the land where those minerals are. Williams filed a claim in this case seeking to condemn rights of way across Maycock's land for access to leases and well-sites.

Williams proposes to develop coal-bed methane under Maycock's surface, and under adjacent lands. To produce coal-bed methane Williams must first pump water out of coal seams. Williams filed a second claim seeking to condemn a right of way across Maycock's property for the discharge of that water across the surface of Maycock's ranch.

After filing the condemnation claims, Williams filed 2 motions for partial summary judgment. Those motions essentially ask for declaratory relief establishing that in certain circumstances, Williams need not condemn rights of way because rights of way or rights of access already exist.

The parties are well aware of the applicable standard of review. The Court will not repeat the standard in this decision.

Access to Leases and Well-sites/Unit Access. The portions of the Maycock ranch relevant to this issue were homesteaded under the U.S. Stock Raising Homestead Acts. The Maycock ranch (the portion applicable to this claim) includes lands patented under approximately 30 different patents. Each of those patents reserved certain minerals to the U.S. Government, using the following language (or substantially similar language):

> Excepting and reserving, however, to the United States all the coal and other minerals in the land so entered and patented, together with the right to prospect for, mine, and remove the same pursuant to (statute).

Maycock claims that the U.S. reservation of minerals in each patent includes the right to enter the surface of each particular patented tract only to develop the minerals under that tract. Consequently, where Williams seeks to place a well on patented tract C, but needs to cross tracts A and B to get to Tract C, Maycock claims that the U.S. did not reserve a right to cross tracts A and B for the development of minerals under tract C.

The leases of U.S. government reserved minerals under the Maycock Ranch have all been committed to a "Unit" known as the Carr Draw Federal Unit. (The unit area also contains non-U.S. leased minerals and mineral leases not committed to the unit. Those tracts are beyond the scope of this decision). The Carr Draw Unit Agreement establishes that production of minerals from one tract in the unit is considered to be production from all other tracts. Williams seeks partial summary judgment establishing that as a matter of law, the government's reservation of access for production of its minerals applies to all lands within the unit.

The United States reserved a right of access for exploration, production and transportation of minerals when it reserved minerals under the Stock Raising Homestead Act.[1] That right of way exists only within each patented tract for the minerals within the area of that patent. The language in the patents clearly reserves only the minerals "in the land so entered and patented," and reserves a right of way within the patented land for production of "the same" minerals. No right of way is reserved in these patents for access to minerals within adjoining lands.

If the minerals in question were not committed to the Carr Draw unit, there would be no further issue. In that case, Williams would have to condemn rights of way across tracts without actual production. However, there is no issue of fact that the minerals reserved

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[1] Even if the patents did not reserve such a right, a right of reasonable access across the surface for production of underlying minerals is implied. The implied right is essentially the same as the specific right described in the patent reservations.

by the U.S. Government underlying Maycock's ranch, and the associated leases, have been committed to the unit. The unit agreement for the Carr Draw unit establishes that production on one part of the unit constitutes production on all of the land within the unit. Production from one place within the unit is shared by all mineral owners within the unit.

Pooling or unit agreements are favored because they encourage orderly development, efficiency, and conservation. The Carr Draw unit agreement sets out these reasons as foundations for the unit. Minerals under a particular tract may be most efficiently produced by drilling elsewhere in the unit. It is entirely logical that the access easement for production of minerals underlying a tract applies to production that occurs at some other location within the unit. It is illogical to recognize unitized production, but to deny that the right of access for production does not extend across the unit.

Other states recognize that when minerals are in a unit, the production is shared and the right of access for exploration, production and transportation also is shared across the unit. Oklahoma holds that "a unit operator has the right to use any surface within the unit for the purpose of efficiently carrying out the approved unit plan, so long as such use is reasonable and not unduly burdensome as to any particular surface area. *Nelson v. Texaco*, 525 P.2d 1236, 1266 (Ok. Ct. App. 1974). Texas has held that the "surface easement of reasonable use extends to the surface of the pooled or unitized area." *Property Owners of Leisure Land, Inc. V. Woolf & Magee, Inc.*, 786 S.W. 2d 757, 760 (Tex App-Tyler 1990). New Mexico recently stated

> ...a mineral lessee's implied surface right of reasonable ingress and egress to reach a well located inside the production unit that the lessee is operating pursuant to a pooling agreement extends across lease boundaries within the unit to the surface of the entire area subject to the arrangement, regardless of where within the unit production is taking place.
>
> *Kysar v. Amoco Prod. Co.*, 93 P.3d 1272, 1282 (N.M. 2004).

Maycock strenuously objects to access across patent boundaries, claiming that "the Court is being asked to grant Williams sweeping authority." The undisputed facts, however, are that Maycock always had record notice that the government reserved the minerals in question. The owner of those minerals leased them, and consented that they could be developed within a unit. The lessee of the minerals has the right to reasonably use the surface for development of the minerals within the Carr Draw unit. Reasonable use of the surface to develop severed minerals is not "sweeping" new authority, but well established law.

Maycock objects that the Carr Draw unit was established voluntarily, and was not mandated by the Wyoming Oil and Gas Conservation Commission. Maycock also objects that the Carr Draw unit is far larger than many other units. The Court finds no reason why unit principles should apply only to mandatory units, and not to voluntary ones, or to small units and not to large ones. The same principles of efficiency apply. Production on one part of a unit is considered production on all of the unit, whether it is voluntary or mandatory, small or large.

Maycock also claims that the Carr Draw unit agreement permits mineral owners to withdraw, destroying the unit. The unit agreement indicates otherwise. Mineral owners once committed to the unit can delay full participation, but they cannot withdraw.

The Court finds that there is no issue of material fact on this issue, and that Williams is entitled to judgment as a matter of law. William may utilize land over U.S. reserved minerals within the Carr Draw unit in a reasonable manner for development of any of those minerals, without limitation by patent or lease boundaries. Mr. Palma should prepare an order to this effect and obtain approval as to form.

Water Discharge. Williams wants to produce methane gas contained within coal deposits in the Carr Draw unit. This gas is commonly referred to as coal bed methane, or CBM. To produce CBM one must first remove water from the coal deposits to "depressurize" the formation. Williams proposes to pump water from the coal beds and discharge that water into drainages called Barber Creek and South Prong Barber Creek.

In this motion for partial summary judgment Williams asks the Court to hold that, as a matter of law, water pumped from coal beds and discharged into Barber Creek and South Prong Barber Creek is water belonging to the State of Wyoming and subject to the State's easement for transportation of its water within natural watercourses. If that is the case, Williams need not condemn rights of way across Maycock to transport the water from CBM operations. Maycock disagrees that CBM water is water belonging to the state. Maycock also asserts that Barber Creek and South Prong Barber Creek are not natural watercourses, and that neither the State nor Williams have an easement to transport water down these drainages.

Article 1, Section 31 of the Wyoming Constitution states that "the water of all natural streams, springs, lakes or other collections of still water, within the boundaries of the state, are hereby declared to be the property of the state." Any water within a natural stream belongs to the state, whatever the source of that water. The water may come from rainfall, snowmelt, seepage, irrigation waste, sewage, pumped groundwater, collection of rain by pavement, or any other source. *See, e.g., Wyoming Hereford Ranch v. Hammond Packing Co.*, 236 P. 764 (Wyo. 1925); *Fuss v. Franks*, 610 P.2d. 17

(Wyo. 1980); *Bower v. Big Horn Canal Association*, 307 P.2d 593 (Wyo. 1957). Water legally placed in natural watercourses, even water produced from CBM, is water belonging to the state.

Maycock argues that only "natural" surface water in watercourses is water belonging to the state. He calls CBM water "artificially produced," and argues that only "naturally flowing" waters belong to the state and are entitled to an easement when running down a watercourse. Maycock fails to present any logic or case law to support such a contention.

Wyoming statutes support the conclusion that CBM water in a watercourse is water of the State. W.S. §41-3-903 identifies "by-product water" as "water which has not been put to prior beneficial use, and which is a by-product of some non water-related economic activity and has been developed only as a result of such activity." CBM water clearly fits under this statutory definition of by-product water. W.S. §41-3-904 provides that once by-product water is not readily identifiable and has "commingled with the waters of any ... watercourse" it may be appropriated just as any other water of the state.

The state has a right of way for its waters to flow through watercourses. *Day v. Armstrong*, 362 P.2d 137, 145 (Wyo. 1961). Such a right of way is essential to our system of prior appropriation. Water users can count on water flowing down watercourses to diversion points only because the state has such an easement. The state's easement applies to all of its water in watercourses, whether from CBM development or otherwise.

The state's easement for its water flowing down watercourses necessarily extends to the normal carrying capacity of the watercourse, and extends to all seasons. Any other rule would negate development and use of water. Although this rule has not been considered directly in Wyoming, other states have clearly recognized it. *See, e.g. Smith v. King Creek Grazing Association*, 671 P.2d 1107 (ID Ct. App. 1983); *Phillips v. Burke*, 284 P.2d 809 (Cal. Ct. App. 1955); *Ambrosio v. Perl-Mack Construction Co.*, 351 P.2d 803 (Colo. 1960).

One of Maycock's primary arguments against the introduction of CBM water into Barber Creek is that the water will be of poor quality. He characterizes the water as "wastewater," "poor quality," "unnatural mineral development water,"and "potentially harmful." He argues that the nature of his ranch will change if additional water flows down Barber Creek. The quality of the water is not an issue before this Court. The issue here is only whether the water, if legally discharged into Barber Creek, is water belonging to the state and subject to the state's right of way.

This decision recognizes that, as a matter of law, CBM water is water belonging to the state once that water is legally placed in a watercourse. Williams argues that the undisputed facts show that Barber Creek and South Prong Barber Creek are watercourses. "A water course is a stream of water flowing in a definite channel, having a bed and sides or banks, and discharging itself into some other stream or body of water." *State v. Hibler*, 44 P.2d 1005, 1009 (Wyo. 1935). A watercourse may have intermittent water flow. *Scott v. Swartz*, 522 P.2d 151 (Wyo. 1974). However, whether the frequency and amount of flow, or other characteristics of a drainage are sufficient to constitute a watercourse, is generally a difficult question of fact. *State v. Hiber*, 44 P.2d 1005 (Wyo. 1935).

Issues of fact remain on the issue of whether Barber Creek and South Prong Barber Creek are watercourses. Maycock claims that there are "a number of areas" where these drainages are "large flat meadow areas with no defined creek bed, banks or channel." He claims that they have "often gone years with no flowing water at all." Williams presents evidence indicating that Barber Creek and South Prong Barber Creek were created by water flow and have stream beds and banks in all but 2 locations. Whether Barber Creek and South Prong Barber Creek are watercourses are issues of fact to be resolved at trial.

Because issues of fact remain on whether Barber Creek and South Prong Barber Creek are watercourses, summary judgment on the issue of water trespass must be denied. Mr. Wendtland should prepare an order to this effect and obtain approval as to form.

Sincerely,

**Keith G. Kautz**
District Judge

KGK/km

Williams.

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February 14, 2007

Wyoming Department of Environmental Quality
Water Quality Division
Herschler Building – 4W
122 West 25th Street
Cheyenne, WY 82002
Attn: Bill DiRienzo

**Re: Comments on Proposed Revisions to Chapter 1 of the Wyoming Water Quality Rules and Regulations, Appendix H, Agricultural Use Protection**

Dear Mr. DiRienzo:

Williams Production RMT Company (Williams) appreciates the opportunity to submit comments to the Environmental Quality Council (EQC) regarding the adoption of Appendix H, Agricultural Use Protection standards, as part of the revisions to Chapter 1 of the Wyoming Water Quality Rules and Regulations. Williams is a significant operator in Wyoming and, in particular, in the Powder River Basin (PRB). Williams is concerned about Appendix H's potential to affect its coalbed natural gas (CBNG) operations adversely.

Appendix H has undergone significant changes over two years and four public comment periods. Throughout that time, the agricultural use protection standards in Appendix H were proposed as a Wyoming Department of Environmental Quality (DEQ) implementing policy. It was only in the last several months that DEQ decided to submit the Agricultural Use Protection Policy to the EQC as a rule rather than a policy. DEQ has failed to consider the mandatory factors specified in the Environmental Quality Act (EQA) for proposing Appendix H as a rule to the EQC. W.S. § 35-11-302 (a)(vi).

The Agricultural Use Protection standards in Appendix H have the potential to impose significant costs and technical burdens upon CBNG operators. Yet, DEQ failed to consider these impacts, and failed to balance the burdens imposed against the purported environmental effects sought to be protected, prior to recommending the adoption of Appendix H as a rule. Williams believes Appendix H would be significantly different in its requirements and breadth if the DEQ had thoroughly considered the factors set forth in W.S. § 35-11-302(a)(vi).

Williams' specific comments regarding the text of the proposed Appendix H follow. In addition, Williams encourages the EQC to consider seriously the development of a risk-based approach to implementation of the agricultural protection narrative standard, as opposed to the one-size-fits-all approach of the currently proposed Appendix H.

## I. Purpose - Chapter 1, Section 20 Should Not be Implemented to Protect Illegal Irrigation.

We agree with DEQ that the purpose of Ch. 1, Section 20 is to protect irrigation that existed prior to an application for a WYPDES discharge permit. As the DEQ has noted, the language infers a pre-existing agricultural use prior to an application for a WYPDES permit, which can serve as a baseline from which a decrease in crop or livestock production could be measured. We also agree that, to be afforded the protection of Section 20, a landowner must have an existing irrigation structure or mechanism in place for diverting water. However, in Appendix H, the DEQ proposes the continuation of its historic practice of protecting illegal diversions, i.e., irrigation which occurs in the absence of a valid existing water right. Williams takes issue with this practice, particularly when the DEQ endorses in a rule this illegal practice be followed by State personnel when translating the Section 20 narrative goals into appropriate WYPDES permit limits.

If a landowner is irrigating without the benefit of a water right from the office of the State Engineer, then the irrigation is illegal. Since there is no right to the use of the water in the drainage, the irrigation could be ordered to cease and desist at any time. Therefore, there is really nothing for the DEQ to protect. Moreover, the DEQ's current practice of protecting illegal irrigation is in direct conflict with the Wyoming law regulating the use of water:

> Water being always the property of the state, rights to its use shall attach to the land for irrigation, or to such other purposes or object for which acquired in accordance with the beneficial use made for which the right receives public recognition, under the law and the administration provided thereby. W.S. § 41-3-101.

By allowing unauthorized structures to trigger application of the standard, Appendix H protects unlawful irrigation use, sanctions the unlawful conduct, and rewards the offender for its offense. We submit that this practice constitutes egregiously bad public policy and produces an absurd result in violation of the canons of statutory and regulatory interpretation declared by the Wyoming Supreme Court. See *In re KP v. State,* 102 P.3d 217, 224 (Wyo. 2004) ("[T]his Court will not interpret a

statute in a manner producing absurd results"); *Corkill v. Knowles*, 955 P.2d 438, 444 (Wyo. 1998).

Lastly, the EQA expressly states that the actions of the DEQ shall not limit or interfere with the jurisdiction, duties or authority of the State Engineer in administering water rights. W.S. §35-11-1104(a)(iii). Protection of illegal diversions could certainly be construed as interfering with these jurisdictional constraints, as it aids conduct directly contrary to the requirements for use of water set out above.[1] CBNG dischargers should not be required to protect such illegal practices. Appendix H should expressly state that in the future unauthorized irrigation use will not be protected and that existing diversion structures not covered by an existing water right will not trigger application of the agricultural standard.

## II. Presumption of Naturally Irrigated Lands is Overly Broad

Appendix H implies there is a pre-existing agricultural use of a stream or drainage when "a substantial acreage of naturally sub-irrigated pasture within a stream floodplain" exists. Appendix H states that infra-red photography, surficial geologic maps, wetland mapping, landowner testimony or any combination of these sources may be used to establish that lands are naturally irrigated. Each of these information sources presents a snapshot of conditions at a specific time, and conditions may have changed e.g., wetlands mapping.[2] In addition, a permit applicant has no method by which it could disprove the presumption of sub-irrigation presented in Appendix H. The application of EC and SAR effluent limits should not be applied unless there is some presence and evidence of the ability to irrigate with a surficial flow.

The EC and SAR effluent limits will be applied where the naturally irrigated land reaches a threshold deemed "agriculturally significant." This threshold is triggered when a stream segment contains "single parcels of naturally irrigated land greater than 20 acres or multiple parcels in near proximity that total more than 20 acres." Given the size of parcels in Wyoming, the definition of agricultural

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[1] The lack of a water right is often an indication that the drainage did not maintain adequate flows or water quality to facilitate irrigation or that the soils or other conditions were simply not supportive of irrigation adequate to allow the landowner to prove up its beneficial use of water and thus obtain a valid water right. And, in the absence of a valid existing water right, applicants for a discharge permit have no notice of irrigation use by such downstream landowners and no way to account for them in their WYPDES permit applications.

[2] The DEQ should not be able to rely solely upon landowner testimony which is inherently biased to establish the existence of naturally irrigated lands.

significance could be easily met through single parcels or the sum of smaller parcels. The practical effect of this definition combined with an easily triggered (unrefutable) definition of sub-irrigated land is that Appendix H's irrigation effluent limits would be applied to discharges into virtually any and every drainage in the State. The agricultural protection standards in Appendix H, if implemented, would result in a gross over-extension of the prior agricultural use presumption, would be overly protective of established agricultural uses which may no longer exist and would significantly restrict CBNG operators' ability to discharge into State waters without expensive treatment of discharges to protect nominally useful parcels of land.

## III. Irrigation Data and Information

Appendix H indicates that "the goal is to ensure that preexisting irrigated crop production will not be diminished as a result of the lowering of water quality." The difficulty, of course, is in assessing the preexisting or baseline crop production that existed prior to any proposed discharge. Often there are no records of crop yield, stream flows, historic water quality, etc., making it very difficult for all parties to apply the "no measurable decrease" standard. This has caused DEQ to historically take an overly conservative approach in developing numeric permit effluent limitations to assure no measurable decrease in crop production. For that reason, we recommend that the following be added to the data and information required under Section d:

- Extent of irrigation permitted by Office of the State Engineer under a valid and existing Wyoming water right.
- Rate of flow required to activate irrigation under the system in place.
- As to the season of use, the EQC should further refine the definition of "irrigation season." The EC and SAR limits will apply during those periods when crop growth is occurring and then only when irrigable flows exist. Irrigable flows are those in which adequate water exists to activate a spreader dike system for artificially irrigated lands or to cause natural flooding or sub-irrigation on naturally irrigated lands. It is not reasonable to assume that the irrigation season is generally considered year-round in Wyoming for passively irrigated lands, given the variation and intensity of storm events supplying water to ephemeral or intermittent drainages used for irrigation purposes. In the absence of such events, the naturally-occurring salinity in these drainages limits their utility for irrigation. When irrigation cannot occur, the water quality standards protective of irrigation should not be applied. Operators should not be required to make the water quality in the stream system better year round than mother nature provided.

- Most importantly, in place of using published tolerance values for the most sensitive crops grown, we suggest use of the Hanson Diagram to manage the SAR limit for two reasons. First, the published tolerance values for most crops generally assume conditions exist for attaining a 100% crop yield. Our experience throughout the PRB is that, given the growing conditions, e.g., a lack of precipitation, poor alkaline and saline soils, and intermittent flows, etc., irrigators in the PRB achieve a crop yield well below the 100% value. Second, as Appendix H acknowledges, the significant irrigation-related effluent limits in the PRB are EC and SAR. The EQC is aware that, within certain broad limits, it is the ratio of EC and SAR that determine the suitability of water quality for irrigation purposes for any given crop. We therefore suggest that the EQC apply the Hanson Diagram in establishing SAR limits. As stated above, these limits should be applied only when adequate water is available to create an irrigable flow. At all other times, to apply effluent limitations which are adequate to irrigate the most sensitive crop would require the dischargers to make the water in the stream better than mother nature provides. That is an undue burden, with no environmental benefit, which will not in any meaningful way enhance the crop production. It will only impose unnecessary additional expense and effort on dischargers of water from CBNG operations.

## IV. Tiered Approach Should Protect Measurable Decrease in Crop Production.

The agricultural protection standards in Appendix H establish a tiered approach which is designed to establish appropriate effluent limits to ensure there is no measurable decrease in crop production. While a tiered approach is absolutely necessary to address the variety of background conditions and quality of discharges in different drainages within the PRB, the default EC and SAR limits in Tier 1 require revision. As discussed above, Williams does not believe that the use of default EC limits should be based on tolerance values for the most sensitive crop or upon 100% yield threshold values. To the extent the EQC decides to use such criteria, calculated values should be based on data which more accurately reflects soil chemistry and crop production in the PRB and Wyoming, not California. The Tier 1 approach is overly conservative and protects against any decrease in crop production, not merely a measurable decrease in such production. Appendix H proposes the application of effluent limits to achieve an end beyond that described in the narrative goals stated in Chapter 1, Section 20 and does so without sufficient supporting credible evidence. This point is well made and fully documented in letters dated May 5, 2006 submitted to the Water and Waste Advisory Board by Kevin C. Harvey on behalf of several CBMG operators including Williams, and we urge the EQC to carefully and fully consider Mr. Harvey's comments and conclusions and modify Appendix H accordingly. See attached letters.

Tier 2 offers dischargers a viable permitting option in instances in which background water quality is worse than its CBNG effluent quality. In such circumstances, Tier 1 default limits should be inapplicable. Williams requests that the EQC amend Appendix H to state that if such circumstances exist, EC and SAR effluent limits must be based upon those background conditions rather than tolerance values for the most sensitive crop.

## V. A New Approach

The agricultural protection standards in Appendix H have undergone a number of changes over the past two years as DEQ and the Water and Waste Advisory Board have struggled with how best to implement Chapter 1, Section 20's prohibition against measurable decrease in crop or livestock production. The agricultural use protection standards were originally contemplated as internal policy guidance, giving DEQ sufficient flexibility to change the standards as needed. Given the renewed consideration of the standard as a rule rather than a policy, Williams believes it is time for the EQC and DEQ to step back and consider whether Appendix H truly addresses its originally intended purpose—to provide a practical, workable, and predictable solution for applying the narrative measurable decrease standard in Chapter 1, Section 20. The last two years of consideration by the Water and Waste Advisory Board, DEQ, and the public has culminated in proposed rule that Williams believes fails to achieve that purpose. Appendix H does not in any practical or realistic way define what is a "measurable decrease" and what is the best way to avoid it.

Williams suggests that the EQC and DEQ take a fresh look at the no measurable decrease standard and work with all stakeholders to develop a new rule that reflects the realities of agricultural production in an arid environment. Measurable decrease must be considered in the context of the background conditions. Not all waters of the State have the same quality and not all agricultural use has the same value. For example, where water quality is poor and agricultural use is limited to low-yield production from naturally irrigated native plants, less protection may be necessary than in situations where the background water quality is high and artificial irrigation supports high-yield commercial crops. Any new rule should take into account site-specific conditions and uses of water in each drainage, rather than applying blanket standards which are derived from data generated in California.

Williams recommends that the newly drafted rule take a risk-based approach to measurable decrease. Effluent limits should reflect that agricultural production in most areas of Wyoming is not at 100% yield under natural conditions due to lack of precipitation, poor alkaline and saline soils, and intermittent flows. EC and SAR standards should not be set to protect 100% yield, but should reflect the actual yield

where produced water may actually be applied. Further, in many cases, stream conditions are such that there is little risk that produced water will reach irrigated acres unless mixed with substantial quantities of natural flows. Any rule should require consideration of whether the water being discharged will be applied to irrigated acreage, the impact of irrigation practices (the amount of water necessary to activate artificial and natural irrigation systems), and the condition of the soil being irrigated. Though Appendix H as currently drafted attempts to address these issues, it does so in an inflexible manner that does not acknowledge varied applications in the field.

Williams appreciates the opportunity to comment on the agricultural use protection standards in Appendix H and appreciates your consideration of our comments. We would be pleased to discuss our comments further with you and respond to any questions you may have.

Sincerely,

Joe Olson
Facilities Engineer

Attachments

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KC HARVEY, LLC
SOIL AND WATER RESOURCE CONSULTANTS

May 4, 2006

FILED
FEB 14 2007
Terri A. Lorenzon, Director
Environmental Quality Council

Mr. Bill DiRienzo
Wyoming Department of Environmental Quality
Water Quality Division
Herschler Building, 4th Floor West
122 West 25th Street
Cheyenne, Wyoming 82002

Subject: Comments pertaining to the derivation of default effluent limits for EC in the Draft Section 20 Agricultural Use Protection Policy.

Dear Mr. DiRienzo:

I respectfully submit for your consideration the following comments regarding the fourth draft of the Section 20 Agricultural Use Protection Policy as it pertains to the derivation of default effluent limits for EC. These comments are being submitted on behalf of Yates Petroleum Company, Williams Production RMT Company, Petro-Canada Resources (USA) Inc., Marathon Oil Company, Lance Oil & Gas Company, Inc., Fidelity Exploration & Production Company, Devon Energy Production Company L.P., Bill Barrett Corporation, and Anadarko Petroleum Corporation. I have submitted additional comments regarding the derivation of SAR limits and the proposed SAR cap to you in a separate letter.

By way of introduction, I am a board-certified professional soil scientist having practiced as an environmental consultant in Montana and Wyoming, and throughout the world, for nearly 25 years. For the past seven years, my practice has focused on water management and soil and water salinity/sodicity issues associated with oil and gas development. I am credited as the first to research, develop, and apply managed irrigation techniques for the beneficial use of coalbed natural gas produced water. I have directed or participated in over 75 separate projects related to produced water management, WPDES permitting, soil and water chemistry investigations, and reclamation for coalbed and conventional natural gas projects in Wyoming, Colorado, and Montana. I have a M.S. degree in land rehabilitation (soil science emphasis) from Montana State University, and a B.S. in Resource Conservation (soil science emphasis) from the University of Montana.

I would like to comment on the proposed changes made to the Agricultural Use Protection Policy by the WDEQ subsequent to the January 26, 2006 meeting of the Water and Waste Advisory Board. My comments will focus on the comments provided by Dr. Larry Munn in his letter to the DEQ dated December 5, 2005. It is my understanding that Dr. Munn's comments resulted in the changes made to the proposed Policy. Specifically, I comment on Dr. Munn's request that the California-based soil salinity tolerance thresholds be used to establish default effluent limits for electrical conductivity (EC) under the Tier 1 process.

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**Summary of Findings**

The fourth draft of the Agricultural Use Protection Policy describes a 3-tiered decision making process for deriving appropriate effluent limits for EC and SAR whenever a proposed discharge may reach irrigated lands. The Tier 1 process would be followed for deriving "default" limits, and as such, this procedure would require a minimum of background information from the applicant. Specifically, the default EC limits would be based on the species-specific 100 percent yield potential values for soil EC reported by the USDA Agricultural Research Service (ARS) Salt Tolerance Database (USDA ARS, 2006).

Alfalfa is considered to be the most salt sensitive plant irrigated in northeastern Wyoming. Given this, my comments focus on the relevant information regarding alfalfa salinity tolerance. The ramifications of the concepts and data discussed herein for alfalfa can be applied to the more tolerant irrigated forage species commonly found in northeastern Wyoming, for example, western wheatgrass and smooth brome.

A considerable amount of research went into preparing these comments, including three months searching and reviewing the relevant scientific literature, and compiling and analyzing available and relevant soil, plant, and water data. The key conclusions of the literature review and data analysis are presented below and will be substantiated by the discussion that follows.

<u>California Based Salinity Thresholds</u>

- The ARS Salt tolerance database relies on California based salinity thresholds developed to approximate the specific plant, soil and environmental variables associated with that region.

- Regional differences in soil chemistry, climate and agricultural practices are likely to have a profound effect on the applicability of California based salinity threshold data to alfalfa growing in Wyoming.

<u>Chloridic Versus Sulfatic Soils</u>

- The natural soil salinity in the Powder River Basin is dominated by the sulfate ion; California soils are dominated by chloride. This conclusion is supported herein by the literature and by an evaluation of actual soil chemistry data provided by the USDA National Soil Survey Center.

- The term "gypsiferous" refers to sulfatic soils and is applicable to the Powder River Basin of Wyoming. Numerous documents, including the ARS Salt Tolerance Database, indicate that in sulfatic (or "gypsiferous") soils, plants will tolerate about 2 dS/m higher salinity than indicated.

The Influence of Soil Salinity on Alfalfa Yield

- Alfalfa is considered the most salt sensitive plant irrigated in northeastern Wyoming. Conditions required for the growth of alfalfa at 100 percent of its physiological yield potential probably do not exist anywhere in northeastern Wyoming and place doubt on the application of this benchmark value there.

- Sources of research and field guidance outside of California suggest alfalfa has a higher relative 100 percent yield soil EC tolerance than 2 dS/m, perhaps as high as 4 to 8 dS/m.

- Alfalfa yield comparisons between California and Wyoming show actual harvest values independent of soil salinity. Identical yields were reported in Wyoming for soil EC values ranging from 1.8 dS/m to 6.5 dS/m.

Based on the review summarized herein, we respectfully suggest that the WDEQ consider adopting an acceptable average root zone EC threshold of 4 dS/m for protection of alfalfa. This would equate to a default (Tier 1) effluent limit of 2.7 dS/m based on the 1.5 concentration factor cited by the draft Agricultural Use Protection Policy. The EC limits for protecting other species of concern in the Powder River Basin, e.g., western wheatgrass, should also be adjusted accordingly, based on the inherent differences in soil chemistry and climate between the northern Great Plans and the California agricultural areas. These conclusions and recommendations are substantiated by the discussion below.

**California-based Salinity Thresholds**

The majority of salinity tolerance data generated in the United States have been a product of field and laboratory trials conducted by the U.S. Salinity Laboratory (USSL) in Riverside, California. The salinity tolerance data generated by the USSL were prompted in response to agricultural production in the areas of the San Joaquin and Imperial Valleys of California. In 1977, Maas and Hoffman compiled the California research in a seminal article titled "Crop Salt Tolerance -- Current Assessment," listing salt tolerance levels for various crops. The subsequent year, Francois and Maas (1978) published an indexed bibliography of plant responses to salinity from 1900 to 1977 with 2,357 references to about 1,400 species. These articles serve as the primary references regarding crop tolerance and yield potential of selected crops as influenced by irrigation water ($EC_w$) or the average root zone soil salinity level ($EC_e$). This information was updated by Mass (1990). The ARS Salt Tolerance Database relies entirely on the Mass (1990) summary as the primary source of relative salt tolerance levels among crops. With respect to alfalfa, the original salt tolerance listings remain unchanged from the original Mass and Hoffman (1977) article.

The Mass and Hoffman (1977) and Mass (1990) listings of salt tolerance levels include the establishment of the 100 percent yield threshold for soil salinity. This value refers to the maximum allowable average root zone salinity level ($EC_e$) that results in no yield reduction for crops grown in chloritic soils. The term chloritic soil refers to the dominant salt type found in California soils (see below). For alfalfa, Mass and Hoffman (1977) and Mass (1990) list the 100 percent yield potential for alfalfa grown in chloritic soils as 2.0 dS/m ($EC_e$). The Mass and

Hoffman (1977) and Mass (1990) assessments also contain a disclaimer that the yield potentials listed should only serve as a guide to relative tolerances among crops, and that the absolute salt tolerance of crops is not simply a function of soil EC but is dependent on "many plant, soil, water, and environmental variables."

Six studies conducted at the US Salinity Laboratory in Riverside, California, served as the foundation for the determination of Maas and Hoffman's 2.0 dS/m threshold value (Gauch and Magistad, 1943; Brown and Hayward, 1956; Bernstein and Ogata, 1966; Bower et al., 1969; Bernstein and Francois, 1973; Hoffman et al., 1975). These studies vary in their methodology, including greenhouse and field experiments, different growth mediums (sand, gravel and soil), various watering regimes (automatic watering, tension-based watering), and multiple sources of chloritic salinity (NaCl, $CaCl_2$, and $MgCl_2$). These studies were designed to assess relative yield values, irrigation leaching fractions, root zone salt profiles, or salinity-ozone interactions. They were not specifically designed to determine a threshold salinity value for alfalfa. Usually, only four salinity levels were tested, with data used to produce a crop yield reduction line.

Furthermore, the source of salinity in the six studies was consistently chloride dominated, with either NaCl or a blend of NaCl, $CaCl_2$, and $MgCl_2$ added to the irrigation water. In Southern California, where these studies occurred, salts found in the soils are largely chloride-dominated. None of these studies were conducted using sulfate-dominated salts, such as are found in Wyoming soils (see below). Such regional differences in soil salinity are likely to have a profound effect on the application of existing salinity threshold data to alfalfa growing in the Northern Great Plains. Recognizing this, Mass (1990), Ayers and Westcot (1985), Hanson et al. (1999), as well as the ARS Salt Tolerance Database, all indicate that plants grown in sulfatic soils will tolerate average root zone $EC_e$ values about 2 dS/m higher than indicated by each of these references. For alfalfa, this would equate to a 100 percent yield threshold of approximately 4 dS/m. This fact is discussed in detail below.

**Chloridic Versus Sulfatic Soils**

Research efforts of the USSL in California identified adjustments in effective plant salinity tolerance expressed or repressed in the field by physiological responses to climate, cultural practices, soil fertility, irrigation methods, physical condition of the soils and the distribution and speciation of salts within soil profiles. A critical difference between the environmental conditions in California and the northern Great Plains (including northeastern Wyoming) is soil chemistry and the primary salt constituents found in these soils. It is widely accepted that the soils of the agricultural areas of California are dominated by salts where chloride is the dominant anion, and that the soils of the northern Great Plains are dominated by salts where sulfate is the dominant anion. In earlier publications, sulfatic soils are sometimes termed "gypsiferous," referring to the most common sulfate salt found in semi-arid soils – gypsum (calcium sulfate dehydrate). The correct term used today is sulfatic soils.

To incorporate the variation of salinity tolerance exhibited by plant response to different salt distributions and dominant salt species, the authors of salt tolerance research included a provision for sulfatic soils. Soils may contain amounts of sparingly soluble salts, such as gypsum and other sulfate salts, many times greater than can be held in solution in the field water-

content range. Sulfatic soils may appear to be saline when exhaustively extracted in the lab (i.e., saturated paste extract), but the in-situ soil solution may be nonsaline because of the limited solubility of gypsum and other sulfate salts (Bernstein, 1975). Thus, the EC measured in a saturated paste extract is higher than the actual concentration of salts seen by plants in sulfatic soils. It was suggested originally by Bernstein (1962) that plants will tolerate about 2 dS/m higher soil salinity ($EC_e$) than indicated in sulfatic soils due to this solubility effect. Since calcium sulfate is disproportionately dissolved in preparing saturated-soil extracts, the $EC_e$ of sulfatic soils will range an average of 2 dS/m higher than that of chloritic soils with the same water conductivity at field capacity (Bernstein 1962). Therefore, plants grown in sulfatic soils will tolerate an $EC_e$ of approximately 2 dS/m higher than those grown where chloride is the predominant ion (Maas, 1990). This narrative provision for sulfatic soils is included in the ARS Salt Tolerance Database, and the classic irrigation guidelines presented in Ayers and Wescot (1985).

Sulfatic soils are the rule not the exception in Wyoming and the northern Great Plains. Sulfatic soils identified by salinity tolerance references are characterized by the presence and influence of gypsum, or calcium sulfate dihydrate ($CaSO_4 \cdot 2H_20$), within the soil profile, as well as the geological and climactic prerequisites for sulfatic soil conditions. Soil gypsum may stem from one of several sources. Soils formed from geologic material containing anhydrite or gypsum often contains gypsum. The amount of rainfall and the topographic setting will strongly influence the amount and location of gypsum in the soil (Dixon and Weed, 1989). Accumulations of soluble salts, including sulfates in the surface layers, are characteristic of saline soils of arid and semiarid regions (Brady, 1974), including Wyoming. Research conducted by the U.S. Geological Survey confirms the presence of gypsiferous parent materials in the Powder River Basin (Johnson, 1993). At this point, it is important to differentiate between the soil taxonomic terms "gypsic" or "petrogypsic," which are used to describe significant gypsum accumulation within soil horizons, from the terms "gypsiferous" or "sulfatic" soils which refer to the dominate salt type in soils of Wyoming and the northern Great Plains.

Published research has addressed the issue of prevailing salt distribution and climate influenced salt dominance. In Springer et al. (1999), Curtin et al. (1993) and Trooien (2001), northern Great Plains prairie soil chemistry is comparatively summarized and/or contrasted to soils of California. Research suggests that recommendations developed for the western United States, where chloride is the major anion in soil and water chemistry, may not be appropriate for sulfatic soils (Springer et al., 1999). Trooien (2001) notes that most plant salinity tolerance information is developed in California and that the chemistry of salinity is different in the northern Great Plains (i.e., sulfate dominated salinity). Therefore, Trooien (2001) indicates that salinity thresholds are greater and yield losses are somewhat smaller in the Northern Great Plains compared to those of California (i.e., chloride dominated salinity). Research in Canadian prairie soils by Curtin et al. (1993) and Wentz (2001) suggest that salt tolerance testing at the Swift Current, Saskatchewan, salinity laboratory (and also at the US Salinity Laboratory) has mostly involved the determination of crop responses to chloride salinity. However, there is reason to suspect that responses to sulfate salinity, which is the predominant form of salinity in prairie soils, may differ from those observed in chloride salt systems. Wentz (2001) summarizes that crop tolerances developed for chloride dominated soils, such as those in California, may not be applicable to crops grown on the sulfate dominated soils typically found in western Canada.

Comparison of actual soil analytical data from the NSSC Soil Survey Laboratory, Lincoln, Nebraska, supports the chloride and sulfate salt dominance designations suggested by Springer et al. (1999), Curtin et al. (1993), Trooien (2001), and Wentz (2001). Analyses from the U.S. Soil Survey Laboratory are available online at http://ssldata.nrcs.usda.gov/ and organized by soil pedon. Data from selected counties in Wyoming and California were obtained from the NSSC Soil Survey Laboratory Research Database in order to determine the dominance of chloride or sulfate soil chemistry in the respective regions. Soil chemistry data were downloaded for use in this study for counties of the Powder River Basin in Wyoming (Sheridan, Campbell and Johnson Counties). Soil chemistry data were also downloaded for counties in California where intensive agricultural production takes place (Imperial, Fresno, Kern, Kings and Tulare).

Data pertaining to soil chloride and sulfate in the saturated paste extract are arranged and averaged by county and state in Table 1 below. These values are based on all of the available data provided by the U.S. Soil Survey Laboratory.

**Table 1**
**A Comparison of Average Soil Saturated Paste Extract Sulfate and Chloride Levels from Counties in Wyoming and California.**

| County | Average Soil Sulfate Level (meq/L) | Average Soil Chloride Level (meq/L) |
|---|---|---|
| Sheridan, WY | 14.9 | 4.1 |
| Campbell, WY | 130.4 | 3.0 |
| Johnson, WY | 30.9 | 1.8 |
| **Wyoming Average** | **58.7** | **2.9** |
| Imperial, CA | 48.4 | 295.7 |
| Fresno, CA | 98.6 | 26.3 |
| Kern, CA | 44.3 | 73.0 |
| Kings, CA | 110.7 | 23.9 |
| Tulare, CA | 9.3 | 21.6 |
| **California Average** | **62.3** | **88.1** |

The summary data suggest that the relative proportion of chloride salts in the selected California counties outweigh the proportion of sulfate salts and verify the chloride dominance suggested by the literature summarized above. In northeastern Wyoming, the relative proportion of sulfate salts in selected counties outweigh the proportion of chloride by an order of magnitude and verify the sulfate dominance and sulfatic conditions implied by the literature. Therefore, the recommendation by the ARS Salt Tolerance Database signifying that plants grown in sulfatic soils will tolerate average root zone $EC_e$ values about 2 dS/m higher than indicated, is valid for the Powder River Basin, and probably all of Wyoming. For alfalfa, this would equate to a 100 percent yield threshold of 4 dS/m.

**The Influence of Soil Salinity on Alfalfa Yield**

As indicated above, the *relative* 100 percent yield potential reported for alfalfa in the ARS Salt Tolerance Database is 2 dS/m ($EC_e$). As such, alfalfa is regarded in the California-based literature as "moderately sensitive" to salinity. An *absolute* salinity tolerance would reflect predictable inherent physiological responses by plants, but cannot be determined because interactions among plant, salt, water and environmental factors influence the plant's ability to tolerate salt. *Relative* salt tolerance is a value based on the climatic and cultural conditions under which a crop is grown (Maas and Hoffman, 1977). Research generated outside the U.S. Salinity Laboratory in the U.S. and Canada has introduced alternative salinity tolerance values for alfalfa influenced by these climatic and cultural conditions.

In a study based on field trials in western Canada, McKenzie (1988) reported the "relative maximum salinity crops will tolerate when combined with intermittent moisture stress throughout the growing season." McKenzie (1988) places alfalfa within a moderate tolerance category, as opposed to moderate sensitivity, and extends alfalfa's 100 percent yield tolerance to an EC range of 4-8 dS/m, as opposed to 2 dS/m. Similar tolerance descriptors and EC values for alfalfa can be found associated with Britton et al. (1977), who supports moderate salt tolerance and an EC range of 5-10 dS/m for alfalfa. Likewise, Milne and Rapp (1968) present alfalfa with a moderate tolerance and an EC range of 4-8 dS/m. Cavers (2002); Wentz (2001); Schafer (1983); Holzworth and Wiesner (1990) and Dodds and Vasey (1985) also contribute to a departure from the established Maas classification of alfalfa salinity tolerance and threshold values. Bower et al., suggests an alfalfa tolerance somewhat between the previous authors and Maas (1990), suggesting maximum alfalfa yield is obtained when the average $EC_e$ value for the root zone is 3 dS/m. Using salinized field plots in southern Saskatchewan, Holm (1983) reported a small, 0.037 ton/acre, reduction in alfalfa yields resulting from an increase in the surface $EC_e$ (0 to 15 cm sample) from a 0 to 4 dS/m range to a 4 to 8 dS/m range. Holm presented these scales as representative of low and medium EC levels.

Relative salinity tolerances reported outside of peer reviewed literature stem from professional observations and judgments, roundtable discussions, experience in the field, and experience with the region, culture and climate; not from experimental data. Incorporation of field experience, observation, and limited data into supporting documents of the Salt Tolerance Database is acknowledged in Ayers and Wescot (1985). Alternative sources listed herein do not always report EC values in terms of 100 percent yield thresholds for alfalfa, but should not be discounted, as they pertain to what is realistic in the field. As an example, the Montana Salinity Control Association reports forage salt tolerances in terms of marginal establishment levels, not 100 percent yield potentials. Conditions allowing alfalfa to produce at 100 percent of its physiochemical yield potential probably do not exist anywhere within the northern Great Plains.

A suggested field-yield value corresponding to the 100 percent yield of alfalfa has never been reported by authors of salinity literature. Specifically, what yield of alfalfa, in tons per acre, could one expect if it was grown under conditions supporting 100 percent yield? Conditions supporting 100 percent alfalfa yields recommended by the ARS Salt Tolerance Database and its supporting documents would be: a soil $EC_e$ of 2 dS/m or less, an irrigation water $EC_w$ less than or equal to 1.3 dS/m, water contents maintained at field capacity, available N, P and K nutrient

levels maximized for alfalfa growth, a sufficiently long growing season, no associated phytotoxicity or pest issues, etc. This data limitation precludes the direct comparison of alfalfa yields generated in an agricultural area to the potential yields theoretically available under optimized conditions. The only available analysis is to compare an alfalfa yield to the average yield generated in its area, or generated between areas.

Using data available from the National Agricultural Statistics Service, selected county agricultural commissioner's data, and the U.S. Census of Agriculture (2002, 1997), irrigated alfalfa yield data were obtained for periods of interest. Alfalfa yield data for Wyoming counties are available from 1959 through 2005, but were averaged from 1970-2005 to reflect the integration of new irrigation technologies. Alfalfa yield data were summarized for the area encompassing the Powder River Basin: Sheridan, Johnson and Campbell counties. Alfalfa yield data for California counties are available from 1980-2004 so the entire dataset was averaged. Alfalfa data were summarized for counties in California related to intensive agriculture: Imperial, Fresno, Kern, Kings and Tulare counties.

Soil salinity data (as measured by EC) collected by the USDA National Soil Survey and analyzed by the National Soil Survey Center (NSSC) Soil Survey Laboratory were also obtained and summarized for the aforementioned counties. Average root zone EC values were calculated to a maximum depth of five feet. The county alfalfa yield and average root zone EC summaries are presented in Table 2 below.

**Table 2**
**Comparison of Average Root Zone Soil Salinity (EC) Values with Historical Alfalfa Yields for Selected Counties in Wyoming and California.**

| County | Average Root Zone Soil Salinity (EC as dS/m) | Historical Average Alfalfa Yield (tons/acre) |
|---|---|---|
| Sheridan, WY | 1.5 | 2.7 |
| Johnson, WY | 1.9 | 2.4 |
| Campbell, WY | 2.0 | 2.4 |
| **Wyoming Average** | **1.8** | **2.5** |
| Tulare, CA | 2.8 | 8.4 |
| Kings, CA | 6.9 | 6.9 |
| Kern, CA | 4.6 | 8.0 |
| Fresno, CA | 6.7 | 7.9 |
| Imperial, CA | 6.7 | 7.8 |
| **California Average** | **5.5** | **8.0** |

Values expressed in Table 2 show substantially higher average root zone salinities in California than in Wyoming. Alfalfa yields reported in California are three times greater than those in Wyoming, even though, on average, the soil salinity values are nearly three times higher than those reported for the Wyoming counties. The values generated in this exercise suggest that environmental factors other than salinity, e.g., climate, may be dictating the obtainable degree of alfalfa yield produced. However, the data also suggest that the California-based 100 percent yield threshold of 2 dS/m may not be appropriate for even the chloritic soils of California. For

example, the historical average yield of alfalfa in Tulare County is 8.4 tons per acre with a corresponding average root zone EC of 2.8 dS/m. The yield from Tulare County is actually slightly greater than the yields from Fresno and Imperial Counties where the corresponding average root zone EC values are substantially higher at 6.7 and 6.7 dS/m, respectively. Regardless, there does not appear to be a substantial difference in yields reported by the California counties with soil EC values ranging from 2.8 to 6.7 dS/m.

Other field data from Wyoming have been reviewed that also suggest an alternative to the California-based salinity tolerance values. The Use Attainability Analysis (UAA) report for Cottonwood Creek (SWWRC et al., 2002) was downloaded from the Wyoming Department of Quality, Water Quality Division webpage. Cottonwood Creek is located in Hot Springs County within the Bighorn Basin of Wyoming. This is an area of extensive conventional oil and gas production. According to the UAA report, discharge of produced water from the Hamilton Dome oil field to Cottonwood Creek constitutes the majority of flow to the ephemeral stream and constitutes the only irrigation water source for approximately 35 ranching operations. The waters of Cottonwood Creek exhibit an $EC_w$ between 4.1 and 4.5 dS/m. At an average $EC_w$ of 4.3 dS/m, an average root zone soil $EC_e$ value can be calculated using the widely accepted relationship: $EC_e = 1.5\ EC_w$ (Ayers and Wescot, 1985). This relationship is expressed in the draft Section 20 Agricultural Use Protection Policy. From this relationship, an average root zone soil EC value of 6.5 is estimated for the fields irrigated long-term with water from Cottonwood Creek. Average alfalfa hay yields reported in the UAA amount to 2.5 tons per acre. This yield is identical to the average of the three Wyoming counties reported in Table 2 above. This is compelling given that the average soil EC value for the three other Wyoming counties is 1.8 dS/m, while the estimated soil EC for the fields irrigated with water from Cottonwood Creek is 6.5.

**Closing Statement**

Based on the review summarized herein, we respectfully suggest that the WDEQ consider adopting an acceptable average root zone EC threshold of 4 dS/m for protection of alfalfa. This would equate to a default (Tier 1) effluent limit of 2.7 dS/m based on the 1.5 concentration factor cited by the draft Agricultural Use Protection Policy. Other species of concern, including western wheatgrass, should be given equal consideration due to the inherent differences in soil chemistry between the northern Great Plains and the California agricultural areas for which the ARS Salt Tolerance Database is based. Factors such as extreme climate, periodic drought, soil moisture regime, duration of growing season, soil depth, and fertility limitations can collectively exert an overriding regional influence on the yield potential of forage crops. Based on this, we ask that the WDEQ exercise caution interpreting the applicability of specific salinity tolerances outlined by the ARS Salt Tolerance Database and thoughtfully consider the difficulty in detecting a "measurable" change in plant production due to soil salinity alone.

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Thank you very much for your time and consideration of this review and the recommendations stemming from it. If you, your WDEQ colleagues, or the members of the Water and Waste Advisory Board have any questions or comments regarding our findings, please contact me.

Sincerely,

Kevin C. Harvey, M.Sc., CPSSc.
Principal Soil Scientist

KC HARVEY, LLC
SOIL AND WATER RESOURCE CONSULTANTS

May 4, 2006

Mr. Bill DiRienzo
Wyoming Department of Environmental Quality
Water Quality Division
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Cheyenne, Wyoming 82002

Subject: Comments pertaining to the proposed default SAR effluent limit cap of 10 in the Draft Section 20 Agricultural Use Protection Policy.

Dear Mr. DiRienzo:

I respectfully submit for your consideration the following comments regarding the fourth draft of the Section 20 Agricultural Use Protection Policy as it pertains to the derivation of effluent limits for SAR, particularly the proposed SAR cap of 10. These comments are being submitted on behalf of Yates Petroleum Company, Williams Production RMT Company, Petro-Canada Resources (USA) Inc., Marathon Oil Company, Lance Oil & Gas Company, Inc., Fidelity Exploration & Production Company, Devon Energy Production Company L.P., Bill Barrett Corporation, and Anadarko Petroleum Corporation. I have submitted additional comments regarding the derivation of EC limits in a separate letter.

By way of introduction, I am a board-certified professional soil scientist having practiced as an environmental consultant in Montana and Wyoming, and throughout the world, for nearly 25 years. For the past seven years, my practice has focused on water management and soil and water salinity/sodicity issues associated with oil and gas development. I am credited as the first to research, develop, and apply managed irrigation techniques for the beneficial use of coalbed natural gas produced water. I have directed or participated in over 75 separate projects related to produced water management, WPDES permitting, soil and water chemistry investigations, and reclamation for coalbed and conventional natural gas projects in Wyoming, Colorado, and Montana. I have a M.S. degree in land rehabilitation (soil science emphasis) from Montana State University and a B.S. in Resource Conservation (soil science emphasis) from the University of Montana.

I would like to comment on the proposed changes made to the Agricultural Use Protection Policy by the WDEQ subsequent to the January 26, 2006 meeting of the Water and Waste Advisory Board. My comments will focus on the comments provided by Dr. Larry Munn in his letter to the DEQ dated December 5, 2005. It is my understanding that Dr. Munn's comments resulted in the changes made to the proposed Policy. Specifically, I comment on Dr. Munn's proposal that all WPDES default effluent limits for SAR be capped at 10 under the Tier 1 process.

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**Summary of Findings**

The fourth draft of the Agricultural Use Protection Policy describes a 3-tiered decision making process for deriving appropriate effluent limits for EC and SAR whenever a proposed discharge may reach irrigated lands. The Tier 1 process would be followed for deriving "default" limits, and as such, this procedure would require a minimum of background information from the applicant. The default SAR limits would be extrapolated from the Hanson et al. (1999) chart relating the established EC effluent limit to SAR, up to a maximum default value of 10. The effluent limit for SAR will be determined in conjunction with EC so that the relationship of SAR to EC remains within the "no reduction in rate of infiltration" zone of the Hanson et al. (1999) diagram.

Two key concerns arise from Dr. Munn's letter regarding sodicity and the discharge of CBNG produced water in the Powder River Basin: (1) the potential impacts on the hydraulic function of irrigated soils during produced water discharge; and (2) the potential impacts of residual adsorbed sodium on the hydraulic function of irrigated fields after produced water discharge has ceased and rainfall/snowmelt leaches salts from the upper root zone. It is assumed that these concerns led Dr. Munn and the WDEQ to propose the SAR effluent limit cap of 10 under the Tier 1 process.

In addressing these concerns, I performed a considerable amount of research, including three months searching and reviewing the relevant scientific literature, and compiling and analyzing available and relevant soil, plant, and water data. The key conclusions of the literature review and data analysis are presented below and will be substantiated by the discussion that follows.

Review of Soil Sodicity

- Plant growth problems associated with excess sodium adsorption are in response to negative changes in soil structure resulting in reduced air exchange, water infiltration and hydraulic conductivity.
- The universally applied sodic soil threshold is an exchangeable sodium percentage (ESP) greater than 15.
- SAR is a measure of the sodicity risk in irrigation water. The higher the salinity of irrigation water, the higher the SAR can be without impacting soil structure and impairing soil infiltration and permeability.

The ESP-SAR Relationship for Soils in Northeastern Wyoming

- Using regression analysis, the relationship between ESP and soil SAR was determined for the Powder River Basin ($n=382$, $R^2=.74$).
- A 1:1 relationship of soil SAR to water SAR exists for soils in equilibrium with irrigation water. This relationship is widely accepted and confirmed by recent research led by Dr.

James Bauder at Montana State University. The relationship of ESP to soil SAR is therefore equivalent to the relationship of ESP to water SAR.

- Based on the regional specific relationship of ESP and SAR, an effluent limit of SAR = 16 corresponds to an ESP of 10, and provides a 33% margin of safety against the formation of sodic conditions (i.e., exceeding an ESP of 15). The proposed default SAR cap of 10 is, therefore, unnecessarily conservative.

The Effect of Rainwater Leaching on Soils Irrigated with Produced Water

- Concern has been raised that subsequent rainfall/snowmelt leaching of residual soil salinity may lower the electrolyte concentration and naturally raise the ESP past the dispersive sodic soil threshold.

- Research demonstrates that arid land soils can release 0.3 to 0.5 dS/m of Ca and Mg to solution as a result of the dissolution of primary minerals and the inherent calcium carbonate content of surface soils. Shainberg et al. (1981) indicates that these concentrations are sufficient to counter the deleterious effects of exchangeable sodium, even when the soil is leached with rainwater.

**A Review of Soil Sodicity**

The physical and chemical phenomena associated with soil sodicity are complex. Therefore, a brief summary is provided regarding the soil and water chemistry associated with the physical affects of soil sodicity.

A large body of research concerning sodic, or "black alkali" soils has been generated in response to the negative effects of high sodium concentrations on soils. Toxicity effects of sodium are rarely expressed in forage and grass crops, but do cause injury to selected woody plants (Lilleand et al., 1945; Ayers et al., 1951; Brown et al., 1953). Plant growth problems associated with high concentrations of sodium are generally a response to negative changes in soil structure. Sodic soils are "nonsaline soils containing sufficient exchangeable sodium to adversely affect crop production and soil structure (Soil Science Society of America, 2001)." High levels of adsorbed sodium tend to disperse soil particles thereby sealing the soil. The result can produce clogged soil pores, hard surface crusts, reduced infiltration, reduced permeability, and reduced oxygen diffusion rates, all of which interfere with or prevent plant growth. By definition, sodic soils are those that have an exchangeable sodium percentage (ESP) greater than 15. The universally applied ESP threshold of 15 percent is acknowledged in numerous publications, including Levy et al. (1998), Abrol et al., (1988), Evangelou (1998), McNeal and Coleman (1966), Sparks (1995), Sumner et al. (1998), Shainberg et al. (1971), the Soil Improvement Committee (2002), university extension publications, etc.

Clay minerals are the most physically and chemically reactive components of the sand, silt, and clay matrix in soil. The structural arrangement of clay minerals in soil is akin to a deck of cards; the clay mineral itself can be thought of as the deck, and the cards as individual layers. The

properties of the deck depend upon the arrangement of the cards and the electrochemical interlayer forces holding the cards together.

Clay minerals in soils are negatively charged and consequently attract ions with a positive charge such as calcium, magnesium, potassium, and sodium. Positively charged ions are called cations. Each cation competes with others in the soil solution for access to the bonding sites based on its valence and hydrated size. Every soil has a definite capacity to adsorb the positively charged cations. This is termed the cation exchange capacity (CEC). The various adsorbed cations (such as calcium and sodium) can be exchanged one for another and the extent of exchange depends upon their relative concentrations in the soil solution (dissolved), the ionic charge (valence), the nature and amount of other cations, etc. ESP is, accordingly, the amount of adsorbed sodium on the soil exchange complex expressed in percent of the cation exchange capacity in milliequivalents per 100 grams of soil (meq/100 g). Thus,

$$\text{ESP} = (\text{exchangeable sodium} / \text{cation exchange capacity}) \times 100.$$

Sodic soil conditions arise when greater than 15 percent of the ions bonded to the deck are sodium, which has a +1 valence and a large hydrated radius. When the ESP exceeds 15, the large hydrated sodium ions can wedge in-between the individual cards and cause "swelling" of the deck (Levy et al., 1998). This causes negative effects on the physical structure of the soil. Upon re-wetting, the individual decks may disperse and settle into soil pores, effectively clogging them and reducing the efficiency of air exchange, water infiltration, and permeability (i.e., hydraulic conductivity). In general, soils with moderately high, to high, clay contents are at higher risk.

Excessive adsorbed or exchangeable sodium can result from sustained use of irrigation water that is high in sodium and low in calcium and magnesium. Consequently, the ratio of sodium to calcium and magnesium ions in water is an important property affecting the infiltration and permeability hazard. The water quality index used to measure the hazard related to sodium abundance or sodicity in irrigation water is the sodium adsorption ratio or SAR.

The SAR is the ratio of the dissolved sodium concentration in water divided by the square root of the average calcium plus magnesium concentration. The SAR can be calculated from the sodium, calcium and magnesium concentrations via the formula:

$$\text{SAR} = [\text{sodium}] / (([\text{calcium}] + [\text{magnesium}])/2)^{1/2}$$

where the concentrations are in milliequivalents per liter (meq/L).

What is not apparent from the SAR formula is the fact that the higher the salinity of the water, the higher the SAR can be without impacting soil structure and impairing soil infiltration and permeability. Put another way, for a given SAR, infiltration rates generally increase as salinity (measured by the EC) increases. The changes in soil infiltration and permeability occur at varying SAR levels, higher if the salinity is high, and lower if the salinity is low. Therefore, in order to evaluate the sodicity risk of irrigation water, the EC must be considered. To this end,

the SAR-EC guidelines presented in Ayers and Westcot (1985) and Hanson et al. (1999) are used to assess the potential sodicity risk of irrigation water.

**The ESP-SAR Relationship for Soils in Northeastern Wyoming**

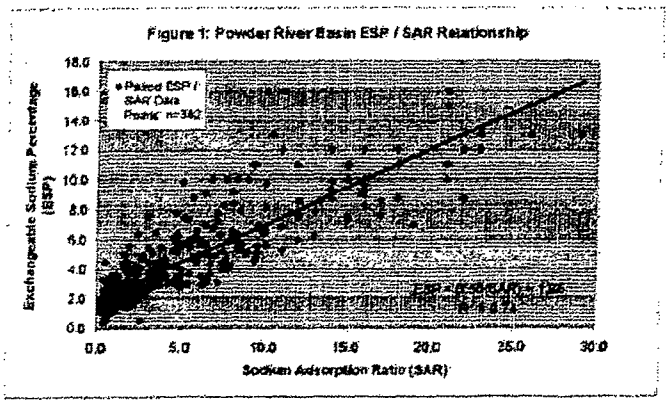
In addition to measuring the SAR of irrigation water, one can also measure the SAR of the soil solution via a saturated paste extract (i.e., the dissolved concentrations of sodium, calcium, and magnesium are measured in a saturated paste extract and applied via the SAR formula presented above). The soil SAR was developed to serve as a rapid and relatively inexpensive index of ESP. It is widely accepted that the SAR of the soil in equilibrium with the SAR of the irrigation water is equal to the long-term average SAR of the irrigation water.

The fourth draft of the Agricultural Use Protection Policy includes a proposed SAR cap of 10 for Tier 1 default effluent limits. To evaluate the appropriateness of the proposed cap, an analysis was performed using 382 ESP-SAR data pairs generated from ongoing soils assessment work in the Powder River Basin of Wyoming (KC Harvey LLC, 2006). This database represents flood plain soils associated with tributaries to the Powder River and the Tongue River, including spreader dike irrigated fields. This database represents baseline soil chemical conditions. In no case were any of these soils irrigated with or influenced by coalbed natural gas produced water. The soil samples from which the analyses were made were collected during soil profile descriptions to five feet, and with a Giddings hydraulic probe up to eight feet in depth. The numerous soil investigations involved were required for various coalbed natural gas water management planning, permitting, and design purposes.

The ESP-SAR data pairs were graphed in Microsoft Excel using simple scatter-plot and trend line analysis. The best fit line resulted in a linear regression which yielded the equation:

$$ESP = 0.5(SAR) + 1.96, \text{ with an } R^2 \text{ value of } 0.74.$$

The regional-specific "Powder River Basin" relationship, based on 382 soil samples, is shown on Figure 1. According to the Powder River Basin equation, a soil SAR of 26 corresponds to the critical ESP threshold of 15 percent.




It is widely accepted that the SAR of soil in equilibrium with irrigation water equals the long-term average SAR of irrigation water. Recent Department of Energy funded research directed by Dr. James Bauder at Montana State University (Robinson and Bauder, 2003) confirms this relationship. Their research, which is related to the potential effects of coalbed natural gas produced water on soils, reports that in general, soil solution SAR

represents the SAR of the applied water. The 1:1 soil SAR to water SAR relationship allows one to relate the SAR of discharge water to the SAR of the soil in the Powder River Basin ESP-SAR graph and equation described above. For example, after long-term irrigation with water exhibiting an SAR of 15, the equilibrated ESP of the irrigated soil would be approximately 9.5 percent. The proposed SAR cap of 10 would equate to a corresponding ESP of 7. An ESP cap of 7 appears to be unnecessarily conservative given the regional specific relationship of ESP and SAR. While an ESP threshold of 15 is widely accepted to be the point at which clay swelling and dispersion occurs, we respectfully suggest that the WDEQ consider establishing a Tier 1 default SAR effluent limit cap of 16, which corresponds to an ESP of 10. An ESP value of 10 provides a 33 percent margin of safety.

**The Effect of Rainwater Leaching on Soils Irrigated with Produced Water**

In his December 5, 2005 letter, Dr. Munn indicates his concern about the potential effects of rainwater leaching of fields that had received produced water due to upstream permitted discharges. In particular, what is the effect of leaching on the sodicity status and hydraulic function of soils after discharge and irrigation with produced water ceases? Fortunately, the considerable research on this subject has been well documented in the scientific literature.

Discontinuation of produced water discharge in the Powder River Basin will effectively reduce the EC and SAR of irrigation waters from tributaries and mainstems so long as the surface water is of higher quality than the produced water. In the case of fields that are irrigated opportunistically (e.g., in response to runoff events that are captured behind spreader dike systems), there can be three sources of water supplying soil moisture: (1) meteoric water (rain and snowmelt); (2) natural runoff water; and (3) subirrigation from a shallow aquifer. In the case of rainfall and snowmelt, the EC of these waters will be similar to that of distilled water, i.e., they will exhibit very low dissolved solids. Owing to the dissolution of soluble constituents within the watershed, natural runoff EC values can range up to 5 dS/m or higher. Regarding subirrigation, shallow aquifers can be relatively saline due to the entrainment of dissolved minerals along the groundwater flowpath.

The concern arises from leaching of residual surface soil salinity with rainfall and snowmelt. Intermittent rainfall and snowmelt may lower the electrolyte concentration (i.e., EC) sufficiently to promote clay dispersion, depending on soil properties (Levy et al., 1998). Conversely, when the electrolyte concentration in the soil solution reaches a moderate level (1-2 dS/m), high sodicity levels (ESP between 10 and 30) cause only small to moderate changes in the physical and hydraulic properties of the soils, which are mostly reversible (Levy et al., 1998). Shainberg et al. (1981) showed that a major factor causing differences among various sodic soils in their susceptibility to hydraulic failure when leached with low electrolyte concentrations (i.e., a low EC) was their rate of salt release from mineral dissolution.

Arid land soils can release 0.3 to 0.5 dS/m of calcium and magnesium to solution as a result of the dissolution of plagioclase, feldspars, hornblends and other sparingly soluble minerals within the soil matrix (Rhoades et al. 1968). The solution composition of a calcareous soil at a given ESP in contact with distilled water (i.e., rainwater or snowmelt) can be calculated (Shainberg et al., 1981). As calcium carbonate ($CaCO_3$) dissolves, the EC of the soil solution increases and

calcium replaces sodium on exchange sites until the solution is in equilibrium with the cation exchange system and the $CaCO_3$ solid phase. Shainberg et al. (1981) calculated that the EC values of solutions in equilibrium with soils having ESP values of 5, 10, and 20 are 0.4, 0.6, and 1.2 dS/m, respectively. Shainberg et al. (1981) indicates that these concentrations are sufficient to counter the deleterious effects of exchangeable sodium, even when the soil is leached with rainwater.

It is evident that water equilibrated with a calcareous soil can never be a very low salinity (Shainberg et al., 1981). Using the same database discussed above for evaluation of the ESP-SAR relationship in 382 soil samples from the Powder River Basin, we can compute an average percent lime ($CaCO_3$) content in surface soil samples (n=81), which is 5.1 percent. This represents a considerable reserve of calcium. Other sources of calcium include residual gypsum ($CaSO_4$) which we know to be prevalent in Wyoming soils.

Various soil SAR-EC relationships (not to be confused with irrigation water SAR-EC relationships) have been reported in the literature by introducing low electrolyte concentration waters to sodic soils. Felhendler et al. (1974) measured the hydraulic conductivity of two montmorillonitic soils as a function of the SAR and found that both were only slightly affected by the SAR of the percolating solution up to a SAR of 20 as long as the concentration of the percolating solution exceeded 1 dS/m. Shainberg et al. (1981) studied the effects of leaching a 1:1 sand-soil column with distilled water and increasing concentrations of a weak electrolyte solution. His findings concluded that an electrolyte concentration of 0.3 dS/m in the percolating solution was adequate to prevent the adverse effects of a SAR of 15 on the hydraulic conductivity of the soil-sand mixture. These findings are very similar to the conclusions of the U.S. Salinity Laboratory Staff (1954) who used electrolyte concentrations equal to or greater than 0.3 dS/m in their regression analysis to determine the sodic soils threshold of ESP = 15.

As a review, an electrolyte concentration of 0.3 dS/m is the minimum value of calcium and magnesium contributions to soil solution associated solely to arid soil weathering. This suggests that an arid Powder River Basin soil with a SAR of 16 (ESP = 10), will have no sodicity related impacts to the hydraulic conductivity, even when the salt concentration of the irrigation or rainwater is equal to that of distilled water.

Of course, irrigation water in the Powder River Basin has an intrinsic electrical conductivity greater than that of distilled water. Use of surface water for irrigation will actually supplement the inputs of calcium and magnesium from weathering and carbonate dissolution alone.

Using the aforementioned Powder River Basin soils assessment database (KC Harvey LLC, 2006), an average surface soil ECe of 1.64 dS/m was calculated from 81 individual surface soil samples. This value suggests that electrolyte concentrations in surface soils of the Powder River Basin, in equilibrium with mineral dissolution, the salinity of runoff irrigation water, and rainwater/snowmelt, is about 1.6 dS/m, or five times (1.6 dS/m divided by 0.3 dS/m) the concentration required to maintain the hydraulic conductivity of a soil at an ESP of 16.

**Closing Statement**

Results of the Powder River Basin regression analysis indicates that a relationship between ESP and soil/water SAR exists, which allows the calculation of one parameter from the other. Using the proposed, default ESP cap of 10 percent, the scientific literature indicates that water with a SAR of 16 can be effectively used for irrigation without adverse effects on the physical structure or hydraulic conductivity of Powder River Basin soils during irrigation. Furthermore, it has been shown that inputs of Ca and Mg from the natural dissolution of plagioclase, feldspars, hornblends and other sparingly soluble minerals, especially calcium carbonate and gypsum, will provide an effective buffer to residual soil sodicity after the discontinuation of produced water discharge and the transition back to native irrigation, precipitation, and runoff regimes.

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Thank you very much for your time and consideration of this review and the recommendations stemming from it. If you, your WDEQ colleagues, or the members of the Water and Waste Advisory Board have any questions or comments regarding our findings, please contact me.

Sincerely,

Kevin C. Harvey, M.Sc., CPSSc.
Principal Soil Scientist

# TESTIMONY – FEBRUARY 15 & 16, 2007

## PAW & Member Companies

## Environmental Quality Council Hearing

### CHAPTER 1 WATER QUALITY RULES AND REGULATIONS

*Resubmitted by*

PETROLEUM ASSOCIATION OF WYOMING

*August 26, 2008*

soils for doing this Tier 2 or Tier 3, you don't get the protections. And I think we essentially are concerned that's somewhat of a blackmail clause. I mean, we understand that maybe there should be some access required, but -- or at least maybe we would suggest that allow the landowner to do their own -- get their own analysis done in order to still apply the protections, but not necessarily allow -- having to allow access for industries consultants to do those analysis.

So we ask you to consider a way to make that more balanced.

CHAIRMAN GORDON: Thank you, Jill. Have you got more?

MS. MORRISON: No, that's it. I appreciate the opportunity to comment. Appreciate your consideration.

CHAIRMAN GORDON: Let me ask if anybody from the Council has questions for Jill Morrison.

MR. BOAL: Your Honor.

MS. HUTCHINSON: We have one comment.

MR. BOAL: Miss Morrison, explain to me -- explain to me the objections to allowing the industry reps on the land to do the soil tests. I mean, it's my understanding that the more site-specific information you have, the better a permit you can -- you can write. And so what's the objection to having a provision in the regs



which would encourage that kind of site-specific information?

MS. MORRISON: Mr. Chairman, Mr. Boal, we're not opposed to I think site-specific analysis. It's about who conducts the site-specific analyses. I think our ideal is to have an independent third party, maybe that's even agreed by both parties, but the concern is for -- I mean, Mr. Harvey was able to come up with, you know, an SAR of 26 and an EC of 6,000 on the soil analysis they did.

MR. BOAL: So your concern is that maybe some of the results coming from the industry consultants aren't as objective as they might be?

MS. MORRISON: I think they're concerned they're not as objective as they might be, and/or the where you do the sampling, how you do the sampling, sort of -- there probably ought to be a whole defined protocol about that.

MR. BOAL: Okay. Thank you.

CHAIRMAN GORDON: Okay. Ms. Hutchinson.

MS. HUTCHINSON: I just wanted to comment that I appreciate the fact that your comments are very specific to the rule itself and what you want changed. That's very helpful, that type of comment, for us.

MS. MORRISON: Thank you.

MR. BOAL: But -- Your Honor, if I may.



Miss Morrison, you do agree with the idea that site-specific analysis is the better way to go in all cases if you can do it; is that correct? Because that seems to me what DEQ is saying, is that we want to encourage site-specific information so that we can issue a good permit. Do you agree with that approach?

MS. MORRISON: Well, not -- I agree with site-specific information. What I think we don't agree with is you can achieve background baseline water quality from soil samples.

MR. BOAL: Uh-huh.

MS. MORRISON: We have saline soils. Now, the background water quality that snowmelt and rainfall that runs down these drainages isn't an EC of 6,000 or SAR of 26. It, in many cases, can be a very, very low SAR. For example, in an area that I'm familiar with on our place where there is an alfalfa field, it's not in the ephemeral drainage, it's not near the CBM, it's not even in a place where that is, we have saline soils.

It is irrigated with mountain water irrigation, but if you went and sampled those soils, you would get a much different -- you would come up likely with something that shows a background water quality that was irrigated with that isn't at all what the real background water quality is we've been irrigating with.



MR. BOAL: So your comment that Tier 1 and Tier 3 were loopholes in the regulations surprised me. And your reason -- the reason you're saying that they might pose loopholes is because it's your belief that the site-specific data might not present an accurate picture of what's out there; is that correct?

MS. MORRISON: I think site-specific soil samples aren't going to necessarily give you background water quality or baseline historic water quality, which is I think what they're trying to extrapolate from those.

MR. BOAL: Thank you.

Thank you, Your Honor.

CHAIRMAN GORDON: Any further questions?

Thank you, Jill.

Staying in tune with my policy, I'm going to pass over Nate Heather from Oedekoven and move on to Matt Grant.

MR. GRANT: Pass.

CHAIRMAN GORDON: Thank you, Matt. Matt passes.

Passing over John Wagner, who signed in, to Bill DiRienzo. You've already commented.

MR. DIRIENZO: I -- yes.

CHAIRMAN GORDON: Okay. We're moving right down the list.

I have Hugh Lowham. Is Hugh Lowham here? Thank

you. I thought I saw you.
MR. LOWHAM: Mr. Chairman, members of the Council, I have some handouts. I have 12 copies here. Who do I --
CHAIRMAN GORDON: Kim, and then please identify yourself.
MR. LOWHAM: My name is Hugh Lowham. I'm an engineer. I have an office in Lander, Wyoming and another one in Gillette, Wyoming. I was born and raised on a ranch in Evanston, Wyoming, and I spent my entire career in Wyoming doing work with hydrology and I'm here today specifically to transfer perhaps some of the knowledge, some of my experience, to Council members, and especially describing flow of the ephemeral drainages.
I would specifically address Section 8 and a description of how natural irrigation occurs. I'm talking about natural streams, not necessarily those that have artificial irrigation on them, such as -- that would have diversions or spreader dams.
Go ahead and kick up the first slide there. I have two handouts today. One is a nine-page very brief overview of flow that occurs in ephemeral streams. It is based --
CHAIRMAN GORDON: Mr. Lowham, how long do you think you'll take on this?



MR. LOWHAM: I'm going to try to be very brief. I'm going to try to wrap up in five minutes.
CHAIRMAN GORDON: Okay. Thank you.
MR. LOWHAM: I did supply the first paper, which is entitled Ephemeral Flows, I believe. So at your leisure you can go ahead and read through. It documents USGS studies and publications, summarizes how flow occurs in the area. I'm specifically addressing ephemeral streams that are in Powder River Basin. These would not include perennial streams such as Crazy Woman and Clear Creek.
I might add, while we're waiting for the first slide, I have been -- I've worked formally for the U.S. Geological Survey for 31 years. I was stationed in northern Wyoming. I've weighed, measured, sampled and observed many of these ephemeral streams during my career. During the last 10 years, I've -- excuse me, about the last eight years I've worked as a consulting engineer and much of my business has been with water management involved with the CBM industry. I'm proud of what we've done.
I believe in many cases, in dozens of ranches that we worked with, that we have essentially helped save the family ranch. We have helped them develop water supplies such as they've been able to greatly increase crop production and be able to make a living on a ranch that perhaps they would have had to give up. They would have



many more years of the conditions that they had.
I said I have two handouts. One is more of a descriptive paper and the other is a copy of the slides that we'll be taking a look at today. The first slide up on the screen behind you is just a photograph I took of an ephemeral stream of a tributary of Dead Horse Creek, happened to catch it during the daytime when a flood occurred. There was a thunderstorm that occurred upstream on part of the drainage area and resulted in a flood, and this is the type of event that I'm going to be describing today.
Next slide, please.
In the Powder River Basin the annual precipitation is about 10 to 16 inches. And runoff occurs from three different types of events: snowmelt, which generally occurs, could be as early as January, but generally now February to April; from chinooks, if there is a snow cover; general rainstorms. And then a primary event that occurs that affects these ephemeral tributaries are the thunderstorms. These occur mainly during the periods of May to September, they're very high intensity, short duration and they're isolated. They can hit one drainage and not another.
And to be able to describe the runoff characteristics of these hydro -- we call them hydrographs.



It would be a graph of when flow event occurs. We have tremendous amount of USGS data and it was summarized in a report by Crick and Rankle, the copy here. It's very widely used by the Wyoming Highway Department. The study was funded by the Wyoming Highway Department, Federal Highways Administration, and they essentially collected data on about 28 basins throughout the plains areas of Wyoming. Many of those stations were in the Powder River Basin.
And then we also have actual data, also. That would be USGS data, gauging stations that have been operated since about 1961. There's probably about 14 to 16 of those. And then also the companies have operated a number of basins, they started in about 2001 to install stations and I'll describe those a little bit more as well.
This next slide is a hydrograph, is typical of a small ephemeral stream. And what I want to mainly present here is that when runoff occurs on these ephemeral streams, it's like a freight train. When runoff occurs, it occurs in a flood. It's not a long event. It's there and it's gone and you better not be in the way, like in a gully or that, when one hits upstream, because you could be washed away, but what the curves are depicting there is a stream, Barker Draw, which is north of Gillette. It's a tributary to Wild Horse Creek. I have depicted on here standard

hydrographs that run from the two-year to the 50-year hydrograph that are molded from the USGS study that I described earlier. It is based on tremendous amount of data they collected it on a wide -- on hundreds of hydrographs.

The reason I have used a model data on this particular stream to describe it, even though we have a stream flow gauging station here, is because we didn't have enough flow events over about five-, six-year period it's been gauged. The highest flow this stream has had in this five or six years is 31 cubic foot per second.

Now, what I have depicted on the chart as well is what the approximately two-year, and which also the equivalent to about the bankfull discharge of this site would be. And the two-year discharge is determined from another USGS study by Miller and it uses data from gauging stations and transfer of two stations that don't have a lot of record like this one. So on this particular station I used the USGS model hydrograph to just show that these events, when they do occur, they're sharp, they're fast, and if you take a look at the line that I have on here, which depicts the two-year flood or about the bankfull discharge of 100 cubic foot per second, you'll see even on the 50-year storm, that the event only lasts about 100 minutes.



Now, we'll go to the next slide. Excuse me.

CHAIRMAN GORDON: Hold on a second. Wendy has a question for you.

MS. HUTCHINSON: I need you to clarify for me, is it a two-year, 24-hour event, six-hour event, 12-hour event? What event time frame for your graph?

MR. LOWHAM: What you're referring to is you're referring to 6-, 12-, 24-hour precipitation event.

MS. HUTCHINSON: Okay.

MR. LOWHAM: Okay. That would be the cause of the runoff event that then occurs. Now, what is a snowmelt event? Is it 6 or 12 or 24? So, see, what you have to take a look at in ephemeral streams like this, there's actually three types of precip events that occur. The precip values or input in the models that predicts storms are based on weather records of precipitation. The USGS study that was published and achieved by WYDOT, was based on actual flow records. They also had precipitation gauges at the stations. They tried to correlate the two so they could develop long-term models.

So there's two different events. Okay? The six-hour, the 24-hour, either of those could produce these hydrographs. These hydrographs here typically were probably produced, however, and most of the ones they gauged here and in the Powder River Basin, are fast-moving



thunderstorms. They don't hang around for 24 hours.

MS. HUTCHINSON: Right.

MR. LOWHAM: Okay. Now, that said, we'll move on to the next slide.

As you get into some larger drainage areas, yes, you do have more effect from your snowmelt and/or general rainstorms that are very intensive; however, those events are pretty rare. 1978, I believe it was we had pretty good snowmelt event in Gillette -- here in the -- in that Powder River Basin here and a lot of streams flowed fairly high, but they're rare. They just don't occur and produce the floods like the fast-moving thunderstorms.

Most of your general rainstorms that occur are light. There's no runoff that occurs from it. Water all soaks into the ground. The 10 to 16 inches a year that falls in the Powder River Basin, mainly, you know, is absorbed in the ground. And it's isolated thunderstorms where the intensity is very high. Those are the ones that do cause some flow. Okay?

On this next graph, this is a hydrograph of one of the gauges that the CBM companies are operating. They're not operating, they're funding my company and CBM Associates to help fund one of these, but this is an actual hydrograph. This is data that we collected on one of the 14 streams, whereby -- where the CBM companies have agreed



to fund these stations.

This station -- this particular peak hit almost 1600 cubic foot per second. That is about a five-year event. On the average, over a very long period of time, not just, you know, five years, but over very long period of time, you would expect that particular magnitude of peak to hit about once every five years.

On the graph, I also have the value of the two year -- well, it's actually bankfull, and we did a survey of the stream, that would be the level at which the water would begin to overflow onto the floodplain. This is also very close to I think it's 500 cubic foot per second, was a two-year estimate for this site using the Miller report by USGS.

The 50-year event at this site, from the USGS studies, would be about 8,000 cubic foot per second. The larger the peak discharge, then the larger the hydrograph, the more volume you have, but even on this particular hydrograph for a very significant event, and this is the largest event that has occurred on this site since about 2002, when a -- when we have the gauge recording there, this is the largest event that has occurred, and it only occurred for the life -- I think about three hours. Okay. That has significance, then, as far as what constitutes natural irrigation.

So go to the next slide.

Okay. For something to be naturally irrigated, you have to -- and for floodplain to be able to be naturally irrigated, it would have to exceed the bankfull discharge, which has a recurrence of about two years, but you also have to have the duration.

These soils that are out in these areas, that deposit along the floodplains, are generally for applying grain. And they have a low infiltration, about .1 to 0.5 inches per hour. So if you only have flood that's out there hundred minutes or two or three hours, it just doesn't have sufficient time to soak in, especially if that flood is only occurring, say, once every five years or 50 years or on that frequency.

What my point is, which is based on USGS data, the records we collect is the fact that the floodplain vegetation you're seeing there is not the result of natural irrigation from these overbanked flows -- floods.

Next slide -- slide, please.

This is a slide of Wildcat Creek. Wildcat Creek, you know, had several years ago -- perhaps some of you were involved in this -- had quite a bit of study on it. And my firm was contracted to go out and obtain information on this stream. This photograph was taken in December of 2003. And it just depicts -- it was a photograph I had



in my file that shows a snow cover on this floodplain. When this snow melts it's not running off, it's infiltrating. Because why? On the floodplain the slope is low, it's flat. So that water's going to stay there. The same for any precip that occurs out here. Any general or even perhaps thunderstorm drops that hit on this floodplain tend to soak in. Additionally, you have some sidehill irrigation that comes in. This stream has not had a flood flow that has topped these banks since 2003, three years. Hasn't seen come close. It hasn't even hit the 20 cubic -- 20 cubic feet per second amount that was agreed upon by DEQ, the landowners and the companies that would be what would be designated as a significant irrigation event for this site.

Now, down in the trees there there is a spreader dike on this stream. Why was it installed? Because natural flood irrigation, if you don't have these devices, is not enough to produce, you know, the irrigation. You have to have -- I mean, that's why they put them in, because you don't have the overbank flows that are large enough and long enough to cause irrigation.

Next slide then, please.

To summarize, my point here is, then, is that, yes, it appears sometimes, and perhaps people that haven't spent, you know, a lot of time out on these areas, would



think, well, yeah, these streams have overbank flooding and it's really critical to the crops that are out there, you know, it's irrigating them, and unless you have an artificial device in there, it's not.

Where the water's coming from is from the precip, the sidehill runoff, which we have characterized here, and the fact that it's fine-grade soils, which perhaps tend to hold the water a little bit better and you do have better soils and vegetation there than you would, perhaps, on the side hills.

So, Council members, thank you for your time. I sped through it. You have a longer report there you can read, you know, later on.

CHAIRMAN GORDON: No, that was helpful.

Let me ask if there are any questions from Council members.

MR. BOAL: Your Honor, I have one.

Thanks for -- thanks for the explanation, but I want you to take it another step for me. Okay? Given what you've just talked about, you know, what's the implication of the fact that -- the fact that -- what's the implication -- I want you to take what you just told us and what implication does it have on the agricultural protection policy? Are you telling me that it's really not needed? Are you telling me -- are you telling the Council



that it's only needed where we have artificial devices spreading the water outside the channel? I want you to take it the next step, Hugh. I want you to tell me how I am to interpret this data with regard to the agricultural protection policy.

MR. LOWHAM: Fair enough. Take a look at Section H, I believe it's page H-4, you'll see how it is specified they will identify natural irrigated areas, use color infrared photography. It's actually imaging, okay? I agree if you take a look at floodplains and use color infrared imagery to view them, it will appear red, depending on the type -- or the time of the year that imagery was taken.

It will appear red, not because of the overbank irrigation that is occurring from that stream, it's going to appear red because of the soils that are out there, the plants that are out there, and the fact that you get greater precipitation staying on those areas rather than runoff to the stream. They're flat, they're fine-grade soils, they show up.

MR. BOAL: Okay.

MR. LOWHAM: In addition, they also say, well, they use wetland mapping. The wetland mapping, most cases they actually use CIR. It's the same thing.

To be able to identify those areas requires

better science. It's a science like companies in my experience are already doing, we're operating 14 gauges out there that have pumping samplers in them so that flow events occur in the middle of the night, they can obtain those water samples, so that they know what the water is, they know how high the water -- you know, the level of the water is. We're obtaining that information.

For example, Pumpkin Creek, Iberlin, that wasn't one I picked because the data would -- it's one I picked because we had some data on it. Many of these gauges we're operating we haven't had a significant flow event.

MS. FLITNER: May I --

MR. LOWHAM: That's what I want to impress upon, is that these flow events that occur in these streams, even if they go overbank, are very rare and very short duration.

MS. FLITNER: May I ask you, in this spirit of Dennis' question, do you have specific language -- that microphone is not amplifying, so I'll yell -- do you have specific language suggestions that would address your concerns about how to better measure and reflect the science? You suggested monitoring, gauging -- I mean, I'm just trying to get at there are several options and it's any combination of them. Are you testifying that there is something missing in -- with regard to a tool that could be



used that isn't there?

MR. LOWHAM: There will be some follow-up presentations.

MS. FLITNER: What -- sorry.

MR. LOWHAM: There will be some follow-up presentations by others today that will --

MS. FLITNER: I'm not trying to press -- could you say --

MR. LOWHAM: Okay.

MS. FLITNER: -- start with yes or no, because I'm trying to follow you and you are way better trained than I am. So, yes, something's missing or, no, there's nothing missing from that list?

MR. LOWHAM: I would say the bottom line is the rule that's written and the descriptions and the way that the data would be obtained is lacking. It's not good science. It's based on speculation, particularly the identification of where these naturally irrigated lands would be, is that -- you cannot do it from a CIR. That's color -- CIR, okay?

MS. FLITNER: Yes.

MR. LOWHAM: And I really don't think there's a problem. I -- am I talking too loud?

CHAIRMAN GORDON: No, you're fine.

MS. FLITNER: I got -- I got that --



MR. LOWHAM: For ephemeral streams I do not see, for at least where it said it's naturally irrigated, I don't believe it's naturally irrigated. That's not my experience. I don't believe there's a problem. So doesn't even need to be in there.

Now, let me clarify. I'm not talking about where there would be a spreader dike or a diversion, and those particular cases, yes, some type of an engineering solution is probably available, some type of mitigation can be done, similar to what was done on Wildcat Creek.

CHAIRMAN GORDON: May I follow up on that? Would you suggest, then, that in order to establish these sites, if they did exist -- you're saying, I think, that they don't exist -- but if you were going to establish them, you'd need better science. For example, would you need to do surveys of the plants that are there so that you could determine which we're finding -- types of vegetation versus other types of vegetation? Because in my experience in -- even in these ephemeral things, drainages, that you do have places with better production, even though the topography may be fairly similar over the whole plain.

MR. LOWHAM: I think you have greater production on the floodplains, yes, I agree with that, but it's not because of natural irrigation, natural irrigation that occurs from the stream flow, and therefore, because of



the short residence time that you have with these slugs, there would be a very small, if any, impact with a mixture of the flood plus any CBM water that happened to be in an upstream reservoir.

CHAIRMAN GORDON: Okay.

MR. LOWHAM: So I guess also what I'm saying is applied to the -- to the rules that require a great amount of storage, a 50-year storage upstream, so no water runs off. I mean, it's unnecessary. We're not getting natural irrigation on these floodplains, and so, therefore, even a mixture of CBM water would have no effect. It would be contained within the channel most of the time.

CHAIRMAN GORDON: Thank you.

I'm going to recognize Mr. Moore.

MR. MOORE: Thank you.

Mr. Lowham, I agree for the most part with your analysis of how an ephemeral stream functions. Where I guess I disagree is that we are talking about taking stream reaches that have been ephemeral for hundreds of years and applying enough CBM discharge water to those reaches that they're being converted from ephemeral into perennial.

And using your last slide, that's conveniently still up there, in my mind I would see once that occurs, that alluvial deposits become saturated and when you do get

those storm events, you get out-of-bank -- overbank flooding much more frequently if it's perennial stream than if it's an ephemeral drainage. Would you disagree with that?

MR. LOWHAM: I believe you stated that if you have some CBM flow in there, and even if it was perennial, that you would get more frequent overbank flooding. No, I disagree with that. The amount of CBM water that would be amongst those streams is very small compared to the bankfull discharges of these streams.

Now, I would agree that if you perennialize a stream, you're going to have a change in vegetation within the stream channel, yes, I agree. Not out on the floodplain, no.

MR. MOORE: Well, wouldn't you agree that once you saturate the alluvium over time, because of CBM discharge, where it was basically unsaturated when it was an ephemeral drainage, that when you do have a runoff event it doesn't have the opportunity to soak into the alluvium, so you're going to have the overtopping sooner rather than later than if it's still an ephemeral draw?

MR. LOWHAM: No, I think because a stream is perennial is not going to increase the frequency of overbank flooding, nor do I necessarily believe there's any danger to the saturation of the floodplain from a perennial



flow, because one of the reports I looked at on Wildcat Creek prepared by Doyle Fritz -- Wildcat has published their own example to DEQ -- and he had a tremendous amount of data from the coal mines that showed indeed the water in the alluvium in these ephemeral streams in general is very poor quality. And one of the reasons is because it occurs from the runoff that comes down off your side hills, your precipitation has a very long residence time there. And so he had a fair amount of data there that he mentioned that he had regarding the alluvial water quality.

And, additionally, there have been some pits that have been installed in the floodplain of the Powder River by Arvada, and part of that the DEQ required some monitoring there. They found the same thing, that the groundwater that comes out of the alluvium apparently had very long residence time. And even though the Powder River is close to the end of the perennial stream, that the water from the Powder River was not getting out into that floodplain. It -- they actually, with the pits they were able to improve the water quality, it's my understanding, that was in the alluvium.

MR. MOORE: Thank you.

CHAIRMAN GORDON: One last question, too, while you're here, because I know you've done a lot of work on this, Hugh, is, do you see any change in the, I guess



for lack of better phraseology, the erosive characteristics of these ephemeral streams if they're saturated, as Rick describes, versus if they're in a more natural state?

MR. LOWHAM: One of the -- one of my staff members, Bobby Tollman, is actually working with -- doing his Master's degree at the University of Wyoming, and he's been collecting a fair amount of data using jet testing method, which will help him improve our means of estimating, you know, the gross ability of soils.

Based on the studies I've done -- and, actually, it was a fear of mine when I first started working here -- and that's actually one of the reasons I was asked to do some of the consulting work, because my background in stream hydrologics, but -- now, if you have a very steep drainage or have had cuts, you're going to have to do some remediation so you don't have erosion occurring, but for most of the streams, once they get down into what we call like about a third order -- second order, third order streams, slopes become low enough that you can have a fair discharge going there without accelerated erosion.

And that once your plants will tolerate the water, calling them wetland plants, hydrophilic, whatever, but once they get some roots established there, you actually have a more stable stream than you had before. What I'm saying in many of the areas where I worked, such



as Barker Draw, my goodness, it looks great out there. I have before and after pictures. And, I mean, we've even had some small cottonwood trees coming up along the stream channel there, and, then, of course, the sages and other vegetation there. So when the larger floods -- now, what happens is those are just small CBM flows. Those are only 6 inches deep, perhaps, okay, that are flowing there. Then when the larger flows come, fill the stream channel, the stream channel is actually more stable, because it has the roots there. They're very resistant to erosion.

That said, it is something that requires monitoring and caution and understanding of stream hydraulics. I would be the last one that would want to do damage to a rancher by causing his stream to erode and, you know, cause a sedimentation downstream or have a stream, say, drop five or 10 feet in a space level. That's why we're very cautious when we do these studies and require the monitoring.

Most of the CBM discharges I've seen they'll be a little turbid for a little while, but then they clear up.

CHAIRMAN GORDON: As the vegetation changes, does the palatability of that vegetation change for the livestock or wildlife?

MR. LOWHAM: I'm not a vegetation expert, so --

CHAIRMAN GORDON: Okay.
MR. LOWHAM: -- but on the other hand, it's a very small area. I mean, it's -- the advantages of like some of the ranchers of having stock tanks up on the hillsides, where there was vegetation that normally they couldn't utilize, more than offsets the fact that for a small area in the stream channel you now have a change in vegetation.
Additionally, we talk about erosion, since you asked a question on it, one of the things we really have to watch when we're running out in an area are the cattle trails. You can come across these cattle trails when you're running on an ATV, and they're 2 feet deep, I've had people injured on them. And you know where they're headed? They're headed for water. So once they head on down the hill towards water, then you start getting a gully going there.
And on many of the ranches that we've worked on, those cattle are not treading now in those areas. They're happy. They're up on the hillsides. The rancher can move them around easier, they can utilize the pasture that's there. So perhaps overall is actually going to be kind of working with the agricultural industry and the grazing practices, a reduction in erosion.
CHAIRMAN GORDON: Okay. It's about noon, I



think, right now. I wanted to know if anybody had any further questions for Mr. Lowham.
MR. BOAL: I do.
So, Mr. Lowham, so the main focus of your testimony was you wanted to debunk this idea that flows down the channel were resulting in natural irrigation of the floodplain; is that correct?
MR. LOWHAM: That's right, significant irrigation.
MR. BOAL: Yeah.
MR. LOWHAM: If you have infiltration out there, there is only point -- you know, a tenth or half tenth per hour, and your flood occurs like a railroad train running down that, and it's only out there for two hours, it sunk down that far. And I know this, because it isn't just, you know, the gauged data, you know, I walked these areas. I worked, you know, flood, flood studies and I walked these areas afterwards. And, sure, you'll be sinking into the mud like that, and two days of hot weather and it's baked and the biggest impact we can see is rattlesnakes got washed down and wrapped around these bushes, and you better be careful when you're walking along them. They are -- they're a very big danger.
MR. BOAL: So your testimony is aimed towards those parts of the agricultural protection policy



that talk about establishing natural irrigation areas and that sort of thing; is that correct?
MR. LOWHAM: It's needless.
MR. BOAL: I understand that. Thank you.
CHAIRMAN GORDON: Any further questions? Okay. Thank you, Hugh.
Let's adjourn for lunch. We'll be back, what -- a recess. Excuse me. What makes sense, 1:30?
We'll try to be back here at 1:30. Thank you all. We have not made it off of our first page, so this afternoon we'll be moving probably a little faster.
(Hearing proceedings recessed 12:05 p.m. to 1:33 p.m.)
CHAIRMAN GORDON: I'm going to try -- we've got a long afternoon. I'm going to try to bring us back in order.
Right before we recessed, Pete, whose last -- from Fish & Wildlife Service requested to be moved up.
Pete, are you here?
Yes, Pete Ramirez; is that right? I'm going to recognize Pete a little bit out of order here.
And you want to come up and identify yourself?
MR. RAMIREZ: Who do I give copies to?
CHAIRMAN GORDON: Yes, give them to Kim, please. Thank you.

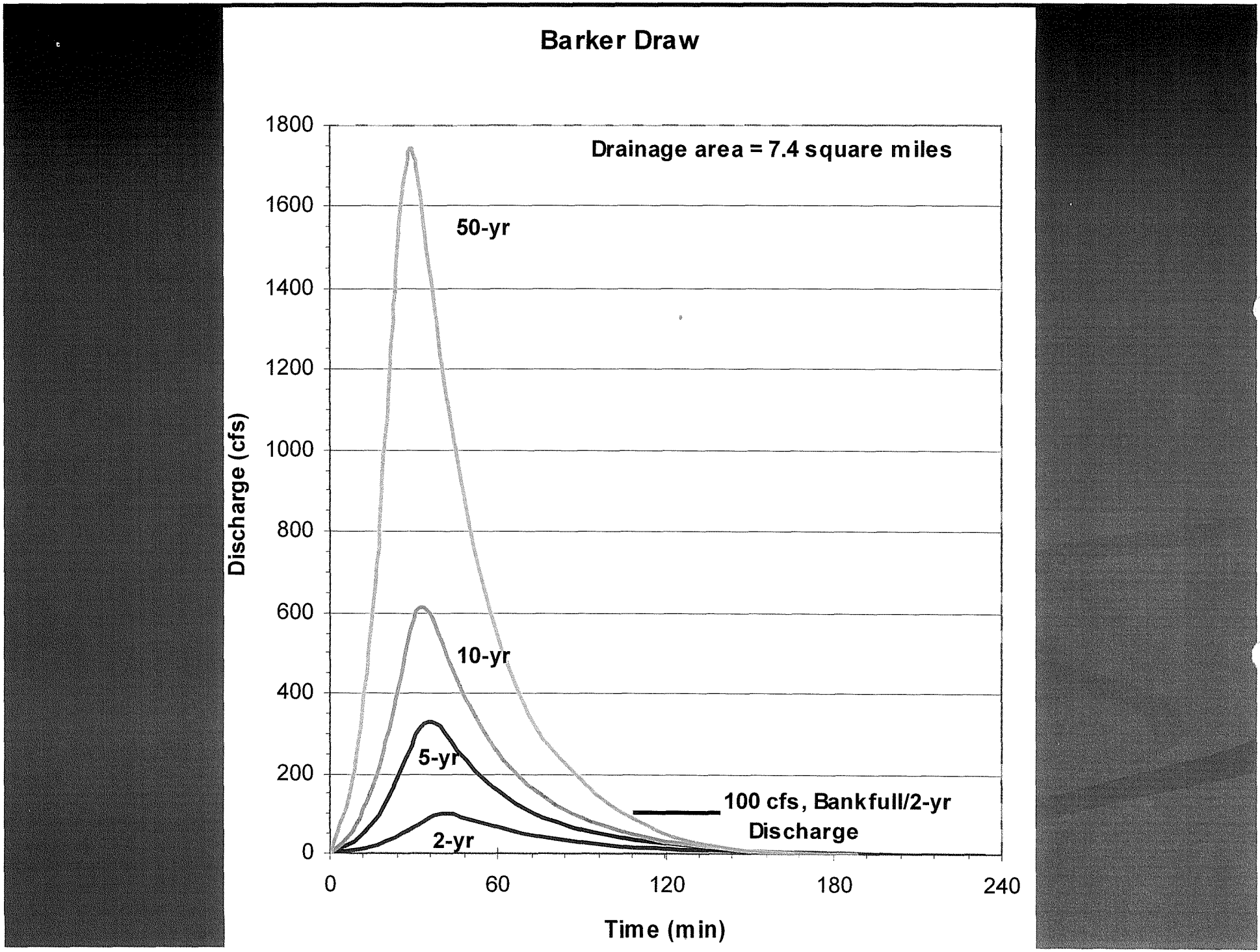


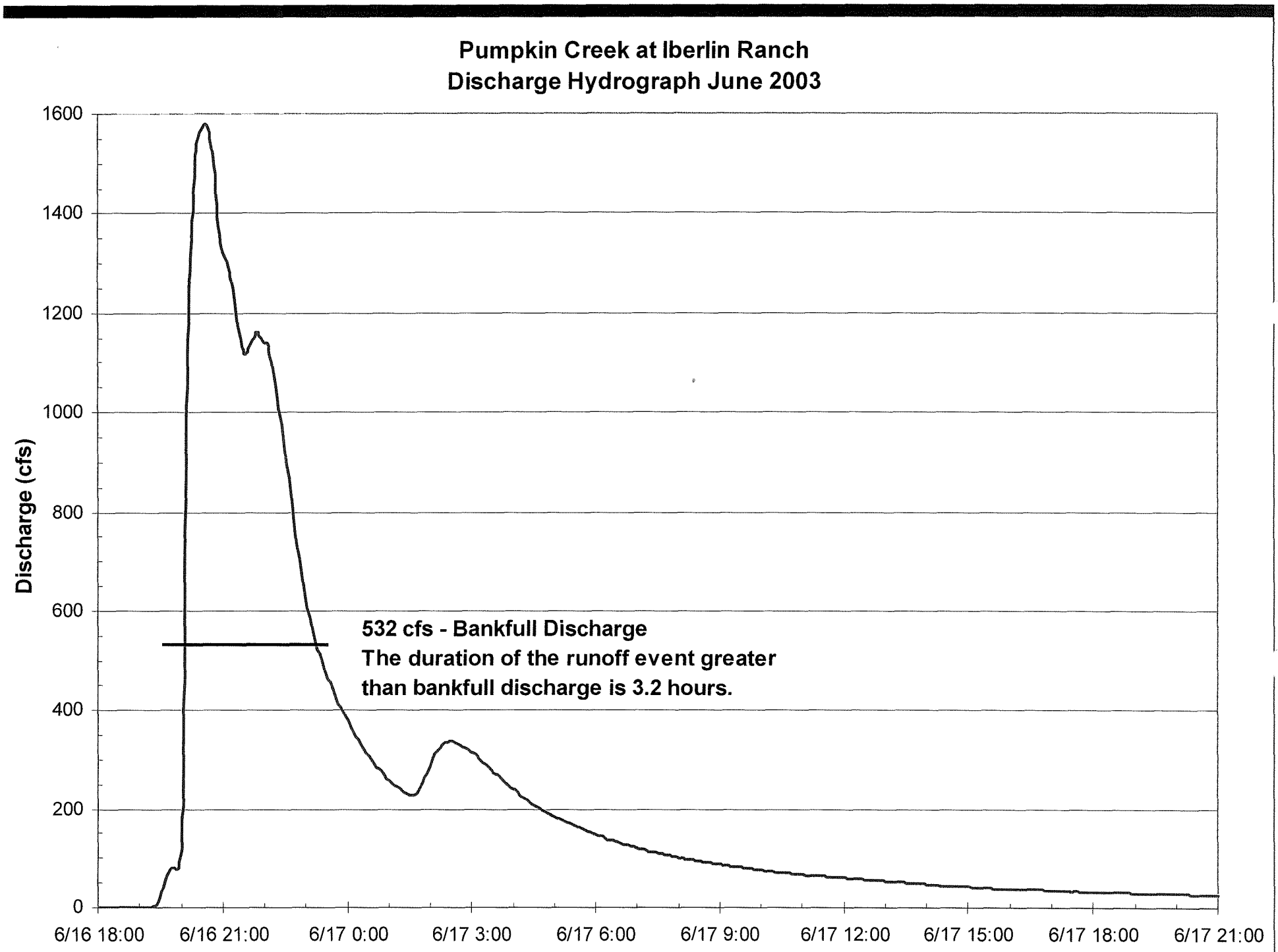
Can everyone in the audience hear? Are the microphones on? I can't tell. Yes? Okay.
MR. RAMIREZ: Mr. Chairman, members of the Council, thank you for the opportunity to provide comments on the proposed revisions. My name is Pete Ramirez. I'm an environmental contaminant specialist with the U.S. Fish & Wildlife Service here in Cheyenne.
My colleague, Kim Dickerson, and I have reviewed the proposed revisions. Cumulatively Kim and I have 27 years of experience with contaminant issues in Wyoming. We have authored 14 scientific peer-reviewed reports on selenium and its effects to fish and migratory birds.
Sorry, I'm out of breath. I ran in here.
We have also presented eight papers on symposiums and published four in scientific journals that deal with selenium.
In addition to the comments that I'm providing here today, the Service has provided more detailed comments. The detailed comments are in copies of the letter to you, as well as letters that we've previously sent to Wyoming DEQ. We provided testimony to the Wyoming Water and Waste Advisory Board on March 2, 2005 at a public hearing, and also again in various letters to DEQ.
We'd like to reiterate our concerns with the following proposed revisions. We're concerned with the

# Ephemeral Streamflows in the PRB

# Modeling Ephemeral Runoff

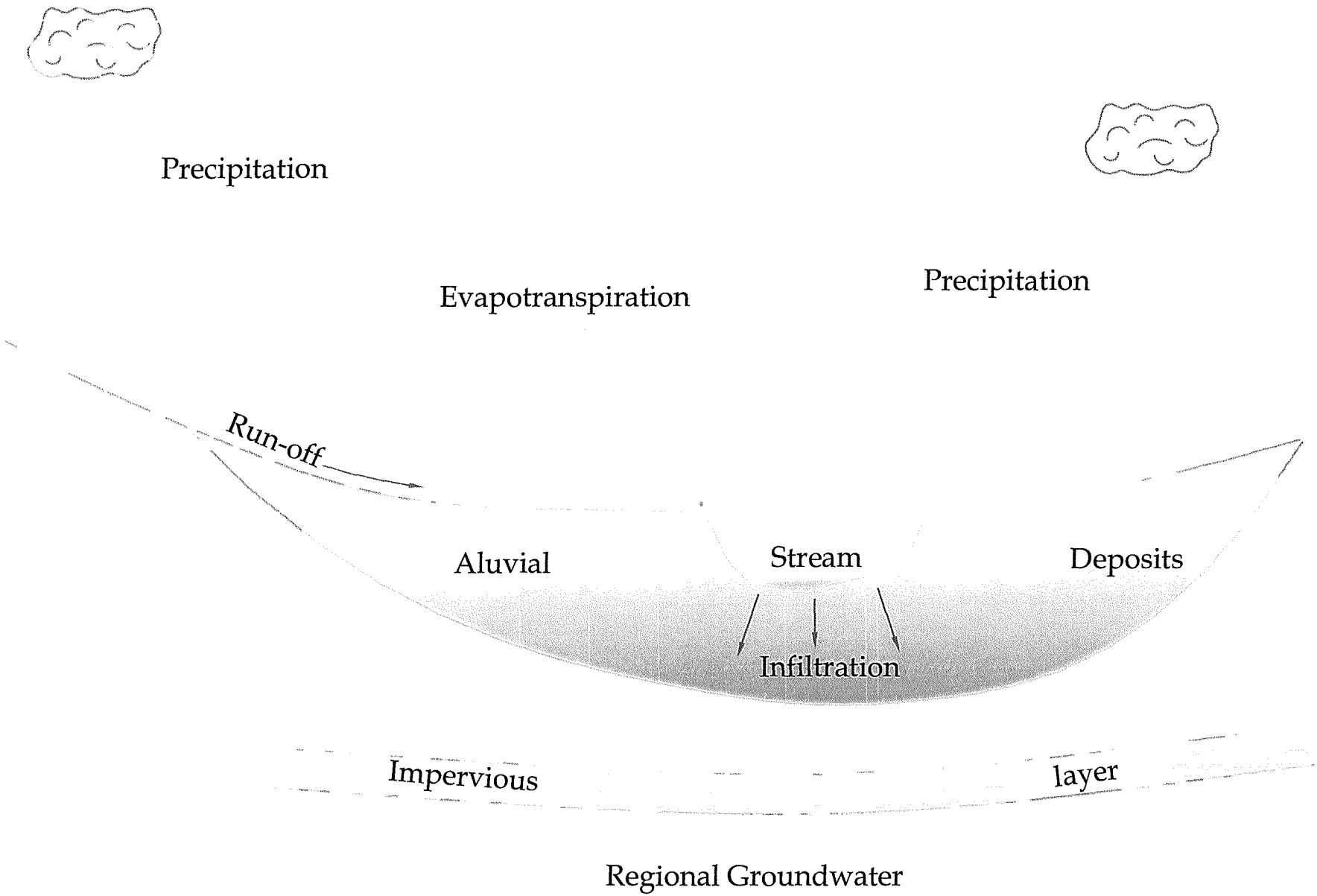
- Runoff hydrograph
  - Empirical data
    - Craig and Rankl (1978)
  - Actual data
    - Streamflow gages


Barker Draw
Drainage area = 7.4 square miles
50-yr
10-yr
5-yr
2-yr
100 cfs, Bankfull/2-yr Discharge
Discharge (cfs)
Time (min)
0
200
400
600
800
1000
1200
1400
1600
1800
0
60
120
180
240


Pumpkin Creek at Iberlin Ranch
Discharge Hydrograph June 2003
Discharge (cfs)
1600
1400
1200
1000
800
600
400
200
0
532 cfs - Bankfull Discharge
The duration of the runoff event greater
than bankfull discharge is 3.2 hours.
6/16 18:00
6/16 21:00
6/17 0:00
6/17 3:00
6/17 6:00
6/17 9:00
6/17 12:00
6/17 15:00
6/17 18:00
6/17 21:00

# Irrigable Flows in Ephemeral Streams

- Must exceed bankfull discharge (capacity)
  - Approximated by 2-year return interval
- Duration
  - > 6 hrs (Cardon, 2003)
  - Low infiltration
    - 0.1-0.5 in/hr (ACSE, 1957)
- Flood plain vegetation
  - Direct precipitation
  - Less runoff


Precipitation
Evapotranspiration
Precipitation
Run-off
Aluvial
Stream
Deposits
Infiltration
Impervious
layer
Regional Groundwater

## Summary of Streamflows in Ephemeral Streams of Powder River Basin

This is a description of runoff characteristics for ephemeral streams in the plains area of the Powder River Basin of Wyoming (See Map 1 in back of report). It applies to streams that have headwaters in the plains area. It does not apply to major streams such as the Powder River and Crazy Woman Creek that have headwaters in the Bighorn Mountains.

### Runoff Characteristics

Annual precipitation in the plains region of the Powder River Basin ranges from 10 inches in the south to 16 inches in the north. Most of the streams that originate in the plains area are ephemeral, with natural flows occurring only in direct response to periodic snowmelt and rainstorm runoff. Runoff rarely occurs during October through January. Runoff during February through April is generally from snowmelt. Runoff during May through September is generally from convective storms (thunderstorms). Precipitation during thunderstorms is often very intensive, and can result in large floods from tributaries having relatively small drainage areas. Basin-wide general rainstorms and snowmelt have increasingly greater roles than thunderstorms in floods from basins with larger drainage areas.

The photograph below shows a runoff event in North Prong Dead Horse Creek, which was the result of a thunderstorm that occurred in 2001 on only part of the upstream drainage.

**Figure 1. Runoff in North Prong Dead Horse Creek during a thunderstorm in 2001**

Prepared by H.W. Lowham, P.E., and R.W. Thoman, E.I.T.,
Lowham Engineering LLC February 12, 2007

Figure 2 shows the tracking of a thunderstorm across a drainage basin, with only several small tributaries receiving precipitation. This is the most common type of rainstorm event that usually results in a high intensity runoff event in ephemeral drainages.

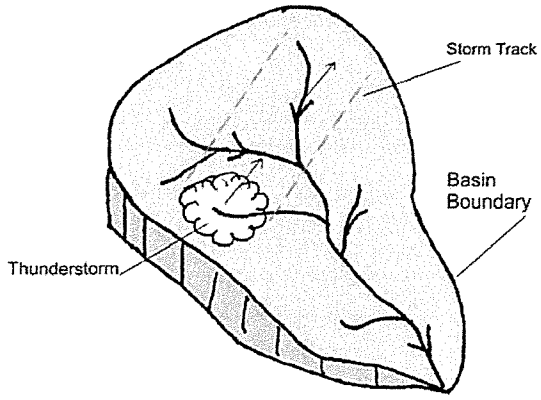



**Figure 2. Example thunderstorm moving across a basin**

## Streamflow Data

Streamflow data are obtained at gaging stations. A continuous-record station (figure 3) has a recorder from which a daily record of stream discharge is determined. Daily rates and volumes of flow can be determined from these records. Some gages are operated for flood information only. These stations are known as crest-stage stations, and they do not have a continuous recorder, but rather collect data only of the peak discharge of a flood.

The U.S. Geological Survey (USGS) has operated streamflow gages on several ephemeral streams in the area. Gages are also being operated by several Coal-bed Natural Gas (CBNG) companies. Map 1 and Table 1 at the back of the report show stations that have been operated on ephemeral streams in the Powder River Basin.

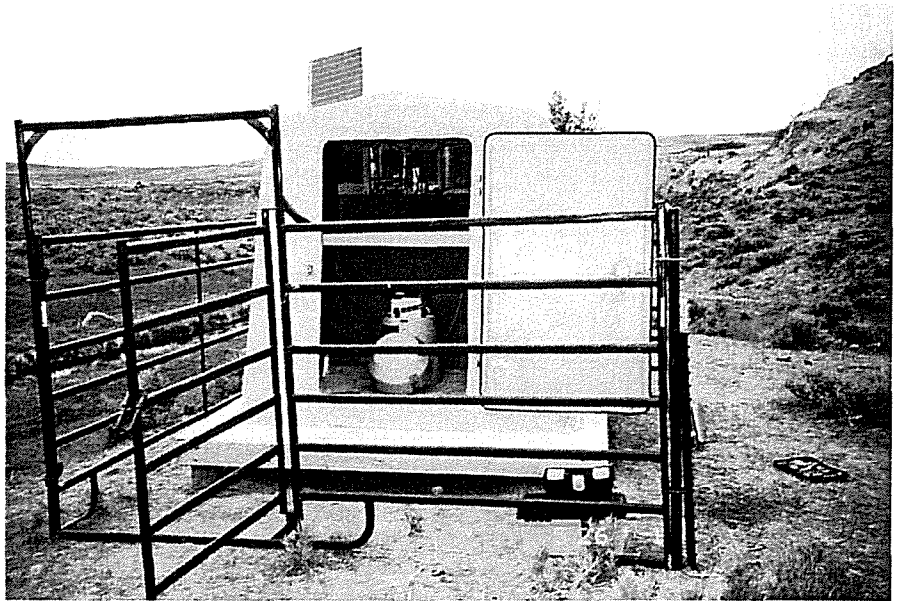


**Figure 3. Streamflow gage on Pumpkin Creek. The equipment in the shelter records water levels in the stream, and also collects water samples when a flood occurs.**



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## Flood Hydrographs

Flow events in ephemeral streams are generally of short duration. An analysis by the USGS of thunderstorm runoff events on 28 small drainage basins in Wyoming showed that runoff for drainages generally followed a standard hydrograph shape (Craig and Rankl, 1978). The standard hydrograph developed by USGS is applicable for drainages of about 11 square miles or less. For example, the modeled hydrographs for Barker Draw, which has a drainage area of 7.4 square miles, are shown in figure 4. The duration that the flood would exceed the bankfull discharge for Barker Draw would be a little less than 2 hours for the 50-year flow event.

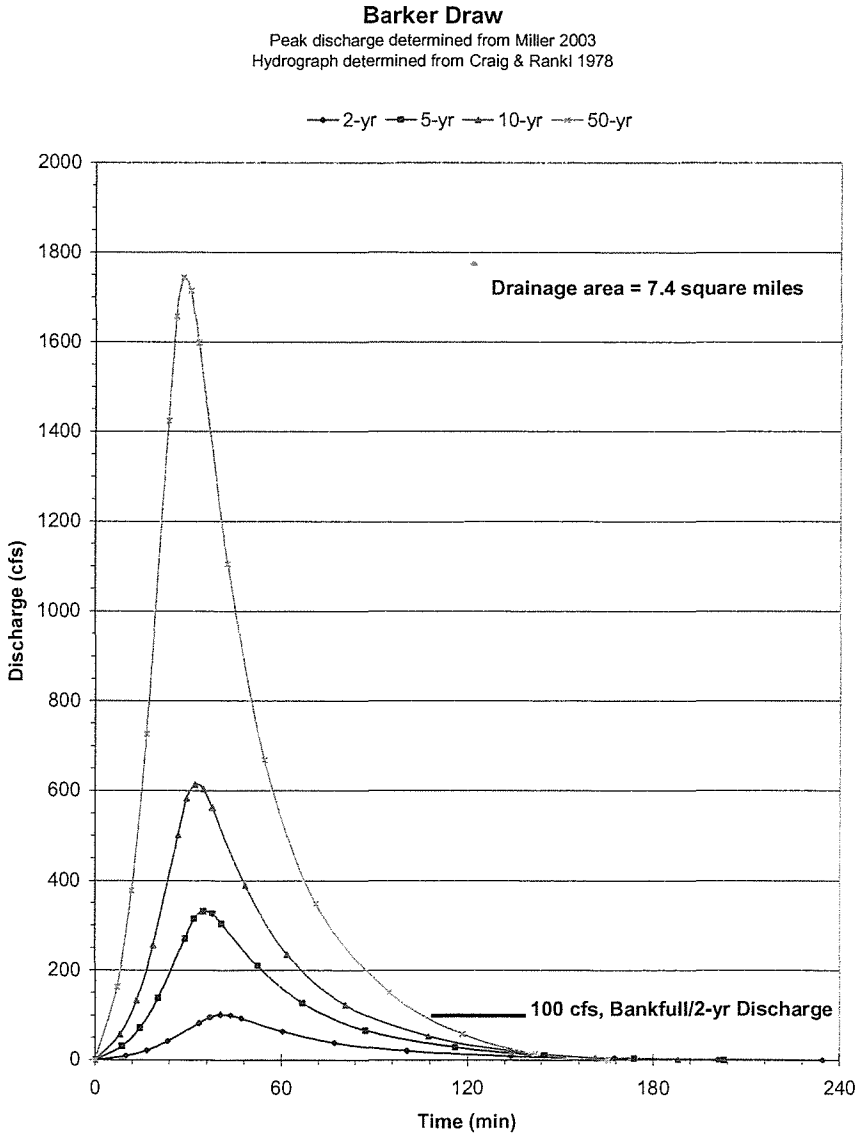


**Figure 4. Synthetic hydrographs for Barker Draw**



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When available, data from streamflow gaging stations are useful to show the characteristics of the runoff. For example, a streamflow gage has been operated on Pumpkin Creek at a site on the Iberlin Ranch since May 2001. A photograph of the site is shown in figure 5. A significant flow event occurred from a thunderstorm at this site on June 16, 2003 as shown in figure 6. The peak discharge was 1,580 cfs. The discharge exceeded the banks and overflowed onto the flood plain for 3.2 hours.

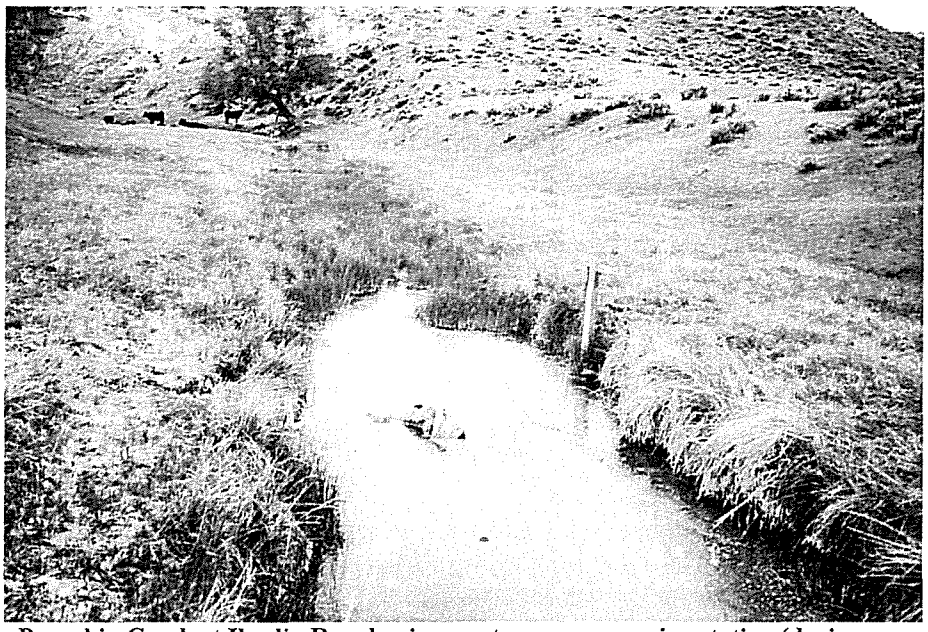

**Figure 5. Pumpkin Creek at Iberlin Ranch, view upstream near gaging station (drainage area = 107 square miles).**

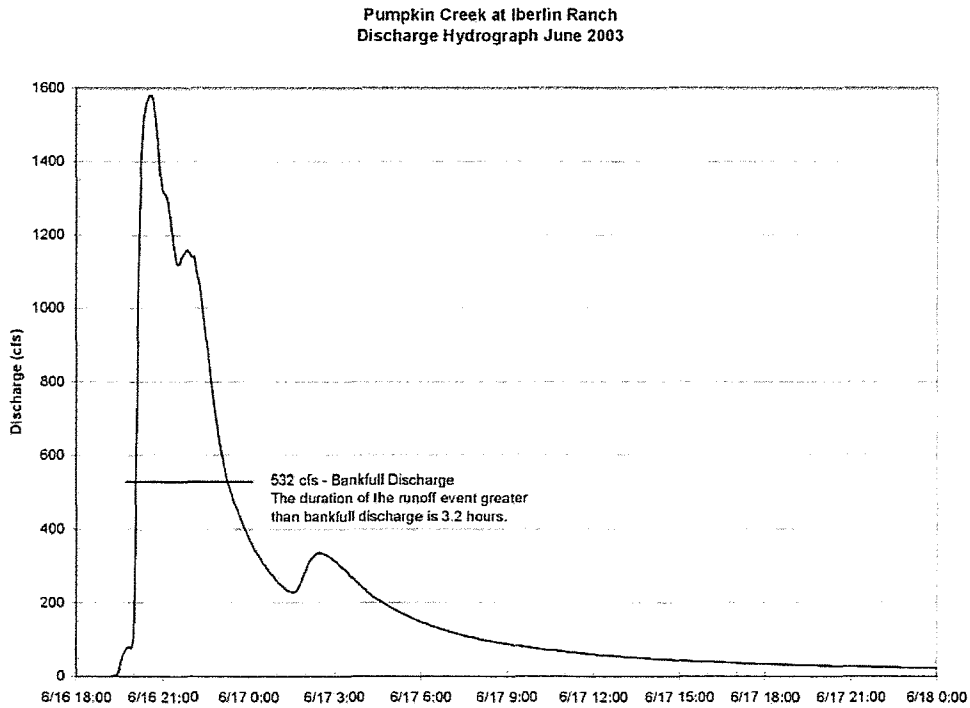


**Figure 6. Discharge hydrograph for Pumpkin Creek near Iberlin Ranch during June 2003.**



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Precipitation and streamflow in the plains area are highly variable, making it necessary to operate gages for a number of years in order to accurately characterize the flow. The longest period of operation for a continuous-record streamflow gage is 19 years for the USGS station 06313700 Dead Horse Creek, which was located just upstream from its mouth (drainage area = 151 square miles). An analysis of the streamflow data by Wahl (2005) showed most of the flow resulted from short duration events. During the 19 years of record the stream was dry or had flows less than 1 cfs for 95 percent of the days.

**Irrigation Events**

Irrigation by natural flow is dependent upon the discharge exceeding the level of the banks and overflowing onto the flood plain. Numerous studies have shown that bankfull discharge has a return interval of 1.5 to 2 years (Leupold et al., 1964). Exceedance of the magnitude of the 2-year flow provides a reasonable estimation for overbank flow.

Overbank flow events are rare, and when they do occur, the duration of time of flow across the flood plain is generally short. If a landowner wants significant irrigation to occur, installation of a spreader dam may be necessary to detain the flood waters and cause it to spread overbank and onto the flood plain.

Flood plains may support greater amounts of vegetation than hillsides. Available information indicates that the relatively greater amount of vegetation apparent on flood plains of ephemeral streams is mainly the result of direct precipitation and snowmelt, rather than from overbank flows. For example, figure 7 shows snow cover on Wildcat Creek. Rainfall and snowmelt on the relatively flat area of the flood plain tends to infiltrate rather than run off.

**Figure 7. View downstream of Wildcat Creek north of Gillette, WY, Dec. 8, 2003**



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Soils of flood plains are generally fine grained, with relatively low infiltration rates (0.10 to 0.50 inches per hour, p. 60, ASCE Manual of Engineering Practice, No. 28). In testimony for the Environmental Quality Council concerning Wildcat Creek, Dr. Grant Cardon (formerly Associate Professor of Irrigation/Water Quality Management at Colorado State University) noted that for flood irrigation to be significant water needs to be applied for a period of not less than six hours. Duration of about six hours is necessary to constitute a significant irrigation event. Based on flood data that have been collected at the streamflow gaging stations, overflow events of this duration would be very rare. Wildcat Creek, which is shown in figure 7, has not had a runoff event that would exceed the significant irrigation flow of 20 cfs since an agreement for monitoring of flows was reached in 2003 between the Wyoming Department of Environmental Quality, CBNG operators, and the landowners.

In summary, floods that overflow the stream banks and result in natural irrigation of flood plains are rare and when they do occur, are of short duration.

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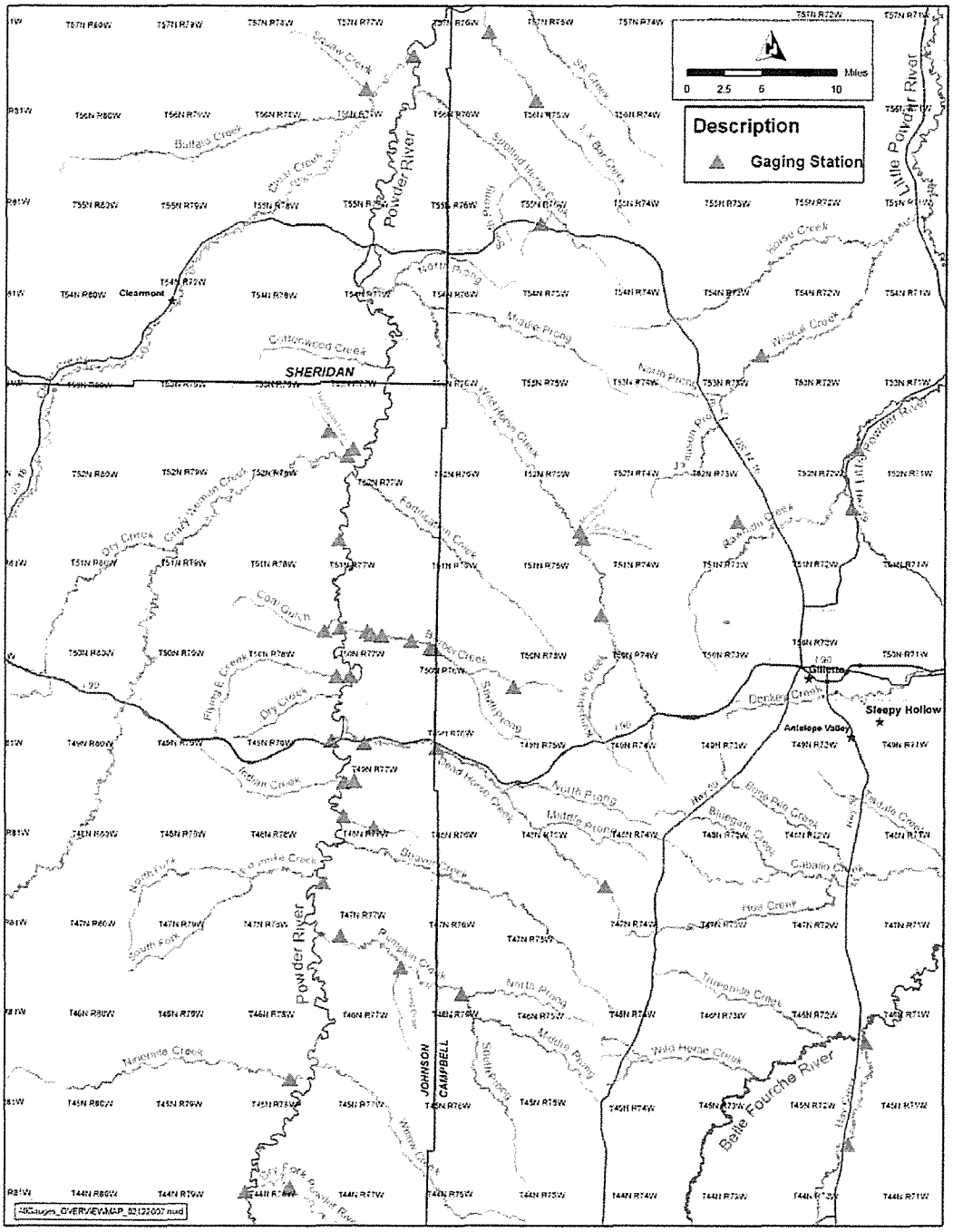


**Map 1. Overview map of gaging station locations in the Powder River Basin.**



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**Table 1. Streamflow-gaging stations for ephemeral streams in the Powder River Basin.**

| USGS station | Drainage area, in square miles | Period of record | Years of record |
|---|---|---|---|
| 6312910 Dead Horse Cr trib nr Midwest | 1.53 | 1965-72 | 8 |
| 06312920 Dead Horse Cr trib No. 2, nr Midwest | 1.34 | 1965-72 | 8 |
| 06313050 East Teapot Cr nr Edgerton | 5.44 | 1965-72 | 8 |
| 06313180 Dugout Cr trib nr Midwest | 0.71 | 1965-74 | 10 |
| 06313600 Burger Draw near Buffalo | 4.57 | 1961-71* | 10 |
| 06313630 Van Houghten Draw near Buffalo | 10.8 | 1971-81* | 10 |
| 06313700 Dead Horse Creek near Buffalo | 151 | 1958-71*<br>1971-90<br>2000-01 | 14<br>19<br>2 |
| 06316480 Headgate Dr at upper station, nr Buffalo | 3.32 | 1965-73 | 9 |
| 06316490 Headgate Dr at lower station, nr Buffalo | 4.5 | 1965-73 | 9 |
| 06316700 Coal Draw near Buffalo | 1.64 | 1965-84* | 20 |
| 06317050 Rucker Draw near Spotted Horse | 3.98 | 1961-81* | 21 |
| 06324800 Little Powder River trib near Gillette | 0.81 | 1960-81* | 22 |
| 06324810 Box Draw near Gillette | 0.50 | 1965-72* | 8 |
| 06324820 Rawhide Creek tributary near Gillette | 2.60 | 1965-72* | 8 |
| 06324890 Little Powder River below Corral Cr | 204 | 1977-83* | 7 |
| 06382200 Pritchard Dr nr Lance Cr | 5.1 | 1964-81 | 17 |



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**Table 1. ( cont.) Streamflow-gaging stations for ephemeral streams in Powder River Basin.**

| Company–operated station | Drainage area, in square miles | Period of record | Years of record |
|---|---|---|---|
| 204777 Pumpkin Creek near mouth | 166 | May 2001- | 6 |
| 104676 Pumpkin Creek at Iberlin Ranch | 107 | May 2001- | 6 |
| 125175 Barker Draw at mouth | 7.4 | May 2001- | 6 |
| 304671 Hay Creek at mouth | 95.8 | Sept. 2001- | 6 |
| 364572 Hay Creek below Hwy 59 | 58.7 | Sept. 2001- | 6 |
| 235776 LX Bar Creek near mouth | 56.6 | Mar. 2003- | 4 |
| 095675 LX Bar Creek above Kline Draw | 36.3 | Oct. 2003- | 3 |
| 300749 Bloom Creek near mouth | 46.9 | Oct. 2003- | 3 |
| 295077 Flying E Creek near mouth | 41.4 | Feb. 2004- | 3 |
| 075077 Coal Gulch near mouth | 21.7 | May 2004- | 3 |
| 085277 Headgate Draw near mouth | 4.5 | July 2002-[b] | 5 |
| 144478 Dry Fork Powder River near mouth | 264 | Sept. 2005- | 2 |
| 114578 Nine Mile Creek near mouth | 149 | Sept. 2005- | 2 |
| Powder River stations, from below Pumpkin Cr to WY-MT state line, 11 sites | | March 2004- | 3 |
| Wildcat Creek at CRX | | Jan. 2005 | 2 |

*** Peak flow records only, b – same location as USGS station 06316490**



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comments to EPA in their rulemaking?
MR. RAMIREZ: I personally haven't, but the Service has.
MS. HUTCHINSON: Okay. Thank you.
CHAIRMAN GORDON: Any other questions from Council members?
Thank you, Mr. Ramirez.
MR. RAMIREZ: Thank you.
CHAIRMAN GORDON: Okay. Carl Taboga.
And I talked to Carl a little bit before we all took off for lunch and said it would be great if everybody could say what their point was and why in hopes of trying to get through as quickly as we can.
Thank you very much. Can you identify yourself.
The flowers were from an anonymous, I hesitate, admirer, but they said, "Ride for the brand."
MR. TABOGA: I'm Carl Taboga. I work for CBM Associates.
CHAIRMAN GORDON: Okay. Thank you.
MR. TABOGA: Today I would like to speak to the -- some hydrochemical analyses that we have done on the flow on Pumpkin Creek. And I do this in reference to those provisions within the proposed ag use policy that will be enforced by DEQ by requiring that on-channel reservoirs be capable of containing a 50-year storm event.



Specifically CBMA, on behalf of several CBNG operators, has been conducting a watershed monitoring program since 2001. And this program measures these very infrequent and very transient flows on ephemeral watersheds. Specifically we have 14 flow monitoring and chemical sampling stations that are set up on 11 watersheds. And these monitor flow and sample for water chemistry during storm flows.
The water samples that are obtained during these storm flows are analyzed by an EPA certified laboratory. The program is currently cost shared by Williams, Lance, Yates and J.M. Huber. And the program has recorded 41 storm events on these 11 watersheds; however, I should caution you that we have as many as eight storm events on some watersheds, and there are several watersheds where we have never recorded a storm event during the seven years that we conducted this program.
This slide here shows what a monitoring station looks like. The automatic sampler is on the lower level, it's the right apparatus on the lower level. What you cannot see is that on the streambed -- or in the streambed nearby there is a piece of PVC pipe that's set up according to a certain design. And that contains a self- contained pressure transducer and data logger. So we can -- we can measure that reach of stream as surveyed, and then based on



how deep the water is, we have some idea of how rapidly -- how to quantify peak storm flows. And also storm flow volumes.
On that particular station, which is the monitoring station at Pumpkin Creek, Iberlin, and this was the station Mr. Lowham referred to, overbank flows occur above 532 CFS. And we have monitored four flow events at this station between August 2002 and August 2005. There are -- if you notice, the August 2002, May 2003 and August 2005 flow events are all well under that 532 CFS rating. And, in fact, June 16th of 2003 was the flow event -- the five-year flow event Mr. Lowham referred to of nearly 1600 CFS.
Another good reason to look at this flow monitoring station is that upstream of this station are numerous CBM reservoirs.
Next slide, please.
This is the Pumpkin Creek at Iberlin Ranch, and monitoring station there is located in the center of the map. If you can go back to that slide, just hit -- there you are. Yeah, there we go. And you'll notice in -- to the southeast of where that monitoring station is there are dozens of CBM reservoirs. These show up as the blue dots on the map.
Next, please.



Now, that storm event of June 16th showed a peak discharge of nearly 1600 CFS and a storm flow volume of 604 acre-feet. And these measurements were obtained directly from the monitoring station. We used -- Mr. Lowham used the power equation model developed by Miller in 2003 for the USGS report. We used a different way to model. We used software that's used by the U.S. Army Corps of Engineers to model that storm event as well. And what we found was -- we arrived at the same result that Mr. Lowham did, using a different model. And that is, in fact, that this is a five-year event.
Also from our data we were able to determine that overbank flow occurred for approximately 193 minutes during the storm event.
The watershed area above this monitoring station is 106 square miles and a storm duration of approximately five hours was determined from the river in Wyoming NEXRAD radar.
Members of the Council, if you would like to take a moment, this is an animation of a storm very similar to the one that occurred in -- on June 16th. If you go back.
MS. FLITNER: Can you do that again?
MR. TABOGA: Go forward.
We tried to download the data from the June 16th storm. We had some problems with this, but this is a storm

event that occurred over the Pumpkin Creek watershed, very similar in August 2002.

Thank you. Next slide.

Here's a discharge in the water quality. Again, peak discharge around 1600 CFS. Peak SAR of 309 -- I'm sorry, 3.09 or nearly 3.1 was reached about 180 minutes into the flow event. And at peak EC of 845 microsiemens per centimeter was reached just shortly before that.

So even on a drainage that has considerable reservoir development, you can see that the SAR and EC in this case the water quality was relatively good.

Next slide, please.

We would like to characterize where the increase in SAR and EC probably originate. And one way to do this, albeit it's somewhat crude, is to look at the ratio between sulfate and sodium in the discharge water. And the reason that these two ions can act somewhat as markers for the source waters in the flood flow is that natural surface runoff contains significant levels of sodium and sulfates, also, whereas what we see in produced waters, stored coal-bed methane waters, is you have significant levels of sodium but relatively low levels of sulfate.

So we use the observed changes in the sulfate-to-sodium ratio in order to characterize, in some sense, reservoir and runoff mix.



Next slide. And here is the sodium to sulfate ratio as -- I'm sorry, this is the sulfate-to-sodium ratio. This slide is in error. This is the sulfate-to-sodium ratio, plotted simultaneously with the SAR for the storm hydrograph. And these samples were obtained over approximately a thousand minutes of flow, but where you see the reduction in the sulfate-to-sodium ratio is probably some indication that you've got an input of low sulfate water into the flow. And the most likely origin of that low sulfate water is probably going to be discharged from the CBM reservoirs.

And you will see several changes where -- several slope changes in that blue line, in the ratio line. And this may be due to the fact that you've got reservoirs that are successively upstream discharging as a result of this storm moving to the east.

What I would point out to you, however, is that we see the sodium adsorption ratio, or the SAR, increasing in this case relatively slightly from 1 to a peak value of about 3.1.

Next slide.

So what we can gather from this is that by using the storm hydrograph and the ion ratio analysis is there's the suggestion that upstream CBM reservoirs probably discharged as a result of this five-year storm



event; however, the in-channel SAR values indicate that the storm flow water quality was dominated by natural runoff. We did not see a -- we did not see SAR reach the high levels that would be characteristic of CBM water.

So the flows that resulted from this storm, the discharges from these reservoirs were actually markedly attenuated by the addition of the overland flow. And storm water quality, even when these reservoirs did discharge, was minimally impacted by the reservoir spills and water quality standards were still in that.

CHAIRMAN GORDON: Thank you.

MR. TABOGA: Any questions?

CHAIRMAN GORDON: Any questions?

MR. BOAL: I do, Your Honor.

Mr. Taboga, direct me in the regulations where it requires a reservoir to be built to the 50-year storm event.

MR. TABOGA: We have been notified by DEQ that they intend to implement the ag use policy by requiring reservoirs.

MR. BOAL: Is it your understanding that's somewhere in the proposed regulation?

MR. TABOGA: I do not --

MR. BOAL: You don't know?

MR. TABOGA: No, it's not my understanding.



CHAIRMAN GORDON: Any further questions?

MR. BOAL: So is it your testimony that reservoirs built to meet the five-year storm event are sufficient, is that what you're telling us today?

MR. TABOGA: What I'm telling you is we have the data, we have 41 storm flow events.

MR. BOAL: Sure.

MR. TABOGA: I doubt anyone else has that data.

MR. BOAL: Right.

MR. TABOGA: But what I'm telling you is if DEQ intends to implement the ag use policy by requiring the reservoirs to contain a 50-year event, it's overly conservative --

MR. BOAL: Right.

MR. TABOGA: -- and, in fact, that can probably be better implemented by looking at site-specific studies or by combination of site-specific studies and hydrologic modeling.

MR. BOAL: Okay. But you're not sure the 50-year event requirement is in the proposed ag use policy? Is it -- is it, Mr. DiRienzo? Is it in there?

MR. DIRIENZO: No, it is not.

MR. BOAL: So what are we talking about here?

MS. FLITNER: Right.
MR. BOAL: What's going on?
MR. MOORE: Thank you, Dennis.
MR. DIRIENZO: In the ag use policy we use that to determine what quality of water can reach different types of uses. For water -- one of the management techniques the industry uses when the water is of lower quality than what we would require is to contain it. And they want to contain it in on-channel reservoirs. And what we have told them is that for us to consider an on-channel reservoir to actually successfully contain the water and keep it from reaching, is that we would need a 50-year reservoir. We don't require 50 -- 50-year runoff reservoirs, but if you're going to have a smaller one, which is going to discharge more frequently, you are not going to have as lax of effluent limits. Those limits will be more stringent in order to protect the crops that that might reach.
MR. BOAL: Okay. But, Bill, that's not explicitly stated in this policy anywhere?
MR. DIRIENZO: That's not in there anyway. That's just a permit option we have available when trying to -- that policy will set the limits. This is one of the options the companies can use in order to meet one limit or another.



MR. BOAL: Okay. Thank you.
CHAIRMAN GORDON: Thank you. That took us 15 minutes and it was a little off topic. I think it's valuable information, but I really hope we stay to topic. And I will be a little lenient, but I want to be careful. We have about 13 people more to go, at least, and we do want to get done today.
So I have Rob Garland. And, Rob, I would suggest, too, that you -- Dennis has asked this point a couple of times, you know, what's the point, and then --
MS. FLITNER: Maybe -- excuse me, Mr. Chairman.
I think, although I'm sure it's clear to you, what we're struggling with is how your comments relate to the specific rule and so if you can provide us with that orientation as you start, that would really help us hear your comments the way I imagine you're intending them. So if you could direct us to the rule with the proposed language and how your comments relate to that, we will be better listeners.
MR. GARLAND: Thank you. Thank you.
CHAIRMAN GORDON: Can you identify yourself, too.
MR. GARLAND: My name is Rob Garland. I'm with CBM Associates.



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MR. BOAL: Thank you.
The interpretation DEQ's taking that isn't explicitly set forth in this policy; is that correct?
MR. GARLAND: That's correct. However, it is where the policy takes you with existing on-channel reservoirs. And we'll see more of those here in a second,



if I can proceed forward.
The situation -- we have the current implementation of this policy is ongoing, actually. We are receiving permits today that require -- or we're required to submit permit applications that do need to have agricultural studies in there as defined under the ag policy -- proposed ag policy -- protection policy for these option 2 permits.
This policy's going to impact virtually all of the permits, discharging entry to produce water to the ephemeral drainages and intermittent drainages also to be on-channel reservoir located on those drainages. Right now you'll have up to 82 percent of these existing permits are going to be impacted by this. All future ones will be impacted by this.
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Historically these option 2 permits were issued and have been operated to allow the beneficial use of this water for livestock, wildlife and agriculture. The SAR and EC requirements associated with these permits are usually met from 1999 to 2006. The Belle Fourche River, where we first started all this type of permitting, we had an 8 percent exceedance over that period of time of the SAR values. Those exceedances exceeded that value of 10, usually in the 11 and very infrequently up to a 13 range.

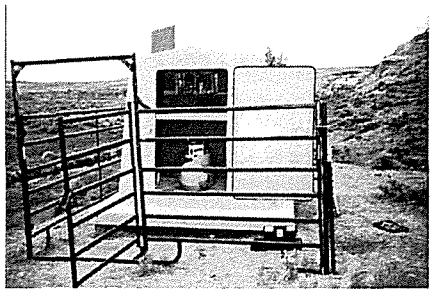
# Hydrochemical Analyses of Storm Events on Ephemeral Drainages in the Powder River Basin

Presented by
Karl Taboga
CBM Associates, Inc.

## CBNG Operator Supported Watershed Monitoring Program

- The Watershed Monitoring Program has been conducted since 2001
- Fourteen stations on 11 watersheds monitor flow and automatically sample in-channel water quality during storm flows.
- The program is currently cost shared by Williams, Lance, Yates, and J.M. Huber
- The program has recorded 41 storm events

## Monitoring Station

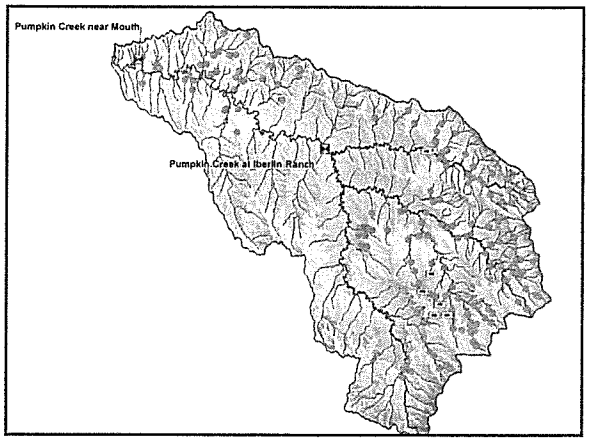




330

## Monitoring Station at Pumpkin Creek Iberlin

- Overbank flows occur above 532 cfs.
- Four flow events were recorded at this station from August 2002 through August 2005.
  - August 24, 2002: 293 cfs
  - May 27, 2003: 160 cfs
  - June 16, 2003: 1570 cfs
  - August 12, 2005: 44 cfs
- This station has numerous CBM reservoirs located upstream.




## Storm Event for June 16, 2003

- Peak discharge (1570 cfs) and storm flow volume (604 acre feet) were obtained from monitoring station data.
  - A return frequency of 5 years was calculated.
  - Overbank flow occurred for 193 minutes
- Watershed area is ~106 $mi^2$.
- A storm duration of ~5 hours was determined from Riverton, WY Nexrad data.



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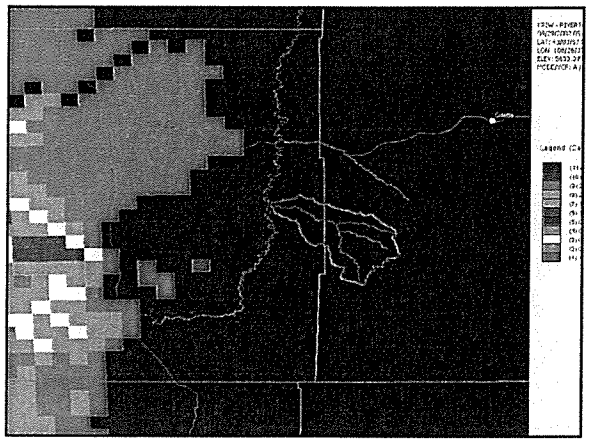
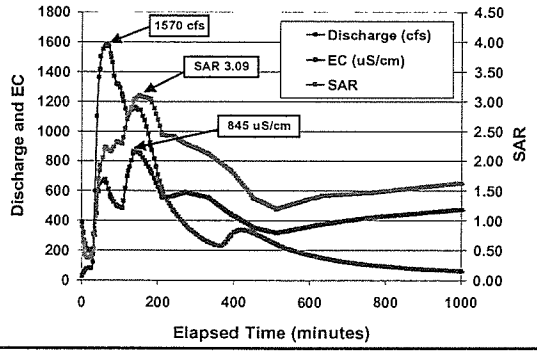


## Discharge and Water Quality




## Ion Ratio Analysis

- Produced water contains significant levels of sodium and low levels of sulfate.
- Natural surface runoff contains significant levels of sodium and sulfates.
- Observed changes in sulfate to sodium ratios are indicative of reservoir and runoff mixing.



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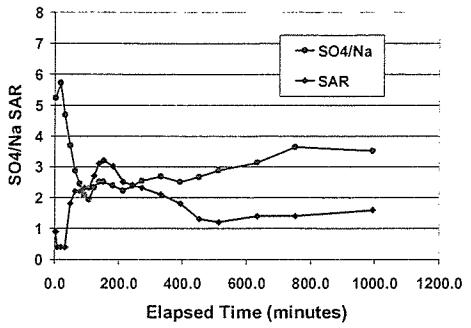
## Sodium/Sulfate Ratio




## Discussion

- Storm hydrograph and ion ratio analysis suggests that upstream CBM on-channel reservoirs discharged to Pumpkin Creek during the 5 year storm event of June.
- In-channel SAR values, however, indicate that storm flow water quality was dominated by natural runoff.
- Storm flow water quality was minimally impacted by reservoir spills and water quality standards were still met.



589

MS. FLITNER: Right.
MR. BOAL: What's going on?
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There was an agricultural use study done on that drainage, they -- DEQ is now allowing up to an SAR 14 on that drainage. We don't have a problem with SAR exceedances anymore on that drainage. The EC was exceeding .3 percent of the time on that drainage.

This map represents the SAR values from the water quality reported to the DEQ for SAR samples between 1999 and 2006. There are over 2100 outfalls -- those are the red dots you see on the maps -- that had SAR reported for them. The black dots you see on the maps are not impacted by the ag use policy -- protection policy, they are off-channel facilities. The contours, the trend of SAR, if you look in the southeastern, lower right-hand portion of that slide, the light blue is SAR below 7 and a half. As you -- if you look towards the northwest or upper left of the map and towards the magenta, that is up to SAR that has a value of greater than 50.

The contour intervals are bracketed by important numbers that are established in the ag use policy or would come from the ag use policy interpretation using the most sensitive species, which DEQ has been interpreting, if there is no vegetation study submitted, as alfalfa.

CHAIRMAN GORDON: Can I stop you for one question?

MR. GARLAND: Sure.



CHAIRMAN GORDON: Explain to me what these SAR numbers are. This from waters from wet zones, permitted outfalls?

MR. GARLAND: From the permitted outfalls. These are the means of the samples over that period of time. So we average them over that period of time. You don't see a whole lot of fluctuation, but that gives you the best perspective of what kind of water quality you're seeing produced from the coals that produce coal-bed methane gas in the basin.

CHAIRMAN GORDON: Okay. Thank you.

MR. GARLAND: And again, as I said, you need to look carefully and you have a full report in front of you, which I encourage you to look at, it will be more explanative. In essence of time here I just wanted to get this out in front of you.

So what you see there is all the data that has been collected and reported to the DEQ on SAR. And that is the spread of all the option 2 outfalls in the basin that are currently or have in the past discharged water that has been sampled for SAR.

Next slide, please.

This is a histogram showing the frequency of the data that you saw on the map spatially. So you can see that at 7 and a half, or below, you have 18 percent of the



discharges -- discharging outfalls falling below that number, which is the -- which is the current number that the DEQ issues if you do not provide any evidence of the sensitive vegetation. It's based on the USDA sensitivity for EC, for the -- for alfalfa, and then we extrapolated that value back from the Hanson diagram to reach that SAR value.

As we go up from 7.6 to 10, 10 is the next cap -- that's the cap that DEQ has on Tier 1 limits if you do show that there is not a sensitive a plant as alfalfa in there, that's what that extrapolates to. They both -- that is actually not true. They will not let you go above that number for the Tier 1 default.

This is my understanding and interpretation of this ag use policy, which I think everybody needs to read very carefully and look at the implications of how it conducts these tier studies.

The next one up would be 16, if you were using the Bridger as recommended by the Water and Waste Water Advisory Board, Bridger values for plant sensitivity for EC. If you look at alfalfa in there, the soil EC equates back to a water EC that equals that 16 in using that -- extrapolating that from the Hanson diagram. Above that the tiers just go forward in 10 -- increments of 10 for the SAR.



Okay. Now we have the same slide, only this is related to EC. Same principle. You're looking at tiered values. Again, the over 2100 outfalls that were measured and reported to the DEQ with EC values, you see down in the southeast lower left -- right of the slide, you can see Wright and Gillette in the fairway we had pretty good recharge. You have lower EC water. As you go towards the northwest again, you see an EC increasing. You do have an anomaly up along the hydrographic divide north of Clear Creek, probably due to the scorias up there, where you have some shallower coals that are producing and may be connected to that fresher water, get a better recharge.

Next slide.

Again, a bracketing showing what would happen here if we have the EC equivalence used -- that water equivalence for EC that are taken from the EC values for soils for the sensitive plant species, and those would be the ranges that you would have issues beyond with the current values, and these -- they're stated in the ag use policy, and what you find when you use alfalfa as the most sensitive plant species as a default.

Next slide, please.

Future impacts. This proposed study shows that these EC and SAR limits are more stringent than we've had before. They must be met at end of pipe. And this is what

necessitates the problem with the existing structures and future use of any on-channel reservoirs. Most cases you're going to get a higher cost for water management, reduce the gas and also reduce amount of water availability.

I'd like to look at this table here. This table I invite you to examine more thoroughly when you have some time. Instead of having a tedious amount of costs and other economic numbers, what we did was look at relative magnitude of impact that's associated with each one of these future options you have that are going to be available because of the changes in the Ag Use Protection Policy and how it's going to impact the current option 2 permits of which over 2100 outfalls that are actually flowing water occur in the basin.

With the first line is option 2, TD. We coined that TD to mean treated discharge, as you see by the asterisk reference below, because that's going to be your option. If you can't meet end of pipe limits in your existing reservoirs, you're going to have to treat that water, or, as I said, drain it down to hold a 50-year, 24-hour event, which you saw in previous testimony didn't have any impact as far as water quality as related on the drainage.

Option 1-B, dig a big hole off channel. This used to be just reserved for off-channel reservoirs. Now



you can dig a bigger hole on your on-channel and that's how you meet the 50 years. I'm sorry. I got that confused. The TD is for treated water, the second one is the 1-B where you have to either dig a bigger hole or drain your reservoir down to meet the 50 or 24-hour.

CHAIRMAN GORDON: I'm going to give you two minutes.

MR. GARLAND: Okay. So the other options there are to have an off-channel pit under 1-A and then oil and gas pit, or injection, shut it in or don't develop your lease. And you can see the impacts across the board on your reclamation costs, your operation costs, your increased capital cost, your loss on gas reserves, water use loss, statement used for tax loss and jobs lost. So if you want some impact out of what you're considering here, if you can interpret the policy this broadly, as you can to do this, I really implore you to examine this carefully because this is where it's going, especially if you make it a rule.

So my recommendation is to amend this agricultural use policy and to address the observes and reasonably estimated risks. Don't go overboard for something that's totally unnecessary, that's going to cause so much surface degradation that is so unnecessary. We got enough of it out there. Be sensible, please, and use the



screen channel monitoring and data we've got to supplement these end of pipe limits. We don't need to put something clean into a reservoir that's going to be dirty when it flows down there due to the natural landscape processes.

I thank you very much for the time that you've allotted me. I'd also like to make one comment. Our work that we do is objective. We do not go out there and we are not paid to write subjective reports. The people I work with, my associates and others that I know in this business, are out there doing the right thing, the right way. I regret and I am taking umbrage at the inference, even in the ag use policy document, somebody is an industry consultant and therefore the value of their information they've provided is suspect. That is extremely irritating, and I think it best in the eyes of the Council and in the DEQ to be objective about the work they're doing. Thank you very much.

CHAIRMAN GORDON: Thank you.

Any questions for Mr. Garland?

MR. GARLAND: Don't get off that easy?

CHAIRMAN GORDON: No.

MR. BOAL: I have one.

Mr. Garland, I think you're saying the water quality advisory board recommended a default cap for SAR of 16.



MR. GARLAND: Yes, sir.

MR. BOAL: And the Department of Environmental Quality is recommending a cap of 10.

MR. GARLAND: Yes, sir.

MR. BOAL: We're talking about the default, so what number do you recommend, 16 or 10 or something else?

MR. GARLAND: I would follow the Bridger document for recommendations on the values for the sensitive plant species, because those values were developed here in Wyoming and Montana. To use the USDA ones, which were developed mainly from the sodic soils in California and Arizona, is not what we think to be the sensible way to go.

Take a look at some of the Section 20's that have already been done -- excuse me, the Tier 3 analyses, and look at where they do look at the soil values and they do actually do the site-specific things and you will see plants are growing in these, quote, highly saline soils here, because they've adapted to it. And if you go out and look at the sediments that are eroding and creating the soils out there, the origin of them are high in sulfate and gypsum and sodium.

MR. BOAL: So if the Council were to adopt the 16 cap, your objections would go away?

MR. GARLAND: No, my objections are to -- I think the 16 cap is good for a default. I would say, yes, I would accept those.

MR. BOAL: Okay. Yeah. Now, I want you to educate me here. That's what really helps me, when people teach me.

Now, I can't find an EC cap anywhere in these regs. Am I missing something?

MR. GARLAND: It's to your most -- I'm sorry. Okay. Alfalfa is the sensitive plant species that the DEQ is using.

MR. BOAL: Right.

MR. GARLAND: So when you look at the alfalfa under the USDA versus the Bridger document, you have two different recommendations.

MR. BOAL: Uh-huh.

MR. GARLAND: And they used the -- under Tier 1 --

MR. BOAL: Under the default tier.

MR. GARLAND: Under the default tier, if you do not provide information to show there is a less sensitive plant species on the drainage --

MR. BOAL: Right.

MR. GARLAND: -- not a more sensitive one like alfalfa --



MR. BOAL: Right.

MR. GARLAND: -- that's what they peg your default at.

So unless you go forth and do other studies, you are automatically going to have that default value -- excuse me, you do go forward and get other studies. You are going to be capped at a 7 and a half -- excuse me -- this is very complicated. I'm sorry. The 10 is the cap under USDA because of the what they define in there, and then 16 is the cap. The 16 is just a little bit over the sensitive value for alfalfa for the sensitive plant species. So, therefore, you would be -- that would be a more sensible cap if you are growing alfalfa downstream the 16 would just be above having to change it. So you're being protective of growing alfalfa downstream, I guess, with a 16 cap is what I'm trying to say, using the Bridger Plant Institute values.

I'm sorry. This is a very confusing thing to try to understand because of the way it's structured. From the default to the Tier 2, Tier 3 studies -- and I tried to make some annotations -- oh, you don't have that, but on the flow diagram I think it would be helpful if the DEQ could make some breaks on there to show you where in their flowchart it goes from being a Tier 1 to a Tier 2 study. That's another important addition that I think would help



people.

That flowchart is useful, but it's hard to tell how it really equates to the different studies and what the value of them is.

MR. MOORE: Correct me if I'm wrong, I don't see anything in the regulation or the policy, if you want to call it that, that says alfalfa is the species you default to. All I see is it says it's the most sensitive crop.

MR. GARLAND: That is correct, but that is what the DEQ then uses to relate the values, the sensitivity that they then use --

MR. MOORE: There's nothing in the regulation as proposed that we can change, other than saying that we want them to use the most sensitive crop that's actually out there on the ground, not default to something that's not there.

MR. GARLAND: That's correct. I'm recommending the Bridger values be used.

MR. MOORE: But that has nothing to do with saying that you're using alfalfa by default, because the policy doesn't say that. The policy says you use the most sensitive species and you look up the EC value from either the Bridger or the Hanson -- or the --

MR. GARLAND: All the other ones --



MR. MOORE: -- the national salinity labs. You look up the EC value for the most sensitive species on the ground from the published resource. Do you take exception to that or is that acceptable?

MR. GARLAND: No, I do not.

MR. MOORE: That's what the policy says?

MR. GARLAND: Yes, that is what the policy says. I do not have any problem with that. It's perfectly legitimate to use the values that are relevant to the country we live in, is my whole comment. I'm sorry. I didn't mean --

MR. MOORE: It has nothing to do with alfalfa is my point. As far as the policy, as drafted, it just says the most sensitive crop species.

MR. GARLAND: That is correct.

MR. MOORE: Okay.

MR. GARLAND: In the policies that we have been receiving back -- excuse me, not the policies, the permit applications that are submitted, when we get one back it says if you don't provide this data, you get the 7 and a half, and that is based -- starts off from there. And then you can raise it up to a 10 beyond that.

MR. BOAL: Okay.

MR. GARLAND: Or a 16, if you use Bridger.

MR. BOAL: So, Mr. Garland, if we were to

adopt the 16 cap for SAR and the Bridger -- what I call the Bridger Plant Material Center's data, as recommended by the advisory board, that would resolve your concerns, is that what I'm hearing?

MR. GARLAND: No, it would not resolve my concerns. The other concerns we have are the terms "naturally irrigated land" and how they are defined.

MR. BOAL: And that's what Mr. Lowham spoke to?

MR. GARLAND: That is correct.

MR. BOAL: Okay.

MR. GARLAND: The assumptions based on that description, those terms need to be better defined.

MR. MOORE: Okay.

MR. GARLAND: And I think that is for future discussion, not to be done here, but it is a document that does need some better definitions in it. It also needs some better equivalency to Chapter 1, see disconnects there as well.

MS. FLITNER: So you have three concerns, and that's -- those are the three, 16, the Bridger data and the natural irrigation language?

MR. GARLAND: Yes.

MS. FLITNER: Thank you.

MS. HUTCHINSON: I have one.



CHAIRMAN GORDON: Wendy.

MS. HUTCHINSON: Short and easy.

The Bridger study, has it been published and peer reviewed?

MR. GARLAND: In a peer-review journal?

MS. HUTCHINSON: Yeah.

MR. GARLAND: I will defer that question to Mr. Todd Gilmer, whose testimony is next. He's the one that did the research on that.

MS. HUTCHINSON: Okay. That would be great. Thank you.

MR. MORRIS: I have just one question.

All this study is based on alfalfa, right?

MR. GARLAND: No, sir.

MR. MORRIS: I mean, your comments --

MR. GARLAND: Just to use them as a baseline for the most sensitive plants that we've seen out there that is grown as a forage crop and generally even as a harvest crop.

MR. MORRIS: And you're saying that alfalfa's --

THE REPORTER: I'm sorry. Can you say that again?

MR. MORRIS: Alfalfa can tolerate up to 16.5?



MR. GARLAND: 16.5 EC?

MR. MORRIS: Based on the Bridger studies.

MR. GARLAND: The 16 is for SAR to be protective of the soils, and it's back calculated from the 2600, that is the water we see that is equated from the 4,000 in the Bridger document.

MR. MORRIS: And alfalfa can tolerate that high?

MR. GARLAND: According to the Bridger salinity tolerances, yes.

MR. MORRIS: That's the Bridger study. Okay.

MR. GARLAND: Yes, sir.

MR. MORRIS: Is alfalfa more sensitive than sagebrush?

MR. GARLAND: Yes, sir.

MR. MORRIS: Sagebrush tolerate that high a standard?

MR. GARLAND: I think sagebrush is extremely tolerant. I am not a vegetative analyst. I have not looked at that. I'd have to go research that. My -- sagebrush doesn't like to get its feet wet too long, but otherwise it seems to tolerate quite an extreme of soil conditions that are prevalent over the state of Wyoming and air conditions.



CHAIRMAN GORDON: I'm going to beg the indulgence of the Council and move on. We're going the wrong way. That took 25 minutes instead of 15.

But I thank you very, very much for your testimony. It was helpful and I thank you.

MR. GARLAND: Thank you, Mr. Chair.

CHAIRMAN GORDON: Mr. Gilmer, Mr. Todd Gilmer.

With that we're done with the first page.

Can you identify yourself, sir?

MR. GILMER: Yes, my name is Todd Gilmer. I'm a geoscientist. I work for CBM Associates as a consultant.

Ready to go there?

And what I'd like to present to you folks this afternoon is a summation of Mr. Kevin Harvey's research over the last year that concerns soils, electrical conductivities and sodium adsorption ratios. Unfortunately Mr. Harvey is not able to attend today. He tried to fly down and he had some mechanical problems in the airplane and so I've been asked to stand in for him.

My background, like I said, I'm a geoscientist, geophysics hydrogeology. Background, I've been working in the coal-bed natural gas -- does everybody have copies?

MS. FLITNER: We do from earlier, I think.

# Impacts Related to Implementation of the Agricultural Use Protection Policy

Presentation to Wyoming EQC
Robert Garland & Caroline Brewer
CBM Associates, Inc.
2/15/07

## SITUATION

- The current implementation of the DEQ's Agricultural Use Protection Policy (AUPP) will have an impact on up to 82% of existing Option 2 Discharge Permit outfalls for SAR.
- The AUPP will impact virtually all future permits discharging untreated produced water to:
  - Ephemeral or intermittent stream channels, or
  - On-channel reservoirs that would contain the produced water unless naturally released due to mixing with infrequent runoff events.

## Historical Background

- Historically, many Option 2 discharge permits were issued and have been operated to allow the beneficial use of CBNG produced water for wildlife, livestock and agriculture.
- The SAR and EC requirements associated with these permits were usually met from 1999 to 2006.
  - All SAR monitored on the Belle Fourche drainage exceeded the numeric limit of 10 only **8%** of the time
  - All EC monitored on the Belle Fourche drainage exceeded the numeric limit of 2000 only **0.3%** of the time



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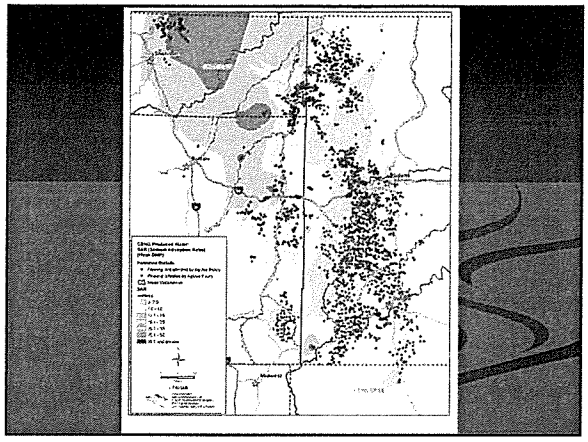
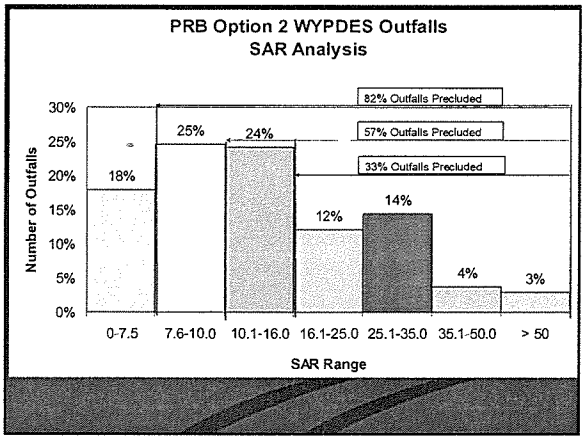
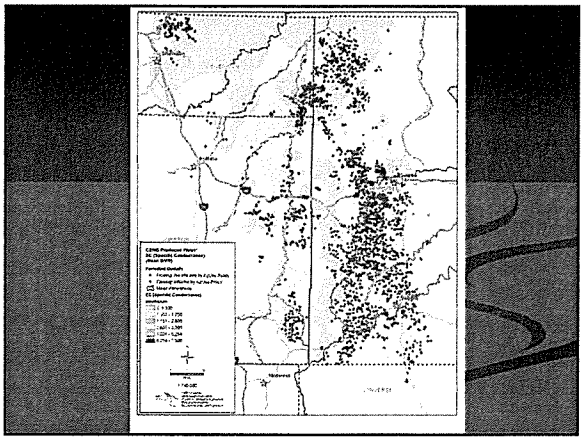
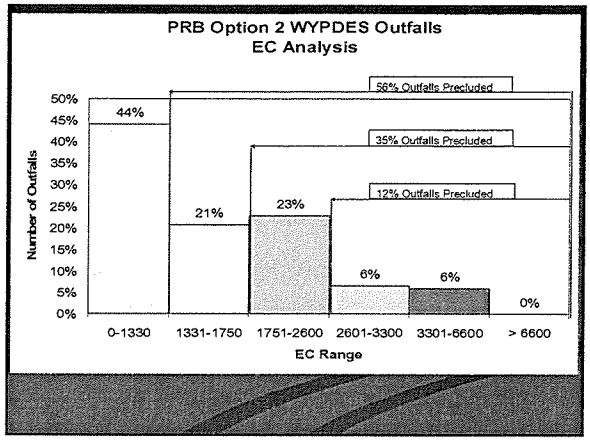



PRB Option 2 WYPDES Outfalls
SAR Analysis
82% Outfalls Precluded
57% Outfalls Precluded
33% Outfalls Precluded
Number of Outfalls
30%
25%
20%
15%
10%
5%
0%
18%
25%
24%
12%
14%
4%
3%
0-7.5
7.6-10.0
10.1-16.0
16.1-25.0
25.1-35.0
35.1-50.0
> 50
SAR Range






## Future Impacts

- The proposed AUPP SAR and EC limits are more stringent than previously used and they must be met at end-of-pipe rather than at a downstream monitoring point to protect irrigation uses. In most cases this will result in higher cost water management which will reduce gas reserves and water availability.
- Based on CBMA's observations, there are very few instances of potential agricultural impairment to date. This demonstrates the efficacy of pre-AUPP permit requirements.

## Future Option 2 Impacts from Implementation of AUPP

| Current | Future | Increased Surface Disturbance | Increased Reclamation Cost | Increased Operation Cost | Increase Capital Cost | Gas Reserve Loss | Water Use Loss | State & Municipal Tax Loss | Jobs Lost |
|---|---|---|---|---|---|---|---|---|---|
| Option 2 | Option 2TD* | x | x | xxx | xxx | xxx | | x | |
| Option 2 | Option 1B | xxxxx | xxxxx | x | x | x | xx | x | |
| Option 2 | Option 1A | xx | xx | x | | x | | x | |
| Option 2 | WOGCC Pit | x | x | | | x | xxxxxxx | x | x |
| Option 2 | UIC-Injection | x | x | x | xxxx | xxxx | xxxxxxx | x | |
| Option 2 | Shut-in/abandon | | x | | x | xxxxxxx | xxxxxxx | xxxxxxx | xxxxxxx |
| Option 2 | Do Not Develop | | | | | xxxxxxx | xxxxxxx | xxxxxxx | xxxxxxx |

* Treated Discharge x = unitized magnitude of impact

5 of 2.

## Recommendations

- Amend the proposed Agricultural Use Protection Policy and to address observed and reasonably estimated risks
- Use stream channel monitoring modeling to protect downstream irrigation and supplement end of pipe limits



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# *Impacts Related to Implementation of the Agricultural Use Protection Policy Presentation to Wyoming EQC*

*February 15, 2007*

*Prepared By:*

CBM Associates, Inc.

*Robert Garland & Caroline Brewer*
*920 E. Sheridan Street*
*Laramie, Wyoming 82070*
*(307) 742-4991*

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## IMPACTS RELATED TO IMPLEMENTATION OF THE AGRICULTURAL USE PROTECTION POLICY

### Background

Historically, many WYPDES discharge permits were issued allowing direct discharge of CBNG produced water to a stream channel or to an on-channel impoundment. Many of the impoundments associated with this type of permit are restricted from intentional releases unless they overflow due to runoff from a precipitation event. The SAR and EC requirements associated with these impoundment permits were usually met from 1999 to 2006. The majority of the exceptions to meeting the SAR and EC requirements have occurred in the Belle Fourche River drainage where SAR has exceeded a value of 10 only 8% of the time, and EC has exceeded a value of 2000 µmhos/cm only 0.3% of the time. Many of the SAR exceedances have been and will continue to be resolved by an agricultural water supply analysis (Chapter 1, Section 20) that increased the SAR limit from 10 to 14.

The implementation of the WDEQ's Agricultural Use Protection Policy (AUPP) will have an impact on up to 82% of existing Option 2 discharge permit outfalls (Figures 1-4). Currently the proposed AUPP is being implemented and has been implemented since about the middle of 2006. The AUPP SAR and EC limits are more stringent than previously issued and they must be met at end-of-pipe rather than at a downstream monitoring point. Fortunately, in most recent cases where AUPP is applied to permit renewals, WDEQ has allowed permit operators approximately 1 year to either conduct the associated AUPP study and/or find a way to otherwise manage discharge to comply with final water quality limits.

### Implications

The new requirements cannot be met at many currently permitted outfalls without implementing costlier water management strategies. Operators will have to either:

- Obtain numerous irrigation waivers that relieve the WDEQ from enforcing AUPP conditions;
- Treat outfall discharges upstream of "artificially" irrigated cropland and newly defined/protected "naturally irrigated lands" in order to comply with the AUPP; or
- Submit new applications for alternative permits that do not require SAR and EC limits for irrigation protection.

Additional strategies are, of course, possible, but may not be economically viable for CBNG producers in the Powder River Basin (PRB). These include:

- Drilling and permitting Class V injection wells to dispose of CBNG discharge. This method is extremely costly, especially in the Powder River Basin where there are not many suitable aquifers to receive the discharge.
- Construction of additional off-channel pits to contain CBNG discharge. Generally, operators have already taken advantage of the basin geography that will allow this type of permitting to take place.
- Shut-in production and abandon wells. A water management strategy to avoid!

Table 1 summarizes the physical and economic impacts associated with the above water management strategies. Note that each management option will have an impact on the environment, water use, and/or the economic viability of current production.

**Table 1:** Physical and Economic Impacts Related to Implementation of the Agricultural Use Protection Policy

| Current | Future | Increased Surface Disturbance | Increased Reclamation Cost | Increased Operating Cost | Increased Capital Cost | Gas Reserve Loss | Water Use Loss | State & Municipal Tax Loss | Jobs Lost |
|---|---|---|---|---|---|---|---|---|---|
| Option 2 | Option 2TD* | x | x | xxx | xxx | xxx | | x | |
| Option 2 | Option 1B | xxxxx | xxxxx | x | x | x | xx | x | |
| Option 2 | Option 1A | xx | xx | x | | x | | x | |
| Option 2 | WOGCC Pit | xx | xx | | | x | xxxxxxxx | x | x |
| Option 2 | UIC-Injection | x | x | x | xxxx | xxxx | xxxxxxxx | x | |
| Option 2 | Shut-in/abandon | | x | | x | xxxxxxxx | xxxxxxxx | xxxxxxxx | xxxxxxxx |
| Option 2 | Do Not Develop | | | | | xxxxxxxx | xxxxxxxx | xxxxxxxx | xxxxxxxx |

X = Unit of magnitude in increase of impact

* = Treated discharge

**Figure 1:** Map showing current outfalls that will be affected by the AUPP as SAR limits are implemented across the Powder River Basin (PRB). Only Option 2 outfalls will be affected. Contours were interpolated using average SAR data between 1999 and 2006 at each outfall (IDW method on ArcInfo Spatial Analyst).

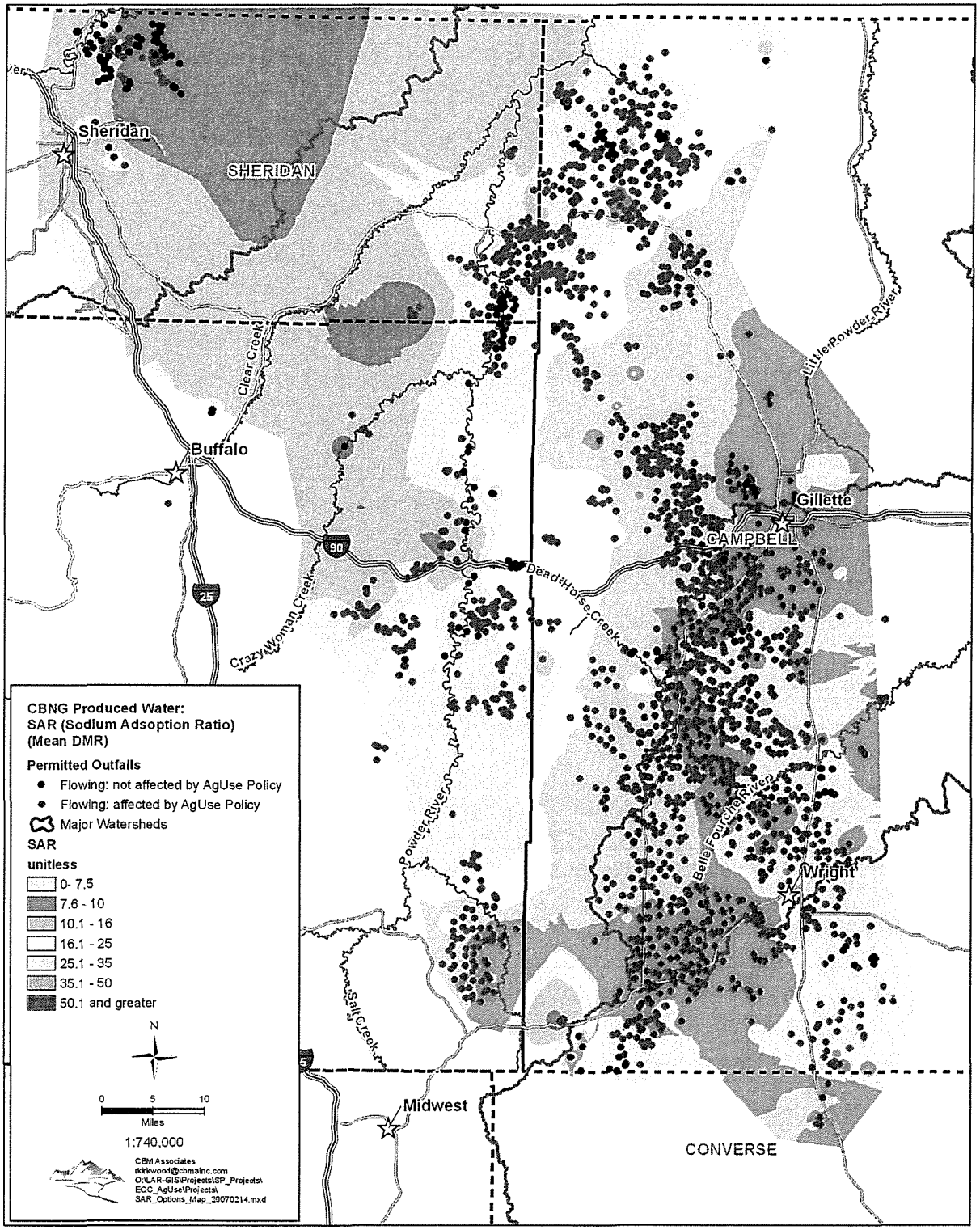




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**Figure 2:** Graphical depiction of SAR contour intervals shown in Figure 1 as compared to percent of outfalls that will be affected by implementation of the AUPP SAR limits. Depending on the reference that will be used to establish default EC limits, as many as 82% of existing Option 2 discharge permits will not comply with SAR limits anticipated by use of the AUPP. SAR data from 2,128 outfalls were used in this analysis.

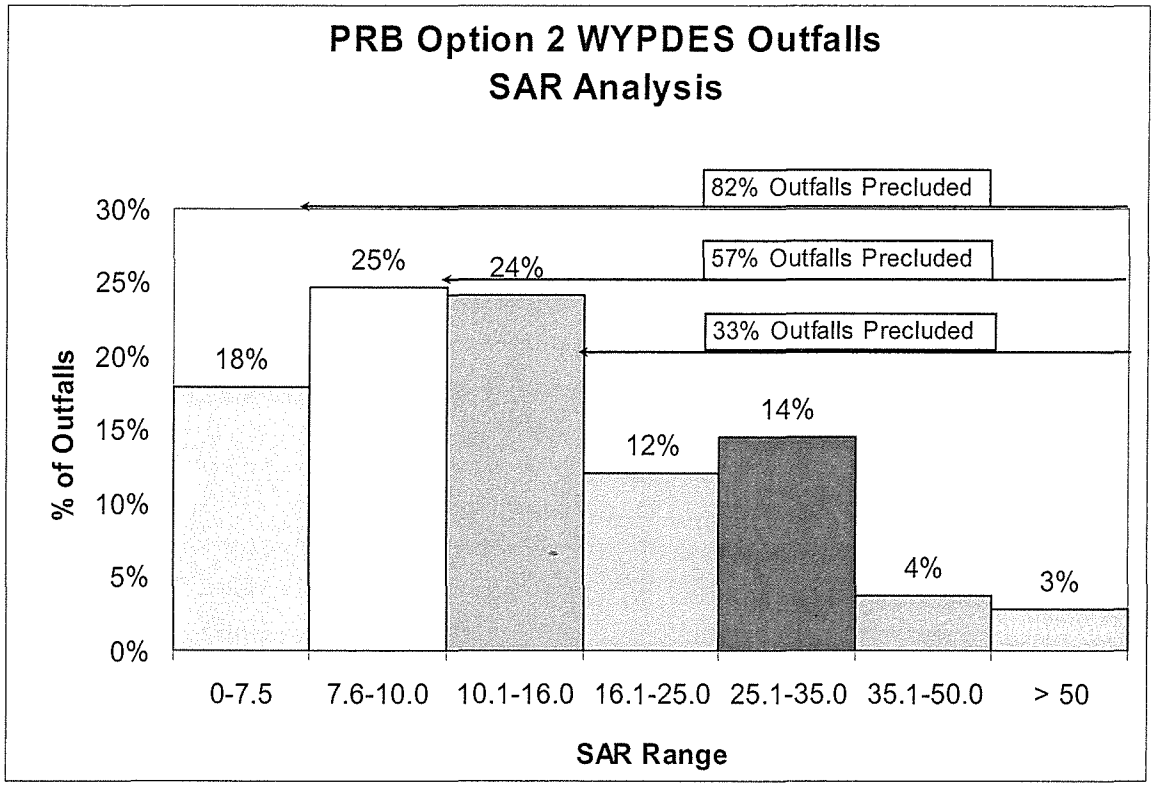




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**Figure 3:** Map showing current outfalls that will be affected by the AUPP as EC limits are implemented across the Powder River Basin (PRB). Only Option 2 outfalls will be affected. Contours were interpolated using average EC data between 1999 and 2006 at each outfall (IDW method on ArcInfo Spatial Analyst).

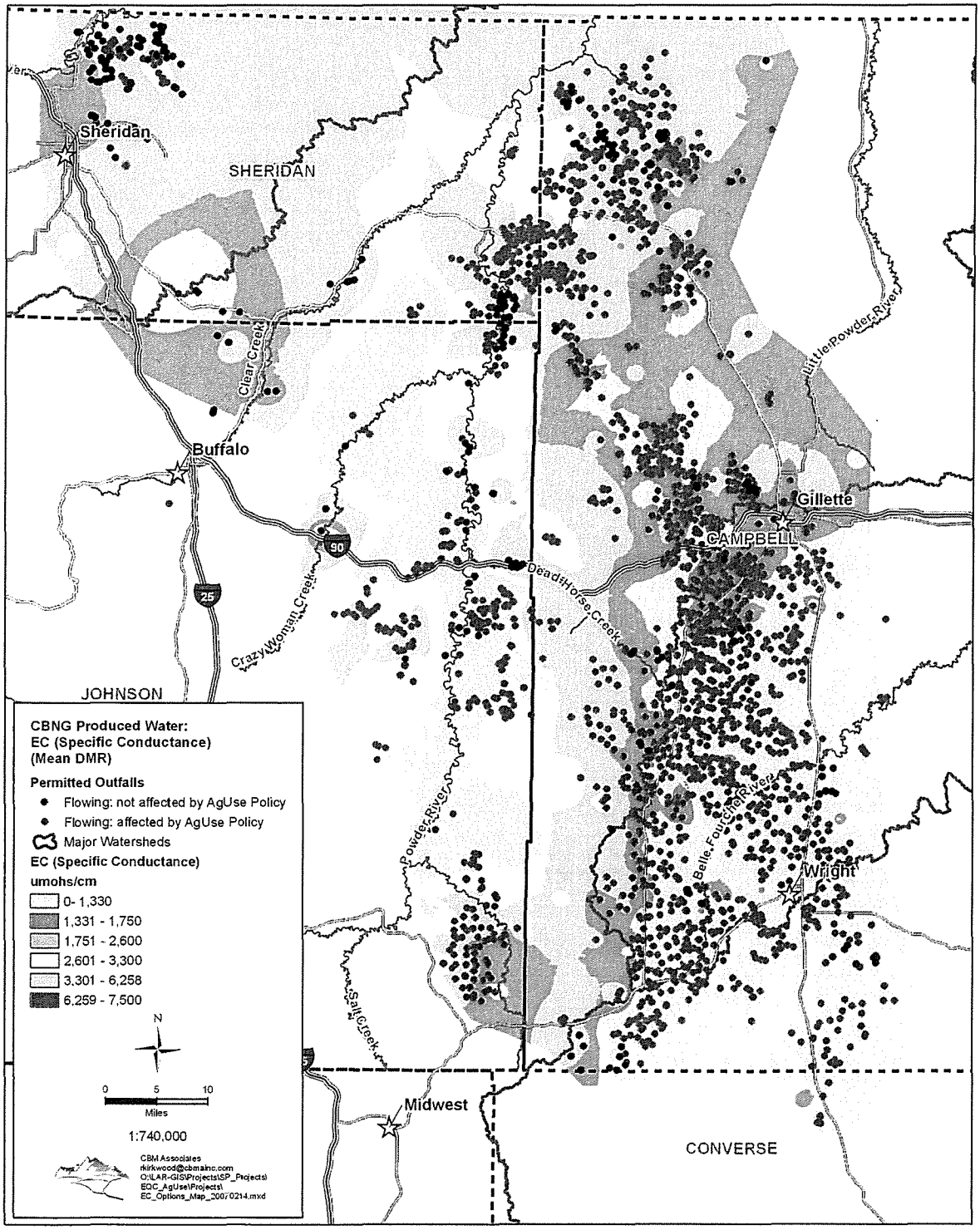




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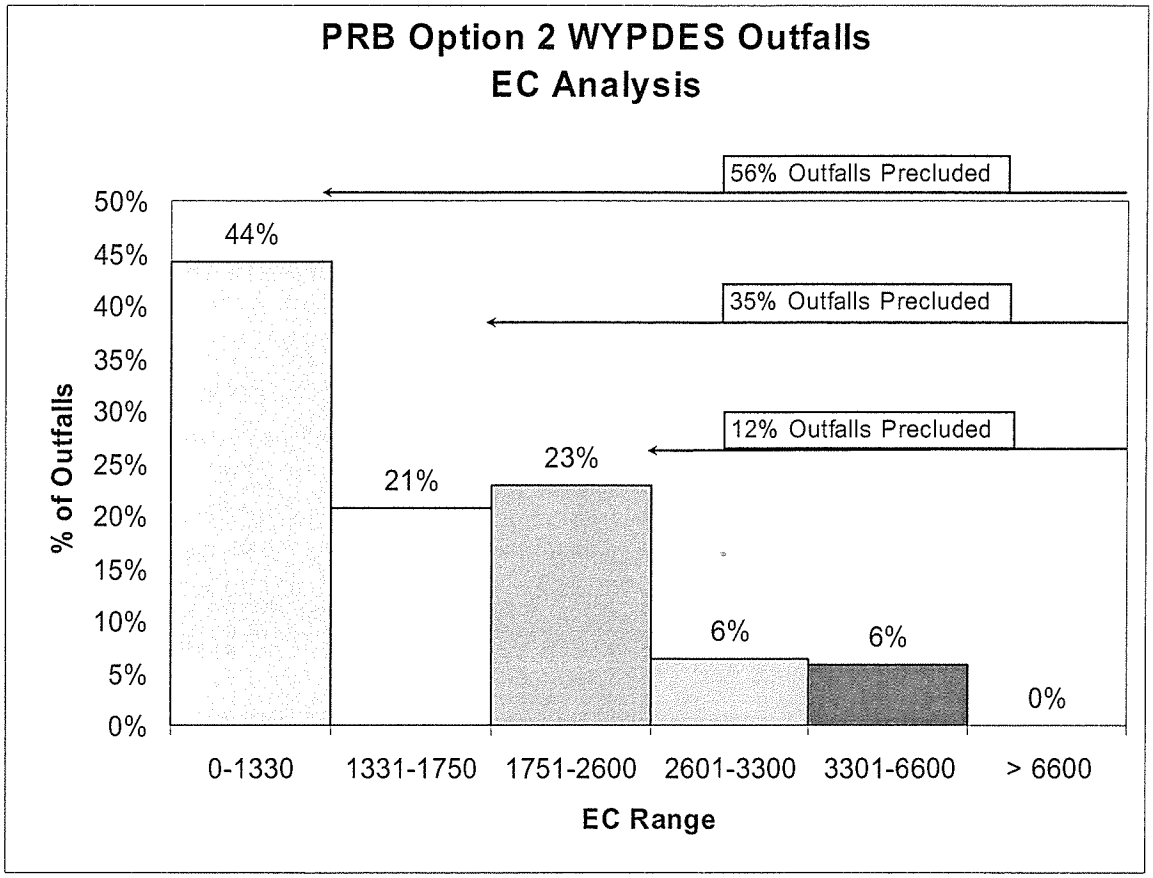
**Figure 4:** Graphical depiction of EC contour intervals shown in Figure 3 as compared to percent of outfalls that will be affected by implementation of the AUPP EC limits. Depending on the reference that will be used to establish default EC limits, as many as 56% of existing Option 2 discharge permits will not comply with EC limits anticipated by use of the AUPP. EC data from 2,231 outfalls were used in this analysis.



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Clearly, the requirements that results from strict implementation of the AUPP will force the operators to employ costlier water management strategies. The following discussion further expands on two of the strategies bulleted above.

**Outfall Treatment to Bring Discharge into Compliance with AUPP Limits**

If it is not feasible for an operator to collect the required irrigation waivers or construct impoundments upstream of protected irrigation, active treatment at each outfall will be necessary to comply with the AUPP EC and SAR limits.

This would require an individual ion exchange system similar to those currently used to actively treat CBNG along the Powder River. Conservative cost estimates for this type of treatment currently range from $0.35 to $0.60/BW (WOGCC: 2006 PRB CBNG produced water).

*This would result in a marked cost increase of CBNG gas produced*

*This will make many producing CBNG wells and reserves uneconomic.*

In addition, if active treatment efforts increase significantly, fewer outfalls will be used by operators due to increased cost. This will lead to a reduction of geographical extent of potential beneficial use waters.

**Permitting Options that will be Employed to the Avoid AUPP Limits**

In order to comply with the AUPP limits that would otherwise be issued for downstream irrigation, operators could apply for 'alternative' Option 1 permits that would not have associated EC and SAR limits. However, these permits require that impoundments be designed to contain all discharge and the run-off for a 50 yr – 24 hr precipitation event.

For those familiar with WYPDES terminology, this means that to utilize existing on-channel impoundments, all existing Option 2 permits will require re-permitting to Option 1B on-channel impoundment permits.

*If this management plan is the most economically feasible, and therefore the most common, the impact is important: permitted impoundments with no freeboard requirements will suddenly require a freeboard to contain up to a 50 yr – 24 hr storm event (per Form C, 6/22/2006).*

The increased impoundment size triggered by this requirement is enormous and generally will exceed the capacity of many of the existing impoundments. The degradation associated with building larger impoundments that will be kept marginally to barely full, will be unacceptable to the BLM and the majority of landowners. Furthermore, impoundments this size will require SEO mandated bypasses that prevent capture of runoff obligated to downstream adjudicated water rights. If these bypasses can even be constructed due to local topographic and geotechnical conditions, they will be prohibitively expensive to construct and cause further surface disturbance.

However, stream monitoring data over the last 5 years has indicated that the need for the 50 yr - 24 hr requirement is unnecessary *and* infeasible in virtually every situation under current Option 2 permitting. Please see additional reports submitted as comment to the Environmental Quality Council February 15, 2007 Hearing on the Triennial Review of Chapter 1: "Hydrochemical Analyses of Storm Events on Ephemeral Drainages in the Powder River Basin" by CBM

Associates, Inc. and "Summary of Streamflows in Ephemeral Streams of Powder River Basin" by Lowham Engineering, LLC.

Impacts of the AUPP will be lessened to some extent if the currently proposed NRCS Bridger Plant Materials Center 1996 EC plant tolerance recommended values are implemented instead of the currently used EC plant tolerance recommended values from the USDA, ARS National Salinity Laboratory Salt Tolerance Database. Nevertheless, a substantial reduction of the current impoundments that can contain produced water will still occur unless the definitions of naturally irrigated lands and the water sources that actually provide irrigation to those lands are accurately defined. As the naturally irrigated lands are currently defined in the AUPP, they can be inferred to exist in virtually every drainage system downstream from existing Option 2 permitted impoundments.

**Recommendations:**

- Amend the proposed Agricultural Use Protection Policy to address observed and reasonably estimated risks.
- Use stream channel monitoring modeling to protect downstream irrigation and supplement discharge limits.
- Amend the document to clarify definitions and rectify ambiguities that exist within the Agricultural Use Protection Policy as well as between the Agricultural Use Protection Policy and Chapter 1.
- Reconsider including the Agricultural Use Protection Policy as an Appendix in Chapter 1. It should remain as a policy and continue to evolve and improve over time.

adopt the 16 cap for SAR and the Bridger -- what I call the Bridger Plant Material Center's data, as recommended by the advisory board, that would resolve your concerns, is that what I'm hearing?

MR. GARLAND: No, it would not resolve my concerns. The other concerns we have are the terms "naturally irrigated land" and how they are defined.

MR. BOAL: And that's what Mr. Lowham spoke to?

MR. GARLAND: That is correct.

MR. BOAL: Okay.

MR. GARLAND: The assumptions based on that description, those terms need to be better defined.

MR. MOORE: Okay.

MR. GARLAND: And I think that is for future discussion, not to be done here, but it is a document that does need some better definitions in it. It also needs some better equivalency to Chapter 1, see disconnects there as well.

MS. FLITNER: So you have three concerns, and that's -- those are the three, 16, the Bridger data and the natural irrigation language?

MR. GARLAND: Yes.

MS. FLITNER: Thank you.

MS. HUTCHINSON: I have one.



CHAIRMAN GORDON: Wendy.

MS. HUTCHINSON: Short and easy.

The Bridger study, has it been published and peer reviewed?

MR. GARLAND: In a peer-review journal?

MS. HUTCHINSON: Yeah.

MR. GARLAND: I will defer that question to Mr. Todd Gilmer, whose testimony is next. He's the one that did the research on that.

MS. HUTCHINSON: Okay. That would be great. Thank you.

MR. MORRIS: I have just one question.

All this study is based on alfalfa, right?

MR. GARLAND: No, sir.

MR. MORRIS: I mean, your comments --

MR. GARLAND: Just to use them as a baseline for the most sensitive plants that we've seen out there that is grown as a forage crop and generally even as a harvest crop.

MR. MORRIS: And you're saying that alfalfa's --

THE REPORTER: I'm sorry. Can you say that again?

MR. MORRIS: Alfalfa can tolerate up to 16.5?



MR. GARLAND: 16.5 EC?

MR. MORRIS: Based on the Bridger studies.

MR. GARLAND: The 16 is for SAR to be protective of the soils, and it's back calculated from the 2600, that is the water we see that is equated from the 4,000 in the Bridger document.

MR. MORRIS: And alfalfa can tolerate that high?

MR. GARLAND: According to the Bridger salinity tolerances, yes.

MR. MORRIS: That's the Bridger study. Okay.

MR. GARLAND: Yes, sir.

MR. MORRIS: Is alfalfa more sensitive than sagebrush?

MR. GARLAND: Yes, sir.

MR. MORRIS: Sagebrush tolerate that high a standard?

MR. GARLAND: I think sagebrush is extremely tolerant. I am not a vegetative analyst. I have not looked at that. I'd have to go research that. My -- sagebrush doesn't like to get its feet wet too long, but otherwise it seems to tolerate quite an extreme of soil conditions that are prevalent over the state of Wyoming and air conditions.



CHAIRMAN GORDON: I'm going to beg the indulgence of the Council and move on. We're going the wrong way. That took 25 minutes instead of 15.

But I thank you very, very much for your testimony. It was helpful and I thank you.

MR. GARLAND: Thank you, Mr. Chair.

CHAIRMAN GORDON: Mr. Gilmer, Mr. Todd Gilmer.

With that we're done with the first page.

Can you identify yourself, sir?

MR. GILMER: Yes, my name is Todd Gilmer. I'm a geoscientist. I work for CBM Associates as a consultant.

Ready to go there?

And what I'd like to present to you folks this afternoon is a summation of Mr. Kevin Harvey's research over the last year that concerns soils, electrical conductivities and sodium adsorption ratios. Unfortunately Mr. Harvey is not able to attend today. He tried to fly down and he had some mechanical problems in the airplane and so I've been asked to stand in for him.

My background, like I said, I'm a geoscientist, geophysics hydrogeology. Background, I've been working in the coal-bed natural gas -- does everybody have copies?

MS. FLITNER: We do from earlier, I think.

MR. GIRARDIN: We got that this morning.
MR. GILMER: Yes, sir.
CHAIRMAN GORDON: Okay.
MS. FLITNER: Go ahead.
MR. GILMER: Okay. Thank you.
Where I'd like to begin is talking about soils and how soil studies that originated in California and elsewhere in the southwestern U.S. have been used to -- by the DEQ to establish limits here. Those limits are, as it turns out, overly conservative with regard to what we actually see in this area based on other USDA studies from Bridger, Montana office.
The second point that I'd like to make is that the electrical conductivities that are being proposed, again are based on information taken from areas other than Wyoming. And again, if we go back to what's available from the data from Bridger, Montana, we end up with values that are much larger than what have been proposed for Tier 1.
The SAR's, Mr. Harvey took a little bit of a unique approach and looked at the science behind the SAR's in terms of exchangeable sodium percentage rather than other methods. Using that method and applying a 33 percent safety factor, ended up resulting in an EC that -- or rather an SAR that would still be acceptable, not create the sodic soil conditions, at a level of 16. And as you're



well aware, all this is related through the Hanson diagram.
The duration of irrigation is an important point that you all need to consider -- we all need to consider. Dr. Grant Cardon previously had stated -- Mr. Lowham alluded to this before -- you need at least six hours for an irrigation event to be effective. What we've seen from the hydrographs that Mr. Lowham presented, as well as Mr. Taboga, that the flood events that occur every two to five years are much shorter in duration or perhaps only of that duration. Hence, you're looking at something from those flood events that is more or less an acute event rather than a chronic event. And it is the chronic impacts that have the most impact on the utility of the water for irrigation. It's not the one time every two years.
As far as the rainfall events that were discussed earlier by a testimony, Mr. Harvey also did some research into that and found that the rainwater leaching effects are not expected to have any substantial impact on the soil structure. That's because of the chemistry of the soils themselves, there's an abundance of calcium and carbonate in the soils, as well as possibility of dissolving additional calcium from the minerals in the soil.
Finally, to wrap this up, make it blessedly short, recommendations. Going back to previous speakers, particularly Mr. Garland, the Bridger values of 16 for SAR,



and -- excuse me, 2700 microsiemens per centimeter for EC for alfalfa are the numbers that we feel are the most applicable for Tier 1 considerations.
That concludes my presentation. Do you have any questions?
CHAIRMAN GORDON: Thank you, Mr. Gilmer. Any questions from --
MS. HUTCHINSON: I'll ask mine.
Has this study been peer reviewed?
MR. GILMER: Has this study been peer reviewed?
MS. HUTCHINSON: Yeah.
MR. GILMER: This is Mr. Harvey's information that has been submitted to DEQ last May and submitted in summary form to you all yesterday.
MR. MORRIS: The question was was Bridger study peer reviewed.
MR. GILMER: Was Bridger study peer reviewed?
MS. HUTCHINSON: Yeah.
MR. GILMER: I'm not sure of that, ma'am. I've seen it referred to in presentations to DEQ, as well as to the Montana folks. And beyond that I can't speak for it being peer reviewed.
MS. HUTCHINSON: To be fair, I should ask



the same, and you may not know the answer to, is the other USDA study out of California, has that gone through some sort of peer review?
MR. GILMER: Knowing what I do, which is a general sense of what happens with government publications, be it USGS particularly that I'm aware of, or any of the other bureaus, there is usually an extensive in-house review process that is employed before any document goes out the door.
MS. HUTCHINSON: Thank you.
MR. GILMER: You're welcome.
CHAIRMAN GORDON: Any other questions? I have a couple.
MR. GILMER: Yes, sir.
CHAIRMAN GORDON: Can you speak just generally to any differences in methodology between the USDA study and the Bridger study and sort of the parameters of how the study was conducted and any other particular facts that --
MR. GILMER: Mr. Gordon, I think that Mr. Harvey would be the proper person to address that question to. What I know in a general sense is that there's substantial differences in the soil types. The soil types in the California and Arizona studies that the ARS studies involved are called sodic soils. Excuse me,

I'm pronouncing that wrong. They are chloridic soils or chloride is the primary source of salinity, whereas in the Montana -- the Bridger, Montana studies, the soils are predominantly sulfatic soils. In other words, there's a lot of sulfates in the soils that we have here in the Powder River Basin.

And for that reason, and that reason and that reason alone, what we see from the Bridger studies would be much more representative of what we can expect here rather than what we see in the more regional studies available from the ARS.

CHAIRMAN GORDON: So what -- I guess what I'm trying to get at is are you suggesting that soils in Bridger, Montana are going to be similar -- the formation of the soils was similar?

MR. GILMER: The geology of the Bridger, Montana area is much more similar to the geology of the Powder River Basin than what the geology of, say, Riverside, California is. Similarly, the soils in those areas, Bridger is more similar to the Powder River Basin than Powder River Basin is to Riverside.

CHAIRMAN GORDON: Okay. Okay.

Mr. Moore.

MR. MOORE: Remind me of a follow-up question.



Do you understand that one of the reasons DEQ staff is recommending that we not use the Bridger is that this is a statewide rule and not specific to the Powder River Basin, and my understanding is that they're not comfortable -- it's been demonstrated that the Bridger values are appropriate for a statewide application?

MR. GILMER: No, I was not aware that it was proposed as a statewide standard; however, from the standpoint of similarity of geology across the entirety of Wyoming versus, say, compared to Montana, and those are quite similar in terms of the underlying rocks as well as the soils, whereas there is not a great similarity between the rocks and the soils of California or Arizona to what we have up here.

MR. MOORE: Okay. Thank you.

MR. GILMER: You're welcome.

CHAIRMAN GORDON: Thank you.

Any further questions?

Thank you, Mr. Gilmer.

So I am now moving on to is it Clara M. Yetter?

MS. YETTER: Yes.

CHAIRMAN GORDON: Thank you, Clara.

We did much better that time. That was only 11 minutes. So I'm going to start trying to keep us going.

MS. YETTER: Clara M. Yetter, supervisor, chairman of the Meeteetse Conservation District. I have statements here from the district, a short piece that I will read to you and then one that -- another longer one that I will hand to you. Re: comments on EQC draft Chapter 1, December 2006, Section 20, Agricultural Use Protection Policy. Dear Mr. DiRienzo and the Wyoming EQC, the Meeteetse Conservation District appreciates the opportunity to provide additional comments on the proposed revisions to Chapter 1, Section 20, Agricultural Use Protection Policy.



As local government, the Meeteetse Conservation District recognizes and appreciates the efforts expended by DEQ, WQD in the field visits to discharge sites and affected water bodies as well as in conducting the public meeting in Worland.

Comment 1, the current revision of Chapter 1 should proceed with the revision of Section 20 set aside. This would allow the remaining provisions of Chapter 1 to be implemented in a timely manner.

Comment 2, the MCD is opposed to the revised Section 20 as written.

Comment 3, now more than ever the MCD believes that the draft revised Section 20 threatens the future ability to use water produced and discharged in conjunction with extraction of hydrocarbons. Section 20 must provide



local flexibility to develop and utilize future water resources associated with mineral development.

Comment 4, local soil and vegetative conditions coupled with the ambiguity and subjectivity of determining and defining measurable decrease in crop production on, quote unquote, naturally irrigated lands will lead to a myriad of lawsuits and will also lead to a game of controlling watersheds through control of strategic land parcels. This will be exacerbated by the ability of unaffected third parties to sue on behalf or against public land management agencies.

Effects on, quote unquote, naturally irrigated lands must be determined in some other manner with the ability for local considerations to be incorporated.

Comment 5, public review of Section 20 needs to be extended. The ability of Wyoming residents to actively participate on a statewide basis has been limited. A process used by the EQC has not properly satisfied the requirements of Wyoming Statute 35-11-302 requiring the state to consider and evaluate social and economic impacts of proposed rules or regulations, to wit, the statute citation 6 in recommending any standards, rules, regulations or permits, the administrator and advisory board shall consider all the facts and circumstances bearing upon the reasonableness of the pollution involved,

# Soils, ECs, & SARs

Presentation to Wyoming EQC
By Kevin Harvey & Todd Gilmer*
15 February 2007

## Soils, ECs and SARs

- Kevin Harvey has provided comments to DEQ in May 2006, and to EQC today. This presentation is based on Kevin's comments.
- Todd Gilmer is making the presentation, as Kevin's airplane had mechanical difficulties which prevented him from attending.
- Todd has a B.Sc. degree in geophysics, graduate studies in hydrogeology and geophysics, and has worked on CBNG projects in Wyoming since 1997.

## **Soils**, ECs and SARs

- **Soils**
  - USDA/ARS standards were developed largely from crop studies in 'chloridic' soils in California, where chloride is the primary salinity source
  - In the Powder River Basin, 'sulfatic' soils predominate, where sulfate derives from gypsum and epsomite in the parent rock
  - Between CA and WY, there are large differences in soils, soil development, soil nutrients, climate, altitude, and cropping practices that explain crop yield differences



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## Soils, **ECs** and SARs

- **EC**
  - Wyoming crops do not respond to EC changes as predicted by USDA/ARS studies in CA
    - For CA soil ECs ranging from 2.8 to 6.9 dS/m, average alfalfa yield is 8.0 tons/acre
    - For WY soil ECs ranging from 1.5 to 6.5 dS/m, average alfalfa yields are 2.5 tons/acre
  - EC100 values from USDA/Bridger MT studies are developed for MT and WY applications
    - USDA/Bridger data indicate ECw100 for alfalfa~2.7 dS/m, or 2,700 uS/cm

## Soils, ECs and **SARs**

- **SAR**
  - SAR is a measure of sodicity risk. Excessively high SAR can result in reduced air exchange, water infiltration, and hydraulic conductivity.
  - The higher the ECw, the higher the SAR can be without impacting soil characteristics.
  - Sodic soil conditions occur when the Exchangeable Sodium Percentage (ESP) exceeds 15%.
  - To provide a 33% margin of safety, ESP < 10%
  - Based on regional soil results, at ESP = 10%, SAR = 16
  - Rainwater leaching effects are not expected, due to inherent calcium content of soils and mineral dissolution.

## Soils, **ECs** and **SARs**

- The Hanson Diagram defines relationships between EC and SAR values such that no reduction to soil infiltration occurs, and such that slight to moderate reductions occur
- At recommended limits of ECw = 2,700 uS/cm, SAR = 16, within 'no reduction' area

## Soils, ECs and SARs

- Duration of irrigation
  - Dr. Cardon has stated that 6 hours are needed for an effective irrigation event
  - Overbank flood events tend to be of this duration, but only once every 2 or more years
  - Irrigation standards apply to 'chronic' or persistent water chemistry, and not that resulting from an 'acute', short-term event
  - Acute events from reservoir overtopping or spilling should not have chronic standards applied

## Soils, ECs and SARs

- Recommendations
  - Limits based on irrigation use need to be understood as 'chronic', not 'acute'
    - Should not apply 'chronic' limits to 'acute' events, such as reservoir releases resulting from storms
  - EC effluent limit 2.7 dS/m (2700 uS/cm)
    - Based on WY and MT data for alfalfa
  - SAR limit 16
    - Difference in CA vs WY soils (gypsum)

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First I'd like to compliment DEQ. Since this first -- this issue first came up back in 2002, they've been very supportive in working with the Forest Service and stakeholders in doing water quality monitoring and water planning, and also to propose the changes to the rule to address the issue.

The most important proposal in the rule change that is most important to us is the opportunity to have a secondary recreation use -- secondary contact recreation use designation to be applied to streams where it's appropriate and to have the use attainability procedures to allow the change to the primary contact use to secondary contact use where that is appropriate.

There are a number of water bodies on national forest system lands that are too small or too cold to support primary contact recreation use, but yet by default they're all protected for that use currently.

We like the idea of using Table A as default, although we recognize there are some procedural issues that go along with making a change in that manner. In our written comments we provided a real -- a real-world example of why this issue is important to us. We have three streams that were listed in the 2004 303(d) list as impaired exceedances of the primary contact recreation use standards. We have been working with DEQ and local



stakeholders to address the issue. One stream in particular, the north branch north fork Crow Creek on the Medicine Bow National Forest is 2 feet wide and 1 foot deep at high flow, so it's like this big (indicating), and it's protected for primary contact recreation use. It was listed in 2004, and since -- basically since the first samples were taken in 2002, Forest has been working with DEQ and local conservation districts on water quality sampling ever year since, implementing best management practices and watershed planning to try to meet that primary contact recreation standards.

Needless to say, the Forest Service, as well as DEQ and conservation districts, have spent lots of money trying to meet this primary contact recreation use.

And, in addition, Forest Service was sued over alleged violations of the Clean Water Act because we have allowed livestock grazing to continue in this watershed, even though we've had exceedances of the standard. We prevailed at the district court level, but it's currently on appeal.

So in addition to spending money working on the ground trying to try to solve the problem to protect a stream that's this big (indicating) for swimming, we've had to spend the money to defend ourselves in court to protect, you know, a standard that is not -- that we feel is not



appropriate. So we think that it's very important that these changes move forward as it will certainly help us in our management of the national forest.

And I appreciate the opportunity to comment and be happy to take any questions.

CHAIRMAN GORDON: Questions?

MS. FLITNER: No questions. Thank you.

CHAIRMAN GORDON: Thank you very much. Have a safe trip home.

MS. CARLSON: Thank you.

CHAIRMAN GORDON: Marvin, there you are. Thank you for your --

MR. BLAXESLEY: Not a problem.

CHAIRMAN GORDON: Can you identify yourself.

MR. BLAXESLEY: Yes. My name is Marvin Blaxesley and I represent Marathon Oil Company.

Mr. Chairman and members of the Council, again thank you for the opportunity to comment.

I'd like to concentrate on the ag protection portion of Chapter 1, and to start off just saying that we're opposed to the changes in Section 20 as are written. We believe that the old language that existed for many, many years work just fine, and that there's really no need to change that. That being said, if this -- as this



document -- or if this document moves forward, Marathon supports keeping it Section 20 as a policy rather than a rule for the following reasons.

Policy allows flexibility and discretion to account for site-specific conditions. It allows changes to be made more easily and quickly than through a rule, which would require a lengthy formal rulemaking process, even to make minor changes.

First, I want to recognize the positive aspects of the document. The document recognizes the magnitude and sustainable agricultural benefits of historic discharges and exempts them from the effects of this document if they are determined not to be hazardous to humans, livestock or wildlife. This is a good provision and I want to thank the DEQ for including it.

It relieves operators of historic discharges from burdensome, expensive and intrusive requirements of a Tier 3 demonstration just to maintain the status quo of which everyone was happy with; however, I submit that the same process should be available to coal-bed natural gas operations, as many of them have demonstrated the same agricultural benefits in the last five to eight years.

The document also allows an agricultural operator to waive the conservative requirements of the numeric livestock standards if they accept the potential risk.

This is also good. I believe the livestock operators should have that flexibility, especially when water supplies are very limited.

The documents allows an EC and an SAR waiver if the agriculture operator chooses to utilize the water that doesn't meet the default values if the water is contained on his property. These are all good provisions.

On the downside, the policy rule would eliminate most opportunities for future discharges of conventional oil and gas produced water. There would be very little, if any, opportunity for a new Cottonwood, Hamilton Dome-type scenario to develop, because of the bottomlands protection clause and the typical water quality of conventional discharges.

Although not specifically stated in the document, I believe it would be the DEQ's interpretation or implementation, and I would obviously ask for their input here, if they so desire, but if you had a new discharge on the watershed and you have 20 people that want that water and you have one person that doesn't, that one person would be able to deprive all others --

MR. BOAL: Where is that language?

MR. BLAXESLEY: That's not in there.

MR. BOAL: Because that's the second time that's come up. And I've looked through this document and



I cannot find the landowner veto language.

MR. BLAXESLEY: It's not in there.

MR. BOAL: Point it out to me.

MR. BLAXESLEY: I believe this is the way it is intended to be implemented, if I may ask that question to --

MR. BOAL: I'm sorry to interrupt, Mr. Blaxesley. Continue on.

MR. BLAXESLEY: Okay.

MR. BOAL: The language is not in there. This is just what people believe DEQ --

MR. BLAXESLEY: I think we have good reason to believe that, but thank you.

MR. BOAL: Thank you. Go on.

MR. BLAXESLEY: The bottomlands protection would not even allow suitable livestock and wildlife utilization of water that doesn't meet the extremely conservative Tier 1 and Tier 2 background quality, even if the landowner wants that water for livestock and wildlife, if there is a 20-acre parcel of bottomlands in that drainage that the DEQ would want to protect for irrigation purposes, you would not be able to utilize that water for livestock or wildlife purposes. The irrigation portion of that naturally irrigated land would trump the livestock and wildlife benefits of that.



In closing, I would just like to reiterate the recurring themes I hear from landowners and government officials in the Big Horn Basin and that is we want our existing water, we want the opportunity to utilize future sources of water, be those either from conventional or coal-bed natural gas sources, and we want the economic benefits of oil and gas production and agriculture benefits of produced water.

Thank you.

CHAIRMAN GORDON: Thank you.

Are there any questions of Mr. Blaxesley?

Hearing none, thank you, sir, very much. Appreciate it.

I have Joe Icenogle next. Hope you're prepared, Joe.

MR. ICENOGLE: Oh, I am. This shouldn't take more than 20 minutes. Just kidding. I'll be brief.

CHAIRMAN GORDON: Can you identify yourself.

MR. ICENOGLE: Yes, my name is Joe Icenogle. That's spelled I-C-E-N-O-G-L-E. I'm with Fidelity Exploration and Production Company out of Sheridan, Wyoming. And Mr. Chairman and members of the Council, I greatly appreciate this opportunity to come down and talk about the ag use protection language. And the



reason I state that is in Mr. Corra's opening remarks he mentioned about the Waste Water Advisory Board and the recommendation that if you want to pursue this as a rule, to send it back to them for another comment period.

Fidelity strongly endorses that, because this language has not been heard as a rule. And as Mr. Corra said, a rule takes on a different character than a policy. We lose that flexibility. And also in my experience, as a regulatory public affairs manager, I have never seen regulation roll back. And I'm very concerned about that, Fidelity's concerned about that, but regardless of whether it stays a policy or a rule, it does need some wordsmithing. It needs some work.

It's been pointed out in previous testimony on definitions or lack of definitions. When you look at page H-2, under measurable decrease, third grammatical paragraph, again on line 20, when it discusses effluent limits on historic discharges. Fidelity concurs with Marathon that this is a good provision to have in here; however, historic discharges is not a defined term.

Further down on the second line -- or, excuse me, second sentence, line 22, you also see many years. What does many years mean? These are examples of terminology or words of art for this ag use protection language that have no definition. And when working with the regulatory

community, it's very important that we have that certainty so we know how to design our operations, plan our operations and work with the landowner and the regulatory body in implementing our procedures that are compliant with the regulations.

So I ask that this be sent back and we do some more work on it in light of also the additional discussion, the technical discussion we heard earlier today.

We greatly appreciate your time. Thank you.

CHAIRMAN GORDON: Any questions for --

MS. HUTCHINSON: Thank you for your comments.

CHAIRMAN GORDON: Joe, I had one question for you.

Could you just -- could you comment -- I guess, one of the things that's valuable about having a defined policy, wordsmith better and all that, is that there's some predictability, it's not done on an ad hoc basis. Have you seen in your time as Fidelity's main guy on this, that there's been more consistency, more predictability in the way these permits are handled and written? I can remember back to questions about mixing zones and how we dealt with those things and there was -- it was almost like writing a new permit each time way back when.

MR. ICENOGLE: Mr. Chairman, members of the



Council, Fidelity's experience working in the regulatory arena, it seems that as time progresses we have less certainty, that pathway to receiving a permit. Things do change. And I think you've heard that discussion today about already the ag use being applied in permits and these other requirements, and those are the things that are concerning, because when we're out making representation to the landowners on what we can do before we go submit the permit, because we want to consult with our surface owners before we go into a permit application. You know, we want their buy-in to what we're doing and we want to make sure it works for their needs as well, but by the time we get down and start working with the permit, we find out a permit writer's perception of it, what we're trying to do becomes more cumbersome in fulfilling the needs of the property owner.

CHAIRMAN GORDON: Mr. Moore.

MR. MOORE: One quick question. Do you have a recommendation on what your definition of historic discharge would be?

MR. ICENOGLE: I would have to say seeing how -- excuse me, an NPDES permit issued for five years, if it's been in for five years, then when it goes up for renewal, it's an historic discharge.

MR. MOORE: Thank you.



MR. ICENOGLE: You're welcome.

CHAIRMAN GORDON: Thank you.

I have Tim Barber.

MR. BARBER: Good afternoon. My name is Tim Barber. I'm employed as a regulatory supervisor with Yates Petroleum. I'll try to make my comments very brief and I appreciate the opportunity to provide them here today.

I would like to speak generally to the ramifications that I see as a person who is working on the ground with permits, permitting, project planning and landowner work that I see would come out of this rule as it's proposed and actually out of the policy as it's being worked now.

CBM water, as you may have gleaned from some of the presentations prior, generally does not meet the default limits for SAR and EC raw coming out of the ground. In order to get a permit to discharge water -- to discharge that water, I have to either pursue the Tier 2 and Tier 3 options that are proposed in there, and I can tell you as a person who's working a number of those right now, that has been an extremely difficult path. I can tell you that I am regularly, not just on one occasion, but on a number of occasions, denied access by downstream landowners either because they don't feel it's necessary, because they don't



feel the water will ever reach them, or they just simply don't want you out on their land conducting soil, vegetation, background water kinds of studies. That's a very difficult road.

The other option that I have is if my water will not meet the default limits, I can construct reservoirs which contain all of my produced water and all of the 50-year, 24-hour flood event that you saw earlier on Mr. Lowham's diagram. Generally speaking, as I've worked in the field, not one out of five reservoirs would work for this situation. So what we have, as these permits that have existed and are renewing, we're seeing constituent limits established for SAR and EC at end of pipe that this water can't meet, we can't get access downstream to conduct the Tier 2 and Tier 3 work, and the reservoir that the water is currently going into cannot contain the 50-year giant flood event plus all produced water.

So really the result of this Appendix H that is entitled ag use protection is in many, many cases going to become ag use prevention. And this situation is repeating itself in permits being issued right now, where we have existing discharges, we can't meet the limits, we can't make the reservoirs contain that, and so I am having to go to landowners and say, by the way, the permit that was just issued to us a year from now is going to prevent that

discharge to that reservoir.

And that is going to be -- if you actually sat down and said here are the number of ag uses that we are protecting with this policy, and on the other side of the ledger, you put the number of uses that are going to be prevented, I can assure you that the side that's going to be prevented is going to be much more heavily weighted.

I'm also going to comment briefly, and I know the actual language of the 50-year, 24-hour containment is not written into the rule. It is, however, part of the options that we have to pursue when we're looking at discharge permits.

Reservoirs that will not contain the 50-year event plus the produced water need to remain a viable option. And this policy actually does not allow that to occur. And I'll tell you why. If you can't get downstream and get the Tier 1, Tier 2 done, and you get limits that your water can't meet, that reservoir's not going to receive water.

Right now there are issues out there in the basin, I think this Council's heard about them, that are not so much about water quality coming down on someone's land, but maybe about water quantity coming down on someone's land. One of the answers to that issue is storage on lands where people like Ms. Tweedy would like to



have that water remain. Under the current rule, proposed as it is, those discharges can't happen. They're not going to work anymore under these permitting options that we are provided.

I want to thank you for your time and good luck in your work.

CHAIRMAN GORDON: Any questions from Council?

Mr. Boal.

MR. BOAL: So, Mr. Barber, you're suggesting that we enact a rule, is that what you're saying?

MR. BARBER: No, I'm --

MR. BOAL: First one up here --

MR. BARBER: -- suggesting that you not enact the rule and I'm suggesting the policy, as it's currently being initiated, is a bad idea as well.

MR. BOAL: See, my -- that's my concern, folks. It's tough for me to hear you say you think it should remain a policy and then criticize the policy. I mean, one of the reasons for rulemaking -- and you all know this a lot better than I do, I'm a poor country lawyer from Evanston, Wyoming -- is a rule sets forth here's the requirements you have to meet in order to get a permit. And if you -- if you meet those requirements, if DEQ



doesn't give you a permit, you have an appeal and the appeal board has something that it can review.

A policy, none of that applies. So when you tell me you think the cap should be 16 instead of 10, the way to make that happen is to enact a rule setting forth a 16. So, you know, I'll continue to listen we want it to be a policy, but we don't like the policy. I can tell you right now, it's not making much sense to me. And that whole litany you just went through, that's exactly what you did, we think it should be a policy, but we don't like the policy. Not a very useful discussion. Not a very useful discussion, Mr. Barber.

CHAIRMAN GORDON: Mr. Moore.

MR. MOORE: You, at the close of your testimony, were talking about problems with Tier 2 and Tier 3 and getting access to data or being able to collect data, but yet the way I read that, the very last section, reasonable access requirements, says if you don't have reasonable access, then you can get a permit based on EC and SAR limits based upon the best information can reasonably be obtained and maybe less stringent than the Tier 1 default limits.

So doesn't that give the flexibility to say if Farmer A won't let me on, based on our knowledge of the area, the soils are X and foliage is Y, that we can go



through two tiers -- through Tier 2 or Tier 3 analysis based on those assumptions?

MR. BARBER: Mr. Moore, I'm not sure exactly how that would play out. I'm very concerned, and I know that folks are, about the way that that is worded. What I can say about that is the way that was handled under the policy. Now, the policy's not the rule and I understand the difference, but in the early stages of the policy, that language was put forth pretty much exactly as you said. If there was no access granted to those irrigation locations, then the ag protection would be removed. And that simply to date has gone away. In other words, if no access is available, we are still being issued permits with the irrigation protection language in it. I'm being issued permits right now at SAR, say, 7 and 1300, where I -- where I haven't had access downstream to do this Section 20 work.

MR. MOORE: But the way I read this proposed policy or rule is that if you don't have downstream access, you can get permits issued that would be less stringent than the Tier 1 default based upon assumed values.

MR. BARBER: That may be the way it plays out. I don't know.

MR. MOORE: That gives you the flexibility

to say to DEQ I can't get access to the soil sampling and the vegetation studies that are required for Tier 1 and Tier 2, but based on our best judgment, based on what we know about the region, here's what we suggest the values are, and we can apply permit values of 17 or 18, based on those values.

MR. BARBER: My concern would be whose best judgment would that be?

MR. MOORE: Okay. Let me shift gears on you a little bit. We heard a little bit of testimony here today about the viability of doing the containment for 50-year, 24-hour flood event, et cetera. The thing I haven't heard anybody mention is what other alternatives are there for management water if you're not going to discharge, and specifically reinjection? You know, it's like that's gone by as not an option at all. Have you or anybody else you're aware of in the industry seriously looked at the option of reinjection?

MR. BARBER: Mr. Moore, there's a lot -- if you look at the data, there's a lot of injection attempts that have been made out in the basin. If you would go to the DEQ information on class 5 injection wells, you'd see a whole list of permits that have been out there and been attempted. And actually CBM operators are injecting waters at some level all the way from very shallow depths like 2



feet in subsurface drip irrigation systems, all the way to 14,500 feet into the Madison.

The result of the situation, though, is that injection, while a tool, is certainly not a broad tool that can be used for the volumes of water that are out there, and I don't believe that this rule, as it's proposed, or the policy as it is being enacted right now, is really considering necessarily other options. I don't know if that's properly before us right at this moment in time, but there's -- if you would, take a look at the information out there, there's a lot of injection work being done by companies.

One of the things that's faced traditionally, though, is very tight geology and we have difficulty getting amount of water we need to manage down injection wells. And if you think and back up for just a moment, if this injection was extremely easy, you probably wouldn't see a lot of folks working as hard as they are on surface water discharge issues.

MR. MOORE: Thank you, that helps.

CHAIRMAN GORDON: Wendy.

MS. HUTCHINSON: I just wanted you to -- one of the last comments you made earlier was on you feel that the way -- when you're actually trying to implement this rule, as we have it right now, that it would preclude



you from being able to utilize the, quote, containment -- 50-year containment, or whatever, like used on Mrs. Tweedy's property. Why -- can you make that a little more clear to me, why you feel when you don't have the Tier 1 or Tier 2, Tier 3 option that you're precluded from using the containment option.

MR. BARBER: Let's just say for the sake of argument that I have an existing permit that's getting ready to renew under this policy or under this rule. My existing permit maybe says that I can discharge water to a reservoir that does not contain the 50-year event, plus my water, maybe it's even not required to contain any particular storm event, but maybe it can only overtop during, you know, some sort of a storm event, but not necessarily a defined storm event.

I have permit limits that my current water needs can go into this reservoir, it doesn't overtop, doesn't flow downstream. That's my permit now. My permit, when it renews under this policy or under the rule, if there is downstream irrigation or downstream bottomland forage -- naturally irrigated lands I think is the terminology -- then I get a permit that says my end-of-pipe limit, before it even enters the reservoir, my end-of-pipe limit is something like SAR 7 and a half, EC 1300, maybe my water is SAR 12 and 1800. So that water no longer is dischargeable



into that reservoir, and so that reservoir, as a containment tool, goes away under the current policy or under the rule.

MS. HUTCHINSON: That's a problem.

MR. BARBER: That's a major problem. And there's so many ag uses that are currently tied to reservoirs, just like we discussed here today. That's why I made the statement I made about ag use prevention.

CHAIRMAN GORDON: Okay. Thank you. Any further questions. John?

MR. MORRIS: Yeah. You said if this rule is enacted it would -- and you had to get the landowner -- downstream landowner access, that it would shut you down, right?

MR. BARBER: What I think I said --

MR. MORRIS: With that permit --

MR. BARBER: What I think I said is if I don't have access downstream to do the Tier 2 and Tier 3 studies that are suggested under the rule, that I could end up having to live with the default limits, which my water likely won't meet, and, therefore, I can't discharge it unless I can go to a reservoir that will contain all the 50-year event plus all of my water.

MR. MORRIS: But you can do that?

MR. BARBER: Not generally speaking, no.

MR. MORRIS: Have you ever tried to negotiate or buy access permit to these people to your benefit?
MR. BARBER: We have attempted to negotiate in a number of cases access downstream, yes.
MR. MORRIS: Monetarily?
MR. BARBER: The negotiations that occur, monetary has been offered, yes, uh-huh.
MR. MORRIS: I mean, they have nothing to gain, why do they want to let you in, unless, you know, they want to use their land for its highest and best use and maybe its highest and best use would be your access.
MR. BARBER: Mr. Morris, whether it's pipelines or roads, use of water containment facilities, well sites, the industry that I work for pays for all of those.
MR. MORRIS: But you haven't been paying for access onto these ranches.
MR. BARBER: We have offered, yes, sir.
MR. MORRIS: But you haven't obtained any?
MR. BARBER: We have not -- are you saying that we've not obtained any access?
MR. MORRIS: Well, you just said you offered it, but you haven't been successful.



MR. BARBER: In the cases where we were unsuccessful, we have offered and it has not necessarily been granted, yes. In some cases we've asked the question can we come down and take soil samples and the rancher simply says yes.
MR. MORRIS: There is a way.
MR. BARBER: There is a way with a willing landowner.
MR. MORRIS: And enough pocketbook.
MR. BARBER: I haven't seen that necessarily being the issue.
MR. MORRIS: What advantages --
MR. BARBER: It's either I want you there or I don't want you there.
MR. MORRIS: What advantage is he going to have to get this bad water and for your benefit?
MR. BARBER: Mr. Morris, in the case I've been describing today, I'm talking about reservoirs that would not overtop except during a storm event, and so that downstream landowner may simply say, man, your water -- I'm 12 miles down below your reservoir. Your water's never going to get to me, therefore, there's no reason for you to be out on my lands drilling for soil samples, for example.
MR. MORRIS: Okay.
CHAIRMAN GORDON: Okay. Are there any



further questions?
Thank you, Mr. Barber.
MR. BARBER: Thank you.
CHAIRMAN GORDON: Joe -- no comment on Mr. Barber's testimony -- can see if the lights will go on. I think it might be over there on the wall somehow. I just -- I feel like I'm in the dark here. Thank you very much.
I have Isaac, and I'm sorry, I didn't bring my glasses today, so --
MR. SUTPHIN: Sutphin.
CHAIRMAN GORDON: Sutphin. Okay. Thank you.
MR. SUTPHIN: Mr. Chairman, members of the Council -- is this the mike? Is this it?
CHAIRMAN GORDON: Yes.
MR. SUTPHIN: Thank you for this opportunity. My name is Isaac Sutphin. I'm an attorney at Sundahl, Powers, Kapp & Martin here in Cheyenne and I represent Merit Energy, and I'm glad to be here and to have this opportunity.
I want to start broad and maybe try to narrow it down a little and direct you, as a Council, to some of the areas that Merit Energy is concerned with in Chapter 1.
First of all, I want to start by saying that



Merit Energy is -- Merit Energy supports the concept of the effluent-dependent water classifications in the Chapter 1, in addition to the site-specific criteria for Cottonwood Creek. I don't want -- I don't want anyone to think that we hate everything about Chapter 1, because that is not certainly the case. But like most of the speakers today, I do want to direct my attention to the Agricultural Use Protection Policy or rule, or whatever it is, because quite frankly I'm still a little bit confused as to whether it's going to be a rule or a policy.
Mr. Boal, I want you to know that Merit Energy is not necessarily opposed to a rule. We are opposed to this rule. And you articulated some reasons why a rule might be beneficial to industry.
MR. BOAL: Sure. If you're going to tell me you got problems with the policy, the way to handle that is to enact a rule that contains the components that you want -- you think are fair, that you think are adequate and you think are protective.
MR. SUTPHIN: That's right. And --
MR. BOAL: So I hope you're not going to be one of these guys that think it should be a policy but then go ahead and criticize the policy.
MR. SUTPHIN: No, what I am going to say is that the language of the rule or policy, as it exists

today, is unacceptable to Merit Energy. This process has been ongoing for almost two years, and I refer to the development of the agricultural use policy, because that's what it was for almost two years, is a policy.

The amount of involvement that Merit Energy devoted to that and to the comments and the process is that rule -- rather is that policy progressed, was based upon an understanding that it was indeed a policy. Again, we're not opposed to a rule, but we are opposed to taking the language that has been purported to be a policy and changing it to a rule at this late date. We do believe that a -- the comments that have been received by both the Water and Waste Advisory Board and by DEQ would have been substantially different had it been proposed initially as a rule.

With that said, I do want to address some of the specific language in Appendix H that Merit Energy is concerned with. And Mr. Icenogle addressed some of this, and I'll try not to repeat too much of what he said, but I do want to go into a little more detail.

Merit is particularly interested in clarifying and strengthening the policy's purported exception for historic discharges. As many of you probably already know, Merit Energy has several discharges that have been discharging for decades, many decades and more. The water



that has been discharged -- and I'm referring, of course, to Hamilton Dome and Cottonwood Creek -- the water that has been discharge has been beneficially used and has been relied on by the agricultural users in that drainage for years. And while we certainly support the idea, and encourage language that would be protective of these existing historic discharges, Merit is concerned that the proposed language does not adequately address those issues.

And let me give you a few examples -- and this is -- when I say that Mr. Icenogle commented on some of these already -- if you want to follow -- or look at the proposed language, I'm looking at page H-2, starting at about line 20.

Mr. Icenogle mentioned already the question about historic discharges as being a term that is not defined. How long does it have to be a discharge before it would qualify for this protection, this exemption, if you will? Additionally -- and again, Mr. Icenogle pointed this one out, the language on line 22 says -- well, starting with the end of 21, where discharges have been occurring for many years. How many years? What does that mean? That's confusing.

MS. FLITNER: Do you have a suggestion?

MR. SUTPHIN: Well, I anticipated that question, thank you, Mr. Chairman and Miss Flitner.



I would agree with Mr. Icenogle that it's five years, but I would actually argue one step further. I mean, if we have an existing permit that's been granted according to certain effluent limits and gone through the process, then I would argue that would -- could qualify under this language. Of course --

MR. BOAL: And now who would decide that?

MR. SUTPHIN: I'm sorry?

MR. BOAL: If it was a policy, who would make that decision? It would be DEQ, right?

MR. SUTPHIN: Right, yes.

MR. BOAL: If you disagreed with that decision, what would you do?

MR. SUTPHIN: We'd argue with them and we would attempt an appeal, if necessary. Again, Mr. Boal, we are not opposed to this as a rule. We're proposed to this particular language being adopted as a rule.

MR. BOAL: So the appeal would come up to the City Council -- to the Environmental Quality Council and we would have to decide if DEQ's interpretation or Merit's interpretation met the narrative standards set forth in the current, what is it --

MR. MOORE: Section 20.

MR. BOAL: -- Section 20.

MR. SUTPHIN: Section 20.



MR. BOAL: Is that an efficient process in your view?

MR. SUTPHIN: Certainly not.

MR. BOAL: Is that one that gives clarity to the regulated community and the agricultural community?

MR. SUTPHIN: I don't know that I would agree it doesn't give clarity, because really the current standard being no measurable decrease in ag -- rather -- back up -- no measurable decrease in crop or livestock production. It's a system that indeed has worked for years, and -- but again, I am not here to say that we do not want a rule.

MR. BOAL: Okay.

MR. SUTPHIN: I am here -- and I hope I've been clear on that.

MR. BOAL: Yes.

MR. SUTPHIN: This particular rule has not been subjected to the proper rulemaking process and we are opposed to it. Does that -- did I answer your question?

MR. BOAL: You did. And I'm sorry to have interrupted. Go ahead.

MR. SUTPHIN: Again, if we look back at the language, on line 22 it refers to the permitted quality of those discharges shall be considered to be background conditions and be fully protective of agricultural uses

that have developed around them.
Again, that language is vague, it's ambiguous and it's extremely confusing. What exactly are the permitted levels that will be considered protective? Is it the permitted levels as it exists today? Is it the historical average in which case by definition half of the discharge wouldn't meet those? Is it the historical worst? Is it the historical best? It's unclear.
The language also there says that it will be fully protective of the ag uses that have developed around those discharges. Does that mean that the agricultural use is generally, as in irrigation and livestock watering, or does it mean specific things like irrigating for one specified crop? If that's the case, can someone come in afterwards, following -- you know, after it's been determined that this is indeed a historic discharge, and start growing another crop, whatever it might be, that has different -- that hasn't been there before. Would the protection for historic discharges exist then?
CHAIRMAN GORDON: Isaac, I don't want to shut you down by any means, but we're at 5 minutes and it's about 4, so --
MR. SUTPHIN: I appreciate your friendly reminder, Mr. Chairman. Thank you.
CHAIRMAN GORDON: Thank you.



MR. SUTPHIN: I have a tendency to ramble.
Let me just conclude, then, by saying this. I have chosen this as one small illustration of the ambiguous nature of this language. As a policy, again, there would be flexibility, and this type of language might be able to slip by, but if this were indeed a rule -- I mean, this -- the language in this Appendix H even uses the term policy in several locations.
Again, we are not opposed to a rule to implement the Chapter 20 -- or Chapter 1, Section 20 standard, but we do object to having what has been considered for all intents and purposes a policy, an internal guidance document, at this late date being changed to a rule. And we would encourage the Council to remand this to the DEQ and to subject it to a proper notice and comment rulemaking period and then we can go forward with that.
And again, I thank you, Mr. Chairman and Council, for your time and attention.
CHAIRMAN GORDON: Thank you very much.
MS. HUTCHINSON: Question.
CHAIRMAN GORDON: Any questions?
Yes, Wendy.
MS. HUTCHINSON: This issue about --
THE REPORTER: I'm sorry. You're going to have to speak up.



MS. HUTCHINSON: I'm sorry.
We've had a lot of questions on this proper -- goes properly through rulemaking or not. I mean, the policy, as a policy, was reviewed five times, whatever, fine, then, you know, 90, 60 days ago, whatever the heck it was, the DEQ then published they were going to consider it to be a rule and gave that published notice on the advisory board meeting so everybody could come and comment and say we don't want it to be a rule, which is what happened, advisory board said we don't want it to be a rule.
Now, that's something we have to take under advisement ourselves, obviously. We've noticed it and that's the purpose of this hearing, is to hear everybody's comments on whether the language is good or if it stinks, which I appreciate your comments that are specific to that, but it seems to me that the procedures have been followed, and that's where I'm still kind of struggling when people say the procedures have not been followed properly.
MR. SUTPHIN: Thank you, Mr. Chairman.
Miss Hutchinson, that's -- I think that the issue that Merit has with that regard is that the process in place is that DEQ -- under this type of rulemaking, of course, that DEQ generates a documents or whatever it may be, and then per statute they go to the Waste -- or Water and Waste Advisory Board and get their recommendations, and



it is after those recommendations have been received that the language then proceeds to this Council, generally speaking.
In this case that did not happen. While you're correct in noting that the language has been before the Water and Waste Advisory Board many times, it has always been as a policy. And, indeed, their discussions and the motions that were made and ruled upon indicated that they recognize this was a policy, that's what we did and that's what we recommended to the EQC. They also recognized, however, that if it were to be a rule, it would have to go back and start that process over again so that it could indeed come before the Water and Waste Advisory Board as a rule.
MS. HUTCHINSON: That's what it did the last meeting, though.
MR. SUTPHIN: I beg to differ, respectfully. What happened at the last meeting was a discussion about should this language be a rule or a policy, oh, and by the way you cannot address the issues -- substantive issues in the language itself. Just tell us if it should be a rule or a policy. That did not give any of the public the opportunity to come in and comment on the effect of this as a rule, the substantive effect of it. We all came in and said, well, yes, indeed, we disagree, it

should be a policy, it should be a rule, but we were prevented from talking about the substantive effects of that as a rule, and that is one of the biggest concerns that Merit has.

MS. LORENZON: But you have that opportunity now.

MR. SUTPHIN: I'm sorry?

MR. LORENZON: You have that opportunity now.

MR. SUTPHIN: We certainly do, but, again, the process is established by statute, that it should go before the Water and Waste Advisory Board, and that didn't happen. They did not -- they did not have the opportunity to listen to comments from the public at large --

MS. LORENZON: We have --

MR. SUTPHIN: -- and make a recommendation on the substantive nature of it as a rule.

CHAIRMAN GORDON: Okay.

MR. SUTPHIN: That's Merit's position respectfully.

MS. FLITNER: To echo Terri's comment right now, I guess I stand to lose the least of anyone whether this goes to another couple of hearings or not, although I will point out that I'm as far away from Cheyenne as you can get, so I share people's concern about travel and so



forth, but if you want to come back in a month or two and have this conversation again, I'll be here, or wherever we go, but I think from a practical standpoint today is, or was, the opportunity to say we like it as a policy sorry as a rule. If you're going to adopt it as a rule, we would suggest this specific language for these reasons.

Now, granted that might be a bit aggressive, that might be overdelivering on the assignment, but if people are interested in saving time and helping -- helping educate those of us, as Dennis has commented a couple of times, and I'm one of those, about specific ways that this would work better for you and your clients and their interests, that's really helpful and constructive.

When I -- I'm not meaning to pick on you at all, because I've heard this theme all of today, but I keep scratching my head and wondering what I'm missing, what am I missing, because now I'm hearing you say we haven't had the chance to comment on the substance. And I was pretty sure when I woke up this morning that's what I was coming to listen to.

So maybe we can do a better job making that more clear, but I'm with Wendy and Terri, I thought that was pretty clear at the last hearing. As I want to reiterate, I don't have any problem opening this up. Let's make sure people understand they're commenting on a proposed rule, if



that's what we decide to do at the end of today, but, you know, this gets really frustrating for everyone when we are looking at the forest and instead of the trees, or whatever metaphor you want to use. I'm interested in what works for you guys and how that may or may not affect neighbors. You know, we're splitting up the baby, let's be real about what we're doing when we do that, and get the issues in a transparent way on the table so that we can -- we can be constructive.

I think that's what -- you know, you're getting the brunt of it's 4:00, 5:00, and we're trying to still figure out how we can still do something constructive today, and we're hearing a lot of the same thing over and over again.

MR. SUTPHIN: Mr. Chairman.

Miss Flitner, I don't mind receiving the brunt. That's fine. That's what I get paid to do.

And I don't know that you necessarily had a question, but I would just -- I would just like to conclude by saying, you know, it may take time. We need to do this right. And I agree that we need to have the opportunity and take the opportunity, when presented, to explain what we don't like, which is what I've tried to do, and explain how we would make it better, and I probably haven't done that as well as I could do, but the fact remains --



MS. FLITNER: Good.

MR. SUTPHIN: -- the fact remains that the statutory process for notice and comment rulemaking is designed so that all of those things can take place.

MS. FLITNER: Uh-huh.

MR. SUTPHIN: And it is our position that has not taken place and that's why we object to this at this time.

Thank you so much.

CHAIRMAN GORDON: Thank you. He, Mr. Isaac, did 6 minutes on that. Council members expanded that to 14, so --

MR. MOORE: Do I get a chance to expand it?

MR. SUTPHIN: Apologize for that extra minute.

CHAIRMAN GORDON: Mr. Moore has one question.

Here's the point, it's about, what, 4:15 now, and I'm going to make the Council members sit here until we're done. We've got 11 people left, so --

MR. MOORE: Thank you, Mr. Chairman.

MR. BOAL: Mr. Chair, what was that? We're going to have to sit here?

MR. MOORE: My question is simply back to the historic discharges. And I concurred with you as

reflected by some of my questions earlier about what is meant by historic discharges and many years, and I got several different pieces of advice as to language that went in there. I didn't ask anyone about your second part on that, which was to modify the discharge, or what is the discharge quality. I just assumed that if you don't have to modify the discharge, that that implies that the permits will be reissued with the same values that they have had in them for the many years -- and DEQ people are nodding their heads -- without change unless there's -- it's shown to constitute a hazard to humans, livestock and wildlife.

Now, that's the type of constructive suggestion that if it's not clear -- it was to me, but if it's not clear to you, then you should just say, and if you concur the discharge permits should be reissued with the same values, unless there's -- it's shown to constitute a hazard.

MR. SUTPHIN: Mr. Chairman.

Mr. Moore, thank you. I would concur with that. The reason I bring -- I bring the ambiguity up is that, indeed -- I mean, that's what I do. I look at documents, I look at contracts and I think of the best way to say something. This is ambiguous and is open to confusion, but, again, it is helpful that -- and I would concur that as I read it the first time, that is indeed how I



interpreted it, that whatever your permit level happens to be at the time when the renewal comes up, if we meet these exceptions, then you can continue at that level.

MR. MOORE: Thank you.

CHAIRMAN GORDON: I have one question. I am terribly sorry.

My one question is this. I'm confused as to why a policy can be confusing, but a rule shouldn't be. I think I heard something about we're objecting to the rule because it's uncertain, but in a policy statement, when we testified and worked it through the advisory board, we were looking at that's a policy. And the implication I draw from that is policies can be confusing. And please disabuse me of that if I'm wrong.

MR. SUTPHIN: Mr. Chairman, I'm not sure I understand your question. I don't believe I've testified that policies are not confusing and rules are. I mean, certainly a policy, as we heard today, can be a much more flexible application of the -- the desired language. You know, it's not that it's more or less confusing, it's the amount of emphasis and interest that the public may have put in, understanding that, well, as a policy I'll have some opportunities later to wiggle around and to work with this and so I'm not going to take the time and the expense of addressing it now. But, you know, I don't believe I've



said -- and if I did, I did not intend to say there's any problem with, you know, whether one or the other is more or less confusing or --

MS. HUTCHINSON: I'm going to make one parting suggestion. You don't even have to reply.

MR. SUTPHIN: Okay. Okay.

MS. HUTCHINSON: If you think the language could be clearer about historic discharges and as the permits get renewed, they would stay the same unless there's something bad going on, when you're setting back here in the next 45 minutes, if you could just kindly jot down some better language and submit them to our secretary, that would be welcome.

MR. SUTPHIN: Mr. Chairman.

Miss Hutchinson, I will make that attempt.

MS. HUTCHINSON: Thank you.

CHAIRMAN GORDON: Thank you.

MR. SUTPHIN: Thank you.

CHAIRMAN GORDON: I have Randy Bolles.

MR. BOLLES: Mr. Chairman, in an effort to help you with time, I'll waive my time.

CHAIRMAN GORDON: Thank you, sir. Thank you very much, sir.

MS. FLITNER: That's the best testimony -- no, I'm kidding.



CHAIRMAN GORDON: Doug Miyamoto.

MR. MIYAMOTO: You don't have to -- my name is Doug Miyamoto and I'm here to provide testimony on behalf of the Wyoming Association of Conservation Districts. And my comments will be brief, because they're not dealing --

MR. MORRIS: You're a little hard to hear.

MR. MIYAMOTO: -- with the Ag Use Protection Policy.

Is it this one?

MS. LORENZON: You've got the right one.

CHAIRMAN GORDON: Looks like the battery's dead on it or --

MR. GIRARDIN: Turn it around. There should be a light on in the back of it.

MR. MOORE: There's not.

MR. MIYAMOTO: There's nothing. Do you want me just speak up or get a new mike?

MS. LORENZON: We'll just trade.

MR. MIYAMOTO: Okay. Sorry about that.

First of all, I'd like to thank the Environmental Quality Council for the opportunity to speak to you today, and particularly to thank the DEQ for the foresight they've shown in developing these proposed revisions to Chapter 1.

To comment on specific components of the proposed

In terms of Appendix H, we generally support the proposals in Appendix H. We've made a number of suggestions that we think would improve Appendix H, and in particular, in our comments we've suggested that the Council consider some new scientific information, a report by Dr. Suarez that was mentioned, I think, both by Bill DiRienzo and Jill Morrison. That is attached to our comments.

I think what's important about Dr. Suarez' report, given the testimony today, is that that study, although done in California, was done using soils collected from both the Tongue and Powder River. And in his study he attempted to mimic the climatic conditions in those river basins. So I think the results of that study do have application to Wyoming.

In his study, he concludes that the SAR values to address the remains of a soil event could be as low as 4 for clay soils and as low as 6 for loam soils. So what we're asking the Council to do there is simply give that some consideration as they look at the proposed Tier 1 cap of both 10 proposed by DEQ and 16 proposed by the board.

In conclusion, we believe that overall the proposed revisions will result in significant improvements to Chapter 1. And the DEQ is to be commended for the work that they've done in both developing the proposals and



putting them before the Council.

I want to thank you for the opportunity to comment. And I guess I ask that you consider the more extensive comments in Karen Hamilton's letter of February 14th.

CHAIRMAN GORDON: Any questions? Yes.

MS. HUTCHINSON: Mr. Suarez' study -- did you -- what review process -- peer-review process did this paper go through?

MR. WUERTHELE: It didn't -- that paper, which is a report to EPA Region VII, did not go through a peer-review process. My understanding is that he subsequently published the results of that in a peer-reviewed journal. And I could get you the information on that. That's based on personal communication with Dr. Suarez.

MS. HUTCHINSON: That would be great if you could get us that publication information. Appreciate that.

That's all.

CHAIRMAN GORDON: Mr. Moore.

MR. MOORE: Could you explain a little bit more your concern or objection to the variance provisions of the E. coli standard?



MR. WUERTHELE: Right. What's being proposed is that there could be, based on unavoidable conditions or conditions in the public interest, a variance from the standard, from the new E. coli standards. That could be temporary or it could be permanent. As I said, we view that as a change to the standard. You have a standard and now you've granted a variance that that standard does not have to be met. And it could be a permanent variance.

Under EPA rule, a variance is a change to the standard, because it's a variance from an otherwise applicable water quality standard. So under EPA rules -- we're not saying you can't have a variance. Other states do that. What we're saying is to grant the variance, it should go through the standard-setting process, since it would effectively change the standard.

MR. MOORE: Would you apply that same logic to whether it's a temporary or a permanent variance?

MR. WUERTHELE: It applies the same. In fact, probably the state in our region that has the most experience with variances is the state of Colorado. Their variance is called a temporary modification. All of those go through standard-setting process. It's temporary in scope. They do not have something that would be a permanent variance.

MR. MOORE: Thank you.



CHAIRMAN GORDON: Any further questions? Thank you very much.

MR. WUERTHELE: Sure.

CHAIRMAN GORDON: I have Nicol Kramer. Nicol, there you are.

MS. KRAMER: Good afternoon. My name is Nicol Kramer. I'm with Williams, Porter, Day & Neville of Casper. I'm here representing Devon Energy.

To address Mr. Boal's question first, I don't think anyone in industry is opposed to a rule. We would like some certainty; however, we've tried to work on this policy before, and if this is what is in front of you, we urge you to reject it as a rule. If we have a choice between a rule and a policy, we would rather have a policy.

MR. BOAL: So you'd rather have a poor policy rather than a rule?

MS. KRAMER: Yes, because --

MR. BOAL: Okay. And then you'll tell me why?

MS. KRAMER: Yes. Because a policy is much more flexible. It's much more changeable. And when issues are identified with that policy, when additional science is developed, the DEQ can adapt that policy as they learn more. This policy was written to target coal-bed gas discharges in the Powder River Basin. I don't think that

there was a lot of thought put into the oil and gas discharges that are in the Big Horn Basin and the effect that it would have on them. That's why the historic discharge provision was put in there.

It's very unclear. I would contend that that applies to any existing permit as of the date the rule is passed; however, I think there are others that are going to say no, that was only put in there to address the discharges in the Big Horn Basin. That starts out ambiguity right there.

That's definitely inappropriate for a rule, but I don't think that we're going to get agreement here as to what that means right now.

MS. FLITNER: So how do you feel about a poor policy versus a good rule?

MS. KRAMER: I love a good rule.

MS. FLITNER: Are you saying it's possible with more time we can get to a good rule or are you saying there's no such thing?

MS. KRAMER: I think it's possible with time we could get to a good rule.

MS. FLITNER: From your experience, which is more than mine, how -- are we talking about the comment period of 45 to 60 days? Are we talking about, you know, the more -- are we talking about in my lifetime or in a



comment period?

MR. MOORE: Policy took three years to us, how long will a rule take?

MS. KRAMER: Mr. Chairman, Miss Flitner, Mr. Moore, I don't know the answer to that. I don't think that 45 to 60 days is going to happen.

MS. FLITNER: Yeah, I don't, but I wonder, really, as far as if you think a good rule is possible, what kind of process would support that discussion and what would help you come to the table with your expertise and other -- you know, others in this room who obviously care about it and are going to be affected by it?

MS. KRAMER: Well, to begin with, I think that the Department should look much more closely at the statutory factors that are required for rulemaking. And those are -- I apologize, no -- yes, I do have them with me.

MS. FLITNER: No problem. I --

MS. KRAMER: The character and degree of interference with health or well-being of people, animals, wildlife, aquatic life, plant life.

MR. BOAL: See, Nicol, that's the beauty of the policy, they don't have to do any of this.

MS. KRAMER: Exactly.



MR. BOAL: They don't have to do any of that. And then, you know, I hear things like there's a landowner veto somewhere out there. I read the darn policy, I don't see it. I hear that there's a requirement that the reservoirs have a 50-year storm event retention plus exist -- I read the rules, it's not in there. I mean, is this working well for everybody? I don't think so.

MS. KRAMER: No. No.

MR. BOAL: I don't think so.

MS. KRAMER: And, you know, one of our comments has been all along the way this policy is written, and the way it was being advanced through the advisory board, is that it was kind of like a rule, but these factors weren't being considered. And so if it was going to be applied like a rule, the Department needs to consider these factors.

MR. BOAL: But they are applying the policy like a rule. That's what I'm hearing.

MS. KRAMER: Somewhat.

MR. BOAL: Somewhat.

MS. KRAMER: Now, the policy -- and I can't speak for how the DEQ is choosing to implement it. The policy is being implemented right now, and some permits are coming out with those effluent limits and some are coming out with something in between.



MR. BOAL: Is that a good thing?

MS. KRAMER: Well, I'd rather have something in between than the effluent -- default effluent limits in the policy as it is.

So we would like the flexibility, but the way the policy is written right now, doesn't work. And --

MR. BOAL: I understand.

MS. KRAMER: -- part of that is because it was written to target a certain -- a certain group of people who have complaints in a certain area of the state with a certain kind of discharge. It's going to apply all over the -- all over the state, yet there -- these balancing factors in the statute haven't been taken into full consideration.

The livestock, in my opinion, in my humble opinion, I think the rule should be written to protect actual irrigation diversions, where there is -- someone has permitted an irrigation diversion is actually working to use that water to apply it to the surface and has active irrigation. Otherwise, the water in the channel is best used for livestock watering, and those should be the effluent limits that apply.

Those would be the basic parameters of the policy. And that is kind of where the DEQ started, but in the middle of this process, it switched into this naturally

irrigated lands, and I think as we heard Mr. Lowham speak this morning, I don't think there's enough evidence to show that that is something that has to be considered in this policy.

MS. HUTCHINSON: Comment.

CHAIRMAN GORDON: Yes, Wendy. Be judicious.

MS. HUTCHINSON: So you have 20 minutes to sit back there with Mr. Sutphin to provide us a new definition of what you think needs to go under identification and protection of irrigation uses. And that is where, A, we have a definition for artificially irrigated lands, and, B, the naturally irrigated lands. Why don't you sit back there, provide us different language that you want for that.

MS. KRAMER: Well, I would eliminate the naturally irrigated lands.

MS. HUTCHINSON: Well, go ahead and propose that. Say you eliminate B, and then you would add some language into A, something like and actually put to such use, probably. So --

MR. MORRIS: This is really what this hearing was supposed to have been about anyway.

MS. KRAMER: Pardon me?

MR. MORRIS: This is supposedly what this



hearing should have been about, that you could present those things.

And, also, why do you say that this Chapter 1 is written just for special interest groups?

MS. KRAMER: Because the DEQ was trying to, in -- I believe they were trying to address a specific group of complaints from the Powder River Basin from coal-bed discharges.

And I understand this hearing is to take testimony on the rule, but I don't think that it's the public's job to write that rule. We are here to say whether we agree or disagree with the rule. I am not a technical person that's got all the expertise to write that. I'm not a regulator.

Now, we have suggestions, we have prepared alternatives in the past, and we've tried to work with DEQ, but we haven't got that --

CHAIRMAN GORDON: Nicol, if there are other comments, I'm just -- I will take them, but I have a question. Is this really the first time that these issues have surfaced in all of this process or have comments been made on this in the past through the advisory board?

MS. KRAMER: They have been made in the past through the advisory board.

CHAIRMAN GORDON: Do we have any



expectation that if we delay this process, these components won't be made again, or are we going to actually go to an end -- are we going to move the chains?

MS. KRAMER: We are certainly willing to continue to work on moving the chains, I guess.

CHAIRMAN GORDON: Respectfully, I think that's to your advantage to continue to work on that. I mean, that -- and I'm not taking a position on this, I'm just saying if I were an industry that expected that in 7 to 15 years, that, you know, this issue would go away, because my gas would be gone, I would be very happy to say I will work for 7 to 15 years and we'll come to conclusion at the end of that.

And I say that with all due respect, but, you know, the worry I have is that we don't facilitate a process simply to avoid resolving a problem, if there is one.

MS. KRAMER: Actually, though, from -- I have two responses to that. Number one, things haven't been static since development started. We are always working with DEQ, we're always working on improving the knowledge base and the water management techniques and working with landowners to try to get the best situation for everyone.

That being said, actually, delay may work against



us. If you pass this as a rule, we could appeal it right now, but DEQ is implementing this policy as it is and it's already causing problems for us. So if we delay action, that could actually hurt us from getting to a resolution. We might appeal it as soon as you pass it as a rule.

CHAIRMAN GORDON: Good point.

Are there any other questions?

MR. MORRIS: Yeah.

It's obvious what you say is true, but there's going to be some problems that you think is already addressed or doesn't need to be changed, but DEQ does. So what's the solution there? And there are definitely some problems.

MS. KRAMER: Well, I think --

MR. MORRIS: You want rules where they will work for you and policies, or other things, is that a mixed standard?

MS. KRAMER: Can you tell me what those problems are you think exist?

MR. MORRIS: You just said this is a self -- special interest group, so if it's special interest group, then there had to be problems to bring it to the board.

MS. KRAMER: I'm saying there's a group of people alleging a certain -- that there's a small group of

people that are pushing to have something changed. I'm not necessarily agreeing that there is a damage that needs to be addressed by DEQ, and I think this is consistent with what I testified to at the PRBRC rulemaking hearing last month.

MR. MORRIS: Who would address those problems, if it is not DEQ?

MS. KRAMER: The court, because DEQ is not issuing the companies a discharge permit so they can flood someone's land. That's not what the permit's for. It's to discharge in the channel. If flooding is going on and there are downstream impacts from that, those are certainly issues that need to be addressed. The landowner should go to the company they think is doing it, try to negotiate. If you can't get to that point and you have legitimate damages, you have a right to go to court to recover for your property damages.

And I don't think that regulations should be crafted to address those few specific instances when this section of the rules has worked for decades as it is.

MS. HUTCHINSON: One comment.

CHAIRMAN GORDON: All right. I was going to make a comment. Joe Olson told me we were over the tipping point and everything would go quickly from here on. Joe, you're wrong.



MS. HUTCHINSON: If you don't think it's your responsibility to provide suggested language during a public hearing, whose responsibility is it? Because someone's going to make changes to these rules and it's going to be me. So if I were you, I would think it's your responsibility, during a public hearing, to be part of the public and provide suggested changes to the language.

MR. MORRIS: Not just oppose it.

MS. HUTCHINSON: Not just oppose it.

That's what we need as a council, we need help from the public and I think you and a lot of the talented people in this room could help us with some of that, so --

MS. KRAMER: Well, we can certainly try, and we have tried in the past.

MS. HUTCHINSON: We appreciate that.

CHAIRMAN GORDON: Thank you, Nicol. Thank you very much.

I'm going to Eric Hiser. Is it Eric Hiser? Yep, it's Eric Hiser.

And I got Steve on deck -- Steve Adami on deck, and Margo in the hold.

MR. HISER: Mr. Chairman, members of the Council, my name is Eric Hiser with the firm of Jorden, Bischoff & Hiser. I'm compliance counsel for Yates Petroleum.



I have about six points I want to briefly touch upon here. I'm going to tie them to the language in light of what the Council's concerns are.

Let's start with the difference between a rule and a policy. One of the most important differences between a rule and a policy is that that rule may go up to EPA. And if it goes up to EPA, we no longer have the ability to change it, because the person over there in the back will say, well, that's relaxation, we're not going to approve it.

You also heard him talk about the fact that they disfavor -- and that's an understatement -- any type of exemption or variance procedure. So if we adopt this as rule and send it up, we may find that the landowner provision that would allow them to use that water won't past federal muster, the rest of the rule be approved, those would be dropped out and unapproved and then where will we be? We'll actually being hurting the people that we've been striving to protect throughout this entire proceeding.

MR. BOAL: So we shouldn't pass a rule because we would have to submit it to EPA scrutiny?

MR. HISER: That is a question you need to look at very seriously.

Another choice that you would have would be to



pass this as a rule, but to direct Department of Environmental Quality not to submit it to EPA for approval as part of the state water program. That leaves it within your purview to make corrections and to preserve the ability to make -- for the landowners to use the water they want to see. So I think you would want to look at that as an additional option, but there are definite risks if this goes on up to the region.

Let's look then at the question of naturally irrigated lands defined on page H-4B. In the Yates Petroleum comments you will see there are a number of suggestions on how to make that definition more apropos. One of those is that in order for irrigation to have an effect upon the soil structure there needs to be water presence on the land and that water needs to be there chronically, which means repetitively, and that needs to be there for some duration or time period. Mr. Lowham's testimony suggests that in general that does not occur for many of the drainages that we have here in the Powder River Basin.

We would suggest, then, that this should be taken either out of the rule entirely or else it should be made the other way, they're presumed not to be present unless someone shows they are there, rather than trying to create a burden of proving the negative in every case. As

Mr. Boal probably knows, proving a negative is very difficult to do.

Second issue, point of application. You heard from testimony of Tim Barber that this is very important for us. We need to clarify in this rule that the point where the standards apply is at the end of the reservoir where the discharge into the uncontrolled drainage occurs. That's important because that allows us to work with landowners that want to use the water so that we can put the water where their cattle can get to it or where we can pump the water from impoundment to other places they want to use it.

If the standards apply at the end of pipe, we can't put that water anywhere where it's going to pool up, because the State takes the position any pooling is a water of the state and needs to be protected. And so we need to make sure where the standards apply is where it's going to discharge out of the reservoir or else mandate there's appropriate consideration of the mixing that will occur before these standards are applied. That would make a tremendous difference right there.

Next we need to look at what limits do we use. Do we use the Bridger limits or do we use the California limits. One of the most important things -- and I would hope that you take the time to wade through Kevin Harvey's



technical data. And I know it's long and it's tedious and stuff I don't understand in there, but the most important thing in there is his looking at that and finding out for alfalfa, which is one of our major crops of concern, if we have soil EC's range between 1.8 and 6.5, so 1.8 to 6.5 decisiemens, there is no difference in the yield. Well, that's Wyoming data showing that any soil within that range really shows no difference in the yield. And we're proposing -- he proposed using the Bridger Center, which is at 4. And so that gives you, based on the data we have here in Wyoming, at least 2.5 decisiemens, a pretty good protection already. And that's more relevant because of the geologic and other factors Mr. Gilmer spoke about than the California data is, which is based on coastal geography, or the Arizona data from where we're looking at desert and essentially sandy soil.

MR. BOAL: Let's -- is the California data pretty old?

MR. HISER: The California data is pretty old, in part. The other thing that's important to remember about the California data is the type of irrigation that occurs in California. California is an intensively flood irrigated, long exposure on the soil situation. If you're looking at what we're looking at here, which is mostly flash flooding on ephemeral drainages, we don't have that



level of repetitive exposure and soaking through the soil. That is what the California center is about. That's what they're there to manage, that's what they do their research on. It's really not applicable to us.

Next thing is to look at some just workability and definitional issues. There's a lot of good comments in the Yates comments, and I hope you take a look at those in terms of some significant suggestions. For example, the rule says when a discharge might reach naturally irrigated lands or artificially irrigated lands. Well, that's something where we can clarify when it's not going to reach, and that would make this rule a lot better, because right now we're going to litigate whether if my discharge is 72 stream miles upstream, am I going to reach that downstream irrigation point.

This rule doesn't help you, members of the Council, answer that question. That means that question will be up here repetitively before you. The rule should do that. We have given you specific suggestions in the Yates Corporation comments about how you can look at that with three or four options to when our discharge would not reach irrigated lands. Those are the types of things that should be incorporated in the rule before it would be adopted.

Another example is with this as a rule as opposed



to a policy -- and I understand that we'd like a good rule, too -- is what do you do with some of the really detailed stuff in the back which talks about you have to have so many samples at this depth and 50 feet from each other and you don't have an area where you can get 50 foot in that, does that mean as a rule that we would have to disapprove the Tier 3 analysis? Technically it would.

I mean, you get into the rule of reason and that means we'll be back in front of you again saying, well, we can only get 30-foot space in here or a hundred foot, how do we handle that? As a rule we know the answer, which is technically a basis for disapproval. It's a policy, it's little bit less clear. So those are some things to think about as well.

Lastly, I think that we should look at two issues of stringency. One of these is there is a concern, and it's legitimate, and I think Mr. Moore has raised it about what about having water in the channel, having it come out more often. Mr. Lowham says he doesn't think it would be more often because the way the hydraulic works. One thing I think was very important and wasn't focused on by Mr. Lowham in his testimony, and I hope you look at his slide, is that the amount of water that comes down to drainage versus amounts of CBNG-produced water is very small.

For example, in the Barker Draw example he gave you, on a two-year event, that generated over a hundred CFS of water. That was a seven square mile drainage. The total amounts of CBNG-produced water discharges throughout the Powder River Basin is a little over 200 CFS, and that's for everything. That is nearly equal by one 7-square-mile drainage in a two-year storm event. I think that points out the amount of variance between the water on the landscape that come down these drainages versus what looking at in the CBNG and the amount of pollution that's going to occur.

Why is that important? Because I think it means there's a resource there in that flow across the landscape that we should be considering in terms of its dilution affects and that may answer a lot of our concerns about how stringent do our irrigation levels needs to be, because they're pretty insignificant in the great scheme of things.

I think I have one last point here that I wanted to make, or maybe it was two. I guess the last one is this, one of the most critical parts of this policy, if you turn to the Tier 2 section. And I don't know if you all have it there in front of you, but you will see that if we do this big study and talks about going out and gathering data up and down the watershed and all that, at the end of all that work, we can discharge up to background. That's



what it says, we do all this work, we can get to background. Ladies and gentlemen on the Council, I would hope that would be a no-brainer, that if we can be below background, that shouldn't be a problem for discharge, but we're going through a lot of steps just to get to background.

Let's put that now as a general context, because you're the council responsible for looking at everything we do. That's like telling a publicly owned treatment work that you can't have any human pathogens above background. That's what this policy says, unless you do all sorts of studies just to get there, or an industrial discharge saying you can have no organics. That's the standard that the industry's being held to by this policy. That's a pretty tough standard. Have to be less than background, unless you do this really involved Tier 3.

We've had some experience with Tier 2, Tier 3, Tim Barber told you about that, and it's been frustrating. We don't know what's required, the Department doesn't know what's required. If we have a landowner that objects, it becomes very difficult for them to move because they want to protect the landowner's rights. And essentially we end up in a stasis situation. And I'm afraid, unfortunately, members of the Council, that stasis means ultimately that all those problems gets dumped in your lap. And so I would



really hope that we would take up Mr. Boal's challenge and Miss Flitner's and Miss Hutchinson's, to maybe take a look can we tighten down this rule, make it a good rule so that we don't take all these imponderable issues and dump them in the lap of the Council and we can fix a lot of them by better language and tighter rule that gives some policy guidance to the Department on where they need to go.

I think those are really what my principal comments are. I would encourage you to read the Yates written comments, we've got number of other language changes which are suggested for this, and I appreciate you being here still at 7 till 5:00 listening to this.

MS. FLITNER: Is it still Thursday?

MR. HISER: I think it is, although it feels like it might be Saturday.

CHAIRMAN GORDON: Thank you, Eric. I will entertain questions here in just a second. I have an issue of agenda management. I have one, two, three, four, five, maybe six people left to comment and -- seven.

MS. FLITNER: See if they're all still here.

CHAIRMAN GORDON: I don't know how our court reporter is doing. I said we'd stay until we were finished. What is the Council's pleasure? You want to



take a brief break here and come back on a -- to finish this off?

MS. HUTCHINSON: Uh-huh.

MS. FLITNER: Can you see if everyone's still here who wants to, show of hands?

CHAIRMAN GORDON: Let me read those here just a second. Hold your questions for Mr. Hiser, if you will. I have Steve Adami, you still would like to speak. I'm sorry, Steve. I was trying to get you in before 5:00, so --

MR. ADAMI: If you hurry, I can still make it.

CHAIRMAN GORDON: Margo Sabec.

MS. SABEC: Yes, Mr. Chairman, I'd still like to comment, but I will be glad to wait until the end if there are people who need to leave town.

CHAIRMAN GORDON: Steve Jones?

MR. JONES: Yes, Mr. Chairman. I can come back tomorrow, too.

CHAIRMAN GORDON: I guess -- could you stay here tonight?

MR. JONES: Yes, I can do that, also.

CHAIRMAN GORDON: Okay. Thank you. I have Tom Clayson.

MR. CLAYSON: Mr. Chairman, I'd like to speak, but very briefly.
CHAIRMAN GORDON: And Keith Burron?
MR. BURRON: Yes.
CHAIRMAN GORDON: And Kate Fox.
MS. FOX: Yes.
CHAIRMAN GORDON: I'm sorry I missed you on the first page.
Everybody still wants to talk. I also have John Corra.
MR. CORRA: I'll be very brief.
CHAIRMAN GORDON: And I think you had some questions for Dr. Munn. Let's take a -- let's ask the questions, we'll take a brief break -- there's a question?
MR. SILER: Mr. Chairman, I believe I signed up on the number six sheet, Duane Siler.
CHAIRMAN GORDON: Well, I'm looking at number 6. I have Tom Clayson and Keith Burron, but I will be glad to put you on.
MR. HISER: Duane Siler.
CHAIRMAN GORDON: Duane Siler.
MR. SILER: D-U-A-N-E S-I-L-E-R.
MS. HUTCHINSON: And I have some questions now for Bill.
CHAIRMAN GORDON: Please ask your questions



of Mr. Hiser. Thank you for your indulgence, sir.
MR. HISER: You're welcome, sir.
MR. MORRIS: What's wrong with tough standards?
MR. HISER: Mr. Chairman.
Mr. Morris, tough standards are not necessarily a problem. The question is is there a good science reason for us to adopt those standards. In this case we have a set of standards, we have the livestock watering standards, which are pretty much uncontroversial. There's really not been much discussion about those. We have irrigation standards, where I guess the question is on the naturally irrigated lands, whether those actually require that protection, and then what the standards should be.
If we adopt standards more stringent than they need to be, what we are going to be doing is taking some of the water people would otherwise use and make it so it's not usable. And that is certainly true with the industry, but it's even going to be more true with the ranchers after the industry goes away, because we may be able to afford treatment and other management options in some cases, they will not. And so they will not be able to continue on with water that they have now become accustomed to using.
MR. MORRIS: So tough standard is a matter of opinion?



MR. HISER: A tough standard is, to some extent, a matter of opinion, and that's why you're here, but it's also a matter of science. What does science tell us about specific land forms that we have here in Wyoming, about the crops we grow and about how those things interact. And the reason that the United States Department of Agriculture established Bridger Plant Materials Center was to look at the Northern Great Plains, which is this area, and to look at those specific issues. That's why it was established.
MR. MORRIS: Okay.
MS. HUTCHINSON: Ask a quickie.
Do you know if the Bridger study was peer reviewed or what type of review it went through?
MR. HISER: Yeah, the Bridger study itself is what's called in their technical notes here, which is part of their mandate to provide the best available information on the salt tolerance and other agricultural practices for plants in the Northern Great Plains. As Mr. Gilmer said, any time you have a USGS technical publication -- this is a technical publication -- they have to go through substantial internal review. As to whether it's gone through one of the ext -- it certainly hasn't been like Science or Nature, one of those. I don't know if it's been publicized otherwhere, but I do know it comes



through internal technical notification procedures.
CHAIRMAN GORDON: Okay. Further questions?
MR. MOORE: Just one quick one.
CHAIRMAN GORDON: Mr. Moore.
MR. MOORE: You talked about using Bridger instead of the California data. Have you had a chance to look at the study by Dr. Suarez that EPA provided, which was purported to test, in California, Powder River Basin soils from Montana and Wyoming, and recommendations that Dr. Suarez came up with as a result of that study?
MR. HISER: That's a very interesting study, Mr. Moore, and it is too bad Mr. Harvey is not actually here to talk about the Suarez study.
The important thing to know about the Suarez study is that it was there for the purpose of assessing impact on soil structure of the application of certain types of water. How did he do that? He came up here to the Northern Great Plains, dug up a bunch of soil, he took it down to California, but the critical point is that at that point he didn't take a column of soil and go test it. Once they got to California, they ground the soil structure up so that it didn't have its original lanes or horizon or anything and put it into a column and put water into it.
The Bridger study looks at the soil as it has developed over time here in the Wyoming and Montana areas,

looking at it in its natural set of soil strata and all that. It is a true soil study. What we have in the Suarez study is a column leaching test with the soil having been ground up and its structures destroyed. Which is more applicable to our situation, you can tell me.

MR. MOORE: Thank you.

CHAIRMAN GORDON: One last question I had, and it's one -- somewhere in your testimony you talked about flood events that were fairly insignificant, and I guess what was roaming around in my mind is years ago I think I went to Tom Harriet's land and at that time there was a consultant CE as we were looking at some applications of that, and I believe they said they wanted to put 39 to 43 inches of water on the soil a year. And you were talking about natural events and not irrigation events as -- okay. I just wanted to clarify that.

MR. HISER: Yes. Our position is that where you have a diversion structure, such as a spreader dike or where they've got water and they're taking it out of the creek and putting it on the land, that is irrigation, that needs to be protected with standards that are appropriate for an irrigation impact.

My comments are really directed more at what the so-called naturally irrigated lands where you don't have that level of spreading, the water is mostly passing by in



the channel nearby, as opposed to on top of the plants, or in rare events where you have the overflow, you have a lot of additional water in a very short duration on the soil.

CHAIRMAN GORDON: Okay. Thank you.

Any further questions?

We will recess for 10 minutes.

(Hearing proceedings recessed 5:01 p.m. to 5:13 p.m.)

CHAIRMAN GORDON: All right. Let's come back to order.

The Council would be seated, and I would like to recognize Steve Adami.

Would you identify yourself and all that stuff.

MR. ADAMI: Thank you, Mr. Chairman.

My name is Steve Adami. I'm a rancher and a landowner from Johnson County, and I'd like to thank the Council for this opportunity to speak here today.

There's three points I'd like to discuss. I submitted written testimony and in it I referenced sections and line numbers and pages with specific comments, and so this time, not to bear Wendy's wrath, I'm going to be general, I have done specific comments.

MS. HUTCHINSON: Thank you.

MR. ADAMI: Whether or not this is a rule or policy, my opinion is it should be a rule, just simply



from the standpoint that it gives clarification. The wiggle room everyone references in the policy I think it is only going to lead to appeals from either side on discharge permits. They're going to say, well, the policy said this and you didn't follow it, so you guys are going to be up here dealing with a bunch of issues, I think. So that's not -- from that standpoint, I believe the rule is the better approach.

One of the issues within the proposed ag use policy that I've had a problem with and commented on in several of the revisions that have gone down is the measurable decline in agricultural productivity, which I believe is a standard set in the rule, and then the policy deals with that. And one of my problems is that I think that the approach that the measurable decline in livestock production has somehow been defined as what the livestock drink and irrigatable crops, whether they're naturally or artificially irrigated. And seems like there's a lot more to livestock production than drinking water and irrigating crops, whether naturally or unnaturally.

And, you know, they're not considering the fact the ephemeral drainage is critical to the ranch's productivity overall. It's used for weather protection. It's used for calving protection. It's used for grazing. And if that drainage is used for water discharge, many of



those traditional uses will be lost and that will be a decline in agricultural productivity and those issues aren't addressed.

So I think the fact they narrowed it to those two areas is somewhat arbitrary and that bothers me a little. I'm also worried then if you proceed on down that path that the definition of what is to be considered a naturally irrigated ephemeral drainage is one that is 50 feet in width or 20 acres in a contiguous parcel. And our land lays right on the divide between Clear Creek and Crazy Woman, so all our ephemeral drainages are the head of the tributaries or the head of the ephemeral drainages. And in our case I'm not sure I have a 50-foot width of ephemeral drainage. So all of my ephemeral drainages could be at risk to be used for discharge and I'd have no recourse, given this definition.

And I don't think my drainages are any less valuable to me than my neighbor, who does have a 50-foot width below me. So I'm a little concerned about those specific definitions. I think they're a little arbitrary overall.

And one of the things -- second point would be the effluent-dependent language that's in this ag use policy. I'm a little concerned about it in that it's -- it seems to me like it's a way to rationalize continuing to

discharge water, once it's begun under the logic that it's better to keep the discharge going, but it seems like some point it's going to stop, whether it's three years, 10 years, 15 years, you know. It's not a question that's going to happen forever, it's eventually going to stop. And if it's causing a problem, it just as well stop sooner than later. These issues aren't going to go away, they've just been deferred until the methane production is over, oil production is over, something along those lines.

So I'm concerned about that, and I think that's kind of a new concept on the national scene is effluent-dependent waters, and I think I would like see Council go slow on that. I think that needs more fleshing out overall. I just see several problems there.

And in conclusion, my third point is on the very end of the Ag Use Protection Policy there's a clause that says if the landowner doesn't provide access to have his soils and forages analyzed, that he defaults to the lowest tier, whatever that is. And I've kind of been in that position, and, you know, it's kind of personal. If they've got the mineral rights on your land they get to use it as much as they want, and if they don't have the mineral rights under it, they have to negotiate for that access and you hit that dead on and either negotiate for it or condemn it. And they get it, don't think they don't.



I don't think that it's the DEQ's place to take that right away from me as a property owner to do what I want with my property or deny someone access and remove from me the ability to make a negotiated couple dollars that otherwise I might have. And if it's really that necessary, they can condemn to get on. It's not going to stop them. They'll get there if they want.

That's my third point. And then I wanted to be available for comments. I think the view that the policy is good is probably going to be the minority view today, so I would answer any questions.

CHAIRMAN GORDON: Any questions from Council members?

MR. BOAL: So your view is the reasonable access requirement kind of takes some of the leverage away from a downstream landowner?

MR. ADAMI: I'm not sure if leverage would be the word I would use. I think it's a property right now that what goes on in my land is my business, until it's taken away from me. And I'm not sure that I want the DEQ to be the one that blackmails me into giving that up. I think many times it's probably to your advantage to have that data gathered, but it should still be up to the individual landowner not to have this hung over his head, not to have -- I don't know if blackmail is the right word,



but it just seems like being forced to let them on is not the way it should be. You know, there's all the traditional methods available to get on your land and gain that data that they have for everything else that they do.

CHAIRMAN GORDON: Further questions for Mr. Adami?

MR. ADAMI: Thank you.

CHAIRMAN GORDON: Thank you, Steve.

MR. MORRIS: Great comment.

CHAIRMAN GORDON: Another Steve. Steve Jones -- or actually, I'm sorry, Steve. I've got Margo Sabec. I dropped over that.

And we're at the end of the day, so I would encourage everybody to be expeditious.

THE REPORTER: But not too expeditious.

MS. SABEC: Mr. Chairman, members of the Council, I will try to be expeditious.

I want to speak to you today about the process that you're engaged in, and the due process rights of the stakeholders, the people who are interested parties who have come to this hearing and who also came to the citizens petition hearing to express their concerns over the impact that these two sets of rulemaking could have on their very livelihoods. And I think that the thing that I see that is in common between this hearing and that hearing, although I



know that from DEQ's perspective, they're very discrete, separate issues.

The bottom line to people is will water that meets livestock and wildlife quality standards be allowed to flow down the drainage? That's really what's at stake here. And the citizens petition has one way of going about it to try to stop that. This has another way of going about it to try to block that water from flowing down the drainage. And I think the thing that causes me concern is that I don't believe people are giving -- being given a fair opportunity to be heard on these issues. Partly because if you look at the rules -- look at the Section 20 policy that's before you today. How many people who are using this produced water on their ranching operations could possibly read through that and decipher what does that mean to me and my ability to continue to use this water?

The industry who discharges this water has spent hundreds of thousands of dollars, frankly, trying to understand, to them, what does it mean in terms of their ability to manage their water. I think the concern that I have is that there are private rights at stake here, and those rights include mineral rights, surface owner rights and water rights. There are over 14,000 wells that landowners have water rights in coal-bed in the Powder

River Basin alone.

And I think that the proceeding here, and the notice, is not adequate to tell people what this is really about. I think the notice should contain a statement of what the substance of the rules are. And really, in my mind, the substance of these rules is that DEQ can and will prohibit the discharge of flow of produced water that is suitable for wildlife and livestock down these ephemeral drainages. That's really the gist of this.

Now, does it say it in the rule? Can you find it in the rule? Frankly, we have interpreted and relied on statements made by the DEQ in these many hearings and public meetings. That's the conclusion we have come to. That's the conclusion that landowners have come to, but I don't think the notice tells people that that's what this is about. And by the time they figure out that that's what it's about, they won't have water anymore. So it's a really important, critical issue, not just to industry, but also to livestock producers who are relying on this water for their very livelihood.

The issues involved are, I believe, whether the DEQ can and should confer upon an individual landowner the right to dictate whether produced water that's suitable for livestock watering can flow down a drainage. That's the issue here. I don't see that in the notice. So I think



that -- that people who are relying and depending on this water are really at a terrible disadvantage and being in a position to comment effectively on this rule.

The question has been posed to people who have been speaking here earlier, go back in the back of the room and spend 5 minutes and write a rule. If we had known that we were supposed to bring alternate rules to this hearing and propose them, I'm sure that there are about 90 people sitting behind me who would have brought alternate rules. The process -- we are constrained -- or we thought we were constrained by the law that says DEQ recommends the rules, they go to the advisory board, the advisory board makes a recommendation and then they come here. I think for us to be asked to craft a rule in the back of the room in 5 minutes jeopardizes the rights of all of those landowners who have a use for this water as well as industry. And I guess I feel that's an inappropriate way for rulemaking to be done.

CHAIRMAN GORDON: Margo.

MS. SABEC: I would suggest we could go back and would go back and bring a rule to you in 90 days, if you'd like to see an alternate rule, but I don't think it's appropriate for us, I think it would be frivolous of us, having heard all the testimony from these landowners, to think that we could craft a rule that would not hurt



people in 5 minutes in the back of the room.

MS. FLITNER: I have a question, and I know that you're anxious to proceed, so did you -- were you able to make the substantive points you wanted, including those two that I heard; one is about the public notice and one is about the frivolity of rulemaking on the fly.

And I guess I want to comment first on the second one, because I -- I -- Wendy can certainly speak for herself, but I did not hear her asking for that, and I don't believe that is our intention whatsoever. What I'm honestly struggling with is -- it's been a couple of years, and five hearings on the advisory Council level, so I'm wanting to hear from you, not write the rule and we're going to adopt that language, but take a crack at getting specific about the language so we can respond to this, so we can understand, you know, specifically what bothers you and what's not working for you and your clients and so forth. That's one thing.

And the other thing is I guess, you know, call me -- call me naive, but I don't understand what -- what is so different -- because we're trying to have a substantive conversation here -- so what's different in terms of the -- all of these issues have been vetted through the advisory board, five hearings, I believe. We've had a little bit of conversation in January. We're here today, so -- so



what -- what impression are we creating right now that gives you so much pause that the issues would change so much in -- we're dealing with the same things, how the water's discharged, who gets permission when, what the implications are for somebody who wants to do things in a different way.

So I guess we'll figure out the public notice thing together, and it will be fair, and I think fair means everybody's okay or we're all equally frustrated or something like that, but I want to make sure I understand if there's a big substantive difference, you know, you walked in here thinking something -- the policy -- the advisory board conversation was going to be so different than this -- I think they should be the same and we'll figure out semantics, but I'm really confused by that.

MS. SABEC: Mr. Chairman.

I could try to answer that question, if I -- indulge me if I didn't get the question right.

MS. FLITNER: It was long. Sorry.

MS. SABEC: The issue, I think, and the reason it rises to such a level of hysteria at this particular point in time, is that this has been represented by the DEQ over and over in a painstaking clarity as a policy, not a rule. And in their definition of a policy, they say it's just a guidance document. It's not a

statewide implementation. It's just something to help us, speaking for DEQ, internally to make decisions as we implement to write permits. It's flexible. It's open to discussion. It's not a rule. It's not --

MS. FLITNER: Right, I get all that.

MS. SABEC: -- it's not a work of law.

MS. FLITNER: What things, besides the 10 versus 16, for instance, what else would change a lot? I've heard three things, the irrigation -- or the natural irrigation language, the numeric standard, and --

MS. SABEC: End-of-pipe limits.

MS. FLITNER: Thank you.

MS. SABEC: Mr. Chairman.

End of pipe limits. And the naturally irrigated lands are two huge changes. It's a shift in the way permitting has been done in this state for decades.

MS. FLITNER: Thank you.

MS. SABEC: And those, I think, are the two things I think are so interwoven into this rule, it's hard to go in and say strike line 10, strike line 12. It's the substance of the rule is written, is crafted to prevent flow of water down the drainage.

MS. FLITNER: Thank you.

CHAIRMAN GORDON: Thank you.

MS. FLITNER: I have some comments.



CHAIRMAN GORDON: I'm going to advise you it's 5:30.

MR. MORRIS: I have a comment.

I guess, Miss Sabec, I have problems with your comments or your testimony. You were involved in the Schwartz case, right?

MS. SABEC: Mr. Chairman.

Yes, I was.

MR. MORRIS: Now, that was -- the Council visited that site. We would like to visit all these other sites we're talking about, but we've been told that we cannot.

But you were there, the Council was there. We all saw the problems of why we were there. You were in agreement that there was a problem because you settled with Mr. Schwartz.

MS. SABEC: Mr. Chairman.

MR. MORRIS: You made a -- let me finish.

You decided that there was problems, so instead of to go with this thing any further, you decided that maybe you'd just settle, which we never knew what the settlement was, didn't make any difference. Now you're coming right back and defending the same thing that you admitted to at that time that there was problems and you needed to get resolved and to get it resolved, you settled



with Mr. Schwartz. I have a hard time of, you know, kind of dissecting just where you stand at this point.

MS. SABEC: Mr. Chairman.

CHAIRMAN GORDON: I will indulge this a little bit. It's a little off topic, but go ahead.

MS. SABEC: Let me say that there are many, many reasons for entering into a settlement when landowner has filed an appeal of a permit that have nothing to do with admitting there's a problem. And they involve cost and delay, shut-in production, you have a lot of capital that's invested that's stranded when you are in a permit appeal. So I can say certainly for my client, they never admitted there was a problem. We entered into a settlement for many of the same reasons that parties settle a lawsuit. That does not mean that -- that I would concede that there is a problem.

And once more, I don't think this rulemaking addresses a shift in wealth, if you will. This is not going to provide a situation where a downstream landowner can receive money. This is about whether or not water can be discharged.

MR. MORRIS: Okay. But you have to admit this is one of four, five, six cases that we have heard in hearings that we have heard that has participated in the looking at the rules. Why would the rules be looked at?



Why would we looking to --

MS. SABEC: Mr. Chairman.

The Section 20 rules says there should be no measurable decrease in crop or livestock production. And if your question is have there been some permit appeals based upon that Section 20 policy, the answer is yes. Will there be less cases if this proposed policy becomes a rule? In my opinion, absolutely not. You will be inundated with them.

CHAIRMAN GORDON: At the risk of cutting anybody off, I just would like to continue moving on with testimony. I understand the points that are being made. Are there any other questions of Margo?

Margo, thank you very, very much.

I have Steve Jones, then I have Kate Fox on deck. And --

MS. FLITNER: Keith, right?

CHAIRMAN GORDON: And then Larry Munn. And then Keith Burron.

I've got you, Tom. You can go get your horse.

MR. JONES: Mr. Chairman, thank you very much. My name is Steve Jones and I represent Wyoming Outdoor Council.

I did prepare some comments -- written comments, which you might have them or they might be being passed

default standards, and I think that's what the Council needs to go with.

You asked for a solution, Mr. Boal, and I think the solution is to adopt the Tier 1 limits and adopt them as a rule. You also asked whether, you know, isn't it true that site-specific studies are the best way to go, and I think the answer is yes, but it depends on the quality of those studies. And because of that reservation, we have very big concerns about Tier 2 and 3 as they are currently set forward, because they permit a dubious quality of work to establish background levels.

And specifically I would say -- again, we've submitted comments, I'm not going to repeat everything that we have in our written comments, but I would urge the Council to look at those. Some of the commenters for industry had the same concern we have, which are what is historic flows for establishing background? They propose that historic flows be CBM flows if they have lasted five years, which I think is a horrendous idea, to take the degradation that's occurred from those discharges and use that as based on a background.

CHAIRMAN GORDON: Kate, one minute?

MS. FOX: Am I done?

CHAIRMAN GORDON: Will that work for you?

MS. FOX: Yeah, I can do it.



CHAIRMAN GORDON: Thank you.

MS. FOX: I can do it, and I'll do it by saying look at our comments.

There are too many flaws and not enough security in the Tier 2 procedure set forth in this policy or rule, whatever it's going to be. And for Tier 3, there are no real standards at all.

So, finally, you know, my suggestion is promulgate the rule. Get this done, get it done right on the science that exists. That's what we need, that's what DEQ's job is, that's what your job is. Keep the waiver at the end, which is at the end of Appendix H. I found it very interesting that landowners did not find comfort in the fact that there's a waiver for them to say, yes, I want this water. And I would suggest to you the reason is that because that requirement also says they have to keep -- contain it fully on their land, they can't discharge it on their neighbors, who are all these people I represent being damaged by that water.

So take Tier 1 and enact a rule. Thank you.

CHAIRMAN GORDON: Thank you, Kate.

Any questions for Kate?

MR. MORRIS: Kate, would you like to see this a rule or a policy?

MS. FOX: I think, Mr. Morris, that a rule



provides more certainty, not only to my clients, but to everybody involved, including the DEQ and industry. Then you know what you got to do, if you do that, you have some certainty.

MR. MORRIS: Thank you.

CHAIRMAN GORDON: Thank you. Any further questions?

Okay. I have Duane Siler, and then I also have on this sheet Larry Munn, and then two more after that.

Same encouragement.

MR. SILER: Thank you, Mr. Chairman. I definitely feel the pressure to be brief and I will. I wanted to talk about these points. I know you're going to read the comments that Marathon submitted yesterday, and I'd also commend to your attention the comments submitted by Dr. William Shafer on behalf of Marathon yesterday.

Dr. Shafer explains why in his view the Bridger number of 16 for a SAR cap is reasonable and justified. And in particular, he cites a peer-reviewed article from Journal of Soil Science from May of 2006, which, according to him corroborates what Mr. Harvey said concerning the fact that soils in this area will -- at given SAR level, will have a lower exchangeable sodium percentage, which would normally be assumed. And so the 16 SAR cap is highly conservative.



The three points I wanted to address from the Marathon comments, and then I will talk about policy versus rule, very briefly, because I think we offer a slightly different take from what you've heard already. One is the definition of natural irrigation. If you look at those definitions, you will see that it's discussed differently in terms of the vegetation that we'll denote what is naturally irrigated land. And I'm not talking now about the area requirements, I'm talking about the vegetation requirements. It speaks about pasture, speaks about unirrigated pasture, speaks about productive vegetation, speaks about just plain old vegetation. It's pretty ambiguous in that regard as to which kinds of vegetation would indicate this is naturally irrigated land, which becomes subject to this whole policy or rule. And we would suggest that that needs to be made more uniform, probably in the direction of some kind of actually used land as a source of forage, actually grazed as was suggested earlier.

The second point I'd like to allude to in our comments is the end-of-pipe issue. Eric Hiser talked about how without an end-of-pipe application of these default limits we couldn't even discharge from an impoundment. Marathon's view is that it's not unusual in issuing Clean Water Act permits or WYPDES permits to use predictive tools to predict what will be actual water quality at the point

of exposures. In this case where the water is actually used for irrigation, either through artificial or natural means, it may be miles downstream from the point of discharge, chemical changes may occur, dilution may occur.

There needs to be some provision whereby a permit applicant can make a demonstration that something less than a total of Tier 3 demonstration, using the same kinds of mixing zone and modeling tools that are used typically to predict what the water quality would be at the point of actual use. These numbers, whether they be Bridger numbers or AARS numbers, are intended as exposure numbers, not water quality numbers. So this program should be applied in whatever form at the point of exposure.

The third point I want to make is we have a -- in our comments we talk some about what we view as the sort of understandable and reasonable expectations that permit applicants should have for landowner reciprocity in terms of providing access to be able to make the showing that would support a Tier 3 application, and indeed that would support a determination whether there's irrigated land or not, naturally or artificial at that location.

This policy is intended to confer understandably a very significant and justified benefit on irrigation water users. And -- but it's not a one-way street. This is a reciprocal program. It also poses major burdens on



dischargers, and there ought to be some recognition that landowners need to provide access so this kind of showing could be made on reasonable terms and conditions.

Now, on the question of policy versus rule, this is a very thorny issue. I'm sure you gleaned that it's a difficult one for industry at this point. And part because this was sprung on us at the 11th hour, after two years of discussion of this as a policy. I would commend you, though -- I discuss in our comments from last August of the transcript of the advisory board meeting in Buffalo, Wyoming, where spokesperson for DEQ explained why it would be a bad idea to make this a rule, why it's really important it be a policy, and it's all about flexibility.

And there's a big -- flexibility has a lot of attractions to it when we're in an area where science may change. This program, on both sides, the DEQ, industry and everyone may gain more learning as this policy is applied. Flexibility is an important attribute.

But the one thing I did want to relate to you is follow up on a comment Eric Hiser made. I'm with Patton Boggs and we represent Marathon and some other companies in litigation against the Montana Board of Environmental Regulation. We've taken discovery in that case, and it's clearly matter of public record that the standards that were adopted, the water quality standards that were adopted



in 2003 by Montana were to a very large extent dictated by EPA before the fact, but certainly under the threat of the fact that they would be disapproved if Montana does not adopt these in accordance with what EPA thought they should be in the standard, and particularly it had to do with whether these water quality standards would be instantaneous or average.

I would think maybe there's one thing everybody in the room can agree on today, and that is Wyoming should be master of Wyoming's destiny in this regard. And I fear that if this is adopted as a rule, it will be an appendix to your surface water quality regulations or the triennial review and amendment of water quality regulations, that you may have to submit it to EPA for approval. And that approval process may open up a host of problems that nobody on any side of this issue really wants to deal with.

CHAIRMAN GORDON: Thank you, Duane. I was just about to ask you if you were done.

Any questions for Mr. Siler?

Thank you very, very much for your comments.

Dr. Munn.

And I have Tom and Keith and then we're done. And I'm sorry that we're rushing the end, but when you -- time -- at this stage, I'm sorry about that.

DR. MUNN: My name is Larry Munn. I'm a



professor of soil science over at the University of Wyoming. I have been at the University of Wyoming since 1981. I also am the Wyoming agricultural experiment station representative to the National Cooperative Soil Survey Program. And I have worked extensively on soil -- soil landscape relations, soil genesis projects, mine land reclamation, a variety of research and problem solving, hopefully, issues in the 25 years I've been there.

MR. MORRIS: Dr. Munn, I have a few things I'd like to hear you address, and that -- just go through them all and you can take them as you like, but one is I'd like to have your comments on the Bridger report. And, number two -- I'll just tell you what else I'm thinking about -- is the -- I have a little concern about -- we're talking about this ephemeral water and having certain salt level and it floods and it runs on off. Okay? That it can stand up to 16, 17 percent number seems to be some cases.

But what about where this water then has been used for irrigation, where you apply -- alfalfa seems to be the crop we're talking about. To grow an average crop of alfalfa takes about a minimum of 24 inches.

DR. MUNN: Yes.

MR. MORRIS: So now if you are -- we're talking one thing about this flood that goes through with this high salt, but if we've got that same amount and we're

or wildlife using this water.

K.J. Reddy, who is a colleague of mine, a water quality specialist in the Department, has a number of projects with the Wyoming Water Development Commission and has studied mixing water in the pond -- in the ponds, water after discharge, looking at the chemistry of it. Very isolated incidences that found some high levels of one or two particular elements, but it certainly is not a general problem.

CHAIRMAN GORDON: Thank you, Dr. Munn. Are there other questions or --

MR. MORRIS: Well, yeah, comment just a little bit on this concentration. The difference between flood draw for your one-time cover and --

DR. MUNN: If a person had alfalfa in the stand, I think the only way that is going to happen, either they have a diversion and have been getting flooding of a sufficient body of water on the site and it's there long enough to soak in to support the crop, or they're getting subirrigation from the channel, but the alfalfa does require a significant amount of water, and because you have the opportunity for that water to be transpired by the plants or simply evaporate from the surface, you will build concentrations of salinity in the soil. And if you have high sodium water you build concentrations of sodium in the



soil over time.

If you irrigate anything long enough, without adequate drainage, you end up with a salt problem. That's been the bane of irrigation for couple thousand years. And a problem with a lot of the landscape there is you have relatively thin soils or soils that are relative -- you just don't have good external draining outlets through them. They haven't put tile systems in like they have a lot of the irrigated fields, so on, and so there is a potential for a salt buildup if the levels are too high.

CHAIRMAN GORDON: Mr. Moore.

MR. MOORE: Dr. Munn, do you have any comment regarding the Tier 1 default value for SAR? We've heard 16, 10 and maybe 6.

DR. MUNN: The 16 number is sort of a way of identifying an absolute desperate problem. When you see that kind of number, the soil will show in a natural landscape, colloidal structure, it will show dispersion, it will have very poor infiltration. I did research in Montana, north of the Missouri River when I was at Montana State University before I came down here, published a paper on the formation of sodium-affected soils. You have extremely low infiltration when you have that kind of an SAR value.

That is the soil -- it's not the minimum of



initiation of a problem. You will definitely have had a problem by the time you get to that level. Certainly 10 would be much more protective. I do not consider 16 protective at all. Any water coming in contact with soil that has that SAR you will have problems if you have any clay content with it.

MR. MOORE: Are you satisfied with 10 as a statewide protective default value?

DR. MUNN: Well, I stepped back and looked at the block of extension irrigation recommendations from some of the surrounding states to get an idea from someone who is not in the middle of a debate about should we rule based -- are you trying to stop something, you know, whatever. The extension service is -- you know, their whole rationale is to help growers produce and do it in a sustainable way for a long period of time.

Colorado, for example, recommends that SAR between 1 and 9 should be no problem. They say you can use 10 to 17, but it will require drainage and probably gypsum additions. That's one example. Most of those extension service recommendations seem to be somewhere around that 8 to 10 limit.

MR. MOORE: So for statewide, 10 is -- default limit would be 10?

DR. MUNN: I think you'll prevent most



problems on most soils most of the time with most water. I'm not saying you might not see an individual problem or very rare problems, but I think it would be -- as a general limit, I think it's pretty good. I think it should give confidence to surface owners to see that it is in the same realm as what is being recommended in plant production systems, not just here in Wyoming but in other states.

CHAIRMAN GORDON: Thank you, Dr. Munn.

MR. MOORE: Thank you, Dr. Munn.

MR. MORRIS: Yeah, Mark, I got just one quick question.

There on --

CHAIRMAN GORDON: Hold on just a second, John.

I think if we -- we may have to recess this evening and take this up again tomorrow. Dr. Munn will not be here. I guess the question I have, is that the pleasure of the Council? Because I do not see how we can get through the last two comments.

I guess my question is, Tom, are you going to be available to tomorrow?

MR. CLAYSON: I can be very brief right now, too.

CHAIRMAN GORDON: How about Keith, because we are pushing up against a 6:30 deadline.

MR. BURRON: Tonight or tomorrow, Mr. Chairman.
CHAIRMAN GORDON: John, go ahead.
MR. MORRIS: One more quick question. Do you have any data on the tolerance of cottonwoods or shrubs, riparian?
DR. MUNN: No, I do not. I have not seen -- that I can recall, I have not seen data on that. You will see the trees that are not commercial agricultural crops like pistachios or something like that that they've done studies on. You'll see trees kind of thrown in a rating group of tolerant or moderately tolerant or whatever, but I certainly wouldn't want to specify limit on those.
I know they cannot stand constant flooding. They do require aeration in the root zone and usually see them on bank above an inside channel, whatever, where they can be flooded for a few days. If they're wet continually, the lack of oxygen will be a problem.
MR. MORRIS: Thank you.
CHAIRMAN GORDON: Thanks. Any other questions? Thank you, Dr. Munn. Thank you very, very much. Okay. Tom.
MR. CLAYSON: It's up to the Council.



CHAIRMAN GORDON: What is the Council's pleasure at this point?
MR. MORRIS: Let's hear him. Let's finish.
MS. HUTCHINSON: We know Keith's going to be with us all day tomorrow.
MR. BURRON: Fair enough.
CHAIRMAN GORDON: Yeah, just give me one second. Go ahead. Identify yourself and all that stuff.
MR. CLAYSON: My name is Tom Clayson, and I'm here today on behalf of PAW, Petroleum Association of Wyoming. I am the chairman of the --
MR. MORRIS: Say that again.
MR. CLAYSON: Petroleum Association of Wyoming. I am the chairman of exploration and production, environmental affairs committee.
Basically I just wanted to get verbally on the record, number one. Most of my comments, and I'll submit here, echo those made by Fidelity Oil & Gas, Merit Energy and the Meeteetse Conservation District, so I won't go into those.
I'd like to bring up an example, or two points, and one is illustrative. And that has to do with the definition agriculturally significant. That definition starts with the term "in general." And can you imagine if



all definitions in Chapter 1 and the standards start out with the term "in general," the difficulty that the DEQ would have to administer, and this body would have in terms of anything that came before them to administer that? And that's kind of illustrative the need to look at definitions.
I went back, second point would be, looked at some definitions in Chapter 1. And a lot of them are very intuitive. You might think they know what they were, adjacent wetland, aquatic life, cold water game fish, construction-related discharges, I think intuitively we all have an idea what those are, yet they wrote -- or wrote the rules for Chapter 1, they saw a need to get to that level of specificity for defining things.
So I would ask, you know, when Mr. Corra stands up again, that he identify or ask him, you know, if that level of specificity and defining terms using the rules have been a benefit to him in administration of those rules.
Thank you.
CHAIRMAN GORDON: Thank you, Tom. Any questions of Mr. Clayson? Thank you very much, Tom.
MS. HUTCHINSON: We're going to save Keith and our questions for the DEQ for tomorrow, is that what



we're doing?
CHAIRMAN GORDON: Let me ask John if that will work for him.
MR. CORRA: Pardon me? Tomorrow for me? Be perfect. That's fine.
CHAIRMAN GORDON: Okay.
MR. MORRIS: Should we give Keith that much time to think?
MR. BURRON: Beg your pardon?
CHAIRMAN GORDON: Okay. Give me just one second here.
Okay. We're going to reconvene tomorrow morning at 8:30 with this hearing to hear Keith and then John Corra and have questions. So that is our plan at this point. 8:30 tomorrow morning, be here, be square.
MS. LORENZON: After that the Council has a regular meeting scheduled. They'll move into their meeting at that point.
CHAIRMAN GORDON: Thank you all for your time here.
(Hearing proceedings recessed 6:15 p.m., February 15, 2007.)

PROCEEDINGS

(Hearing proceedings reconvened 8:37 a.m., February 16, 2007.)

CHAIRMAN GORDON: All right. Sorry. We got everybody here? Sorry for a little bit of a delay.

When we last saw this episode, Keith Burron was rocketing his way towards the front of the room. I'm actually going to reopen the hearing and let Keith perform his heroics --

MR. BURRON: Expectations.

CHAIRMAN GORDON: -- in 5 minutes or less. Thank you, Keith.

MR. BURRON: Your expectations are far too high, I think.

Mr. Chairman, my name is Keith Burron. I represent Petro-Canada Resources USA, a coal-bed methane company on the Powder River Basin.

I'm commenting on the Section 20 ag use document, rule, policy, whichever it may be. We did submit written comments, which I think were distributed yesterday. What I'd like to do this morning is hit on a few of those points in the written comments, but also I took my notes from yesterday, tried to address some of the questions that came up and I'd like to present a little bit of that information, if I could.



The first thing I want to talk about is this rule versus policy issue and just indicate that we do have some process problems. And I know that has come up a couple of times yesterday, but I want to kind of outline this rulemaking process briefly and show you what I think are the process problems.

Under typical rulemaking by the Department, it begins with the administrator, who recommends to the director, after consultation with the advisory board, the promulgation of rules, regulations, standards or permitting systems. That's Section 302 of the act.

The next step is the director takes action necessary to promulgate the rules, which, in practice, means he allows them to come to this Council for promulgation. That's Section 109 of the act.

The third step is the Council promulgates rules or conducts hearings, and this is a quote from Section 112 of the act, for the adoption, amendment or repeal of rules, regulations, standards or orders recommended by the advisory boards through the administrators and the director. And, importantly, the EQC does not hold hearings or adopt or approve policies under its authority, and DEQ had recognized this in its draft Statements of Principal Reasons when it said originally that it was sending policies to this Council for informational purposes, not



for adoption.

So that's an important distinction. So what's the problem here? The problem is that DEQ presented this ag use rule as a rule to the Council before the DEQ sought the advisory board's input. And the public notice in December indicated that DEQ had reconsidered its previous position and now thinks that this policy that had been developed for two years should be a rule. And by the way, in the notice, we're going to take it to the advisory board in February for their endorsement as a rule.

That is not the process outlined by Section 302, which says advisory board consultation comes before a recommendation for the rule to the EQC. So importantly, also, instead of the advisory board's endorsement, the advisory board recommended against the adoption of a rule, and so promulgation of a rule is certainly going to -- in this case, this policy as a rule, would be in derogation of Section 112, which indicates the EQC is going to promulgate rules recommended by the advisory board. There is no recommendation here to do that.

So the third issue that I see is what is the Department's recommendation in this particular instance, because I understood it to be to promulgate a rule, because that's what the notice said, that this is now being proposed as a rule to the Council.



But in the first five minutes of this hearing yesterday, I think we all learned that maybe that's not the case, because Mr. Corra was asked point-blank early on, Mr. Corra, are you recommending a rule or a policy, and the answer was I'll tell you at the end of public comment. Now, that's a very good response. I credit Mr. Corra on that, because I think that's a good strategy, and it indicates a willingness to continue to listen to the comments, but that's not how the rulemaking process is set up. Mr. Corra is to come here after he has a recommendation, and we don't know what that recommendation is, and advocate that proposed rule.

Another interesting section is Section 109(a)(x), which says director is to serve as adviser to the Council on all matters other than the consideration of rules proposed by the Department. So in this case he can advocate the rule he proposes, but in terms of acting in an advisory capacity as the rule's been proposed, I think that becomes somewhat questionable.

Now, enough said about the process. I'll now turn to the content, which I know is something that you folks are interested in. There are a couple of things in particular that I want to draw your attention to. If this ag use document is to become a rule, the first one is there are many, many amorphous provisions in the rule. The one

that is probably most glaring is the definition, or lack of definition, of the term naturally irrigated lands. That needs a better definition that uses a range of objective benchmarks, because right now it's very open. And if you look at the definition under the rule, it's just wide open. So we've got to pin that down somehow.

Naturally irrigated lands also pose a problem in terms of how they're protected. The policy -- I'm sorry. The document recognizes one important concept that Mr. Lowham pointed out yesterday, and that is on page H-3 it says the most basic question is whether a proposed discharge will reach irrigated lands. If the discharge will not reach an irrigated field, either because of natural conditions or water management techniques, it could not affect crop production on that field.

Where Petro-Canada believes a policy is lacking is in the implementation tools to ensure that limits will only apply when that water reaches an irrigated field and the policy says EC and SAR limits will be calculated and applied in all instances where the produced water may reach any artificially irrigated lands. And it also says page H-6, on subirrigated lands and passively irrigated lands, such as those under spreader dike systems, the irrigation season shall generally be considered to be year round.

Three concepts we'd like to have the Council



recognize as important under this ag use document, the first one is the flow-dependent nature of irrigation on these lands. If there is insufficient flow, irrigation is not going to occur on naturally irrigated lands, or, for that matter, on artificially irrigated lands operated by spreader dikes that require a certain volume of water be activated. So livestock water quality may be able to flow in the drainage without ever impacting naturally irrigated lands, and so there needs to be an acknowledgment in the document of the flow-dependent nature of irrigation on these lands.

Second concept is mixing of flows under irrigation conditions, because when the water reaches the land, as described by Mr. Lowham yesterday, that occurs under flood conditions. That is necessarily going to involve a mixing of CBM water with natural flow. And so that mixing ought to be -- mixing and modeling ought to be a component of any policy that acknowledges protection of irrigated lands, which are irrigated only under flood conditions.

In essence, we can't -- we shouldn't have a standard applicable 365 days a year for -- at the end of the pipe for irrigation that occurs once every year or two years or three years. And to do that, to require that end-of-pipe limit, is going to impose some severe burdens



which are not justified under the hydrology of the drainage or the actual circumstances under which irrigation occurs.

Third point is monitoring where it matters, and monitoring where it matters is on the field itself, where this irrigation is occurring, at the times it's occurring.

Now, I know DEQ has concerns about setting up monitoring points, that there are concerns about it's difficult to enforce, but it is possible to enforce and it's a preferable alternative to requiring an end-of-pipe limit 365 days a year. Those are our issues.

Options at this stage. The options for the Council, I think there are really two of them. One of them, decide whether this should be a rule or policy. If it's a rule, then we would ask that you heed the comments that you've heard and heed the comments of the advisory board, and also fix the rule before it's adopted and fix it to address the concerns that have been expressed, you know, over the last day.

And probably remand -- the best way to do that is remand that to the DEQ to incorporate the concepts that you think are important in a rule, rather than try to craft the language of the rule yourselves up here today. If this is to become a rule, the appropriate process would be send it back to DEQ. Let DEQ work with the stakeholders to incorporate the comments that the Council believes are



worthwhile in a rule.

CHAIRMAN GORDON: Keith, I'm just going to urge you on, just --

MR. BURRON: I'm nearly finished. And if you'll indulge me for maybe one more minute, I can wrap it up.

CHAIRMAN GORDON: Thank you.

MR. BURRON: The second would be you decide you don't want it to be a rule, have DEQ retain it as a policy, but express your concerns and ask the DEQ to address them. Now, while you don't necessarily shape the policy or approve the policy, you certainly have the ability to telegraph to the DEQ what the Council believes is appropriate in a policy, because any appeal that comes to you is going to be evaluated based on does it protect Section 20.

So my last point is recommendation, should this be a rule, should this be a policy. We have said it could be either, but if it's going to be either, it's got to be a good rule or it's got to be a good policy. I would urge a policy. And it's unclear to me why the DEQ brought this as a rule, when it does so many things by policy. Mixing zones, antidegradation, use attainability, reservoir bonding, ground water monitoring, a similar capacity, all of those are programs implemented by the DEQ under

policies. Why does this one necessarily got to be a rule? I don't understand the justification provided by DEQ for this particular case, when we have these six other, seven other policies out there that are being implemented as policies and not rules.

Secondly, I think the EPA issue is a significant issue. And I realize I'm pressing my time here, I apologize, but the EPA concern is a big one. This is part of Chapter 1. This is subject to triennial review. This is subject to -- this is a program, and this program is a federally delegated program. EPA does retain some strings over the program, and so to the extent that we approve a rule and make that part of our rule package, it becomes a piece that EPA looks at. That is a concern and when it comes to Wyoming controlling its destiny under implementing its clean -- or its water quality programs, if we think it's not important to EPA how this comes out, we got to know that EPA has been here for both days of this hearing and they wouldn't be here if they weren't interested in it.

So, third, do we really want a rule to implement a rule? Section 20 is the regulatory provision. That's the benchmark. Do we need a rule to implement how we're going to address the standard? When an issue under Section 20 comes to the Council on review of a permit appeal, the question is, has the goal of Section 20, ag use protection,



been met. That's the question that's going to come before the Council. And I think we confuse the matter when we say not only has ag use protection been protected in this permit, but have we complied with every jot and tittle of the Section 20 policy, or rule as the case may be, which may somewhat get lost in the noise of -- that may -- that's a less important inquiry than the actual objective of Section 20.

CHAIRMAN GORDON: Keith, I'm really nervous about -- you know, we've given you quite a bit more time than we gave people at the end.

MR. BURRON: I apologize and I am finished. Thank you.

CHAIRMAN GORDON: So are there questions from the Council for Mr. Burron?

And I apologize for doing that. I just want to make sure we are fair and consistent.

MR. BURRON: I understand. I apologize for running over.

CHAIRMAN GORDON: Mr. Moore.

MR. MOORE: Thank you, Mr. Chair.

Mr. Burron, your comment about needing to consider mixing for naturally irrigated lands concerns me somewhat. And I'm thinking of -- there's two separate and distinct ways that water can get on the land in an



ephemeral drainage, and one is as you described, the water flows down through a defined channel and doesn't leave that channel unless there's adequate flood flow to carry it out of the channel and onto those naturally irrigated lands.

But the other way that naturally irrigated lands can be irrigated by water, whether it's CBM or flood water, is areas in ephemeral draws where there is no defined channel, just you walk down the slope of the hillside and get to the bottom of the hill you've been walking down and there's a nice broad flat area. And I'm familiar with many, many ephemeral areas in Wyoming that are just like that, there is no stream channel. So any flow that comes down that draw doesn't go down the channel, but it does more or less sheet-flows across that flat area where there is no defined stream channel. And in my mind that's a situation where if there's coal-bed methane water being discharged into this draw, it's going to come down and it's going to sheet-flow across that flat area where there is no defined channel, hence there is no mixing. Do you have a response to that scenario?

MR. BURRON: I guess there are two -- maybe two responses. One is that would appear to be a water management issue as well, because in some of these drainages where natural channel disappears, that can be due to a number of factors, silting, and, you know, some action



to promote that occurring. And as the Council's aware, it's been our position that, you know, and it's somewhat outlined by the district court in the Maycock case, that we've got to be able to preserve the State's easement through natural drainage. So that is water management issue in that sense. Whether that means you need to do some work in the channel to facilitate the flow in there, that's one thing.

The other piece of that is, I believe, in the policy those areas that you're describing where the channel disappears are areas that would be excluded from coverage under the policy. And I'm referring specifically to page H-4, where it indicates criteria which may be used to exclude lands, include lack of a persistent active channel and consolidate a floodplain deposits which are generally less than 50 feet in width.

So it appears that the DEQ had not contemplated that as an area that would be naturally irrigated necessarily, but the other one is just in terms of how do you manage water.

MR. MOORE: So in your first response is that you -- the company would cut a channel through that flat area to --

MR. BURRON: I think that is an option.

MR. MOORE: An option.

MR. BURRON: And certainly an option that ought to be considered where those areas are discretely defined within otherwise drainages that are natural waterways in the state.

MR. MOORE: Thank you.

CHAIRMAN GORDON: Further questions? Any other questions?

MR. MORRIS: Yeah, I've got just a couple of questions.

What do you consider irrigated lands? You --

THE REPORTER: I'm sorry. I can't hear you.

MR. MORRIS: What do you consider irrigated lands? You said they were not identified.

MR. BURRON: Okay. There's two sets of irrigated lands which are identified under the policy. The first one is artificially irrigated lands. I don't think anybody disputes that a diversion structure and a permitted water right is an irrigated land. And that's another comment that we've made that we think that ought to be dictated by the State Engineer's Office; however, there are also areas which are agriculturally significant. And significant from a production standpoint. And I think -- well, I know that the position of industry is those areas, to the extent that they are utilized for crop and forage



production, are something that needs to be protected. The question is how do you protect those areas and how do you define those areas?

MR. MORRIS: Do you have a definition of irrigated lands?

MR. BURRON: I think the definition has to be based on -- to answer your question, no, I don't have the definition, Mr. Morris, but what I do have is the concept that those areas ought to be defined based on objective criteria, and currently they're not. Under the policy there are a number of individual pieces, any of which could establish a naturally irrigated area and a very general definition of what --

MR. MORRIS: Who makes those definitions, the DEQ or the Council or industry or --

MR. BURRON: I think a combination of the above. I think it's incumbent upon the DEQ to adequately define those areas -- or not those areas, necessarily, but the means for which those areas are going to be -- the means by which those areas are going to be established.

MR. MORRIS: Okay.

MR. BURRON: And that ought to be based on things like objective measuring sticks, how -- you know, how does the Corps address that, how does Reclamation address that, you know, Bureau of Reclamation, things like



that. There are established procedures for doing that, but we don't find those in the policy.

MR. MORRIS: So we can get that irrigated land 101?

MR. BURRON: I think so. I would like to see much more definition in the policy as to how that determination's going to be made.

MR. MORRIS: Now, your comments just kind of refer -- the way that I heard it -- as seasonal. This water runs year-round.

MR. BURRON: Yeah, I do not believe my comment would be seasonal. My comment would instead be at times when the lands receive irrigation water, which could happen at any number of times of the year, but typically will not happen absent a significant natural event that would -- that would cause that irrigation to occur.

MR. MORRIS: But irrigated lands could be getting this water if it's flooding area around, it'd still be irrigated lands.

MR. BURRON: That's right. And our position is not that we define it to a season. Our position is that we define it to an event.

MR. MORRIS: Which could occur year-round?

MR. BURRON: Correct, with some exceptions, but yeah.



MR. MORRIS: You talking about -- explain to me about this mixer you're talking about.

MR. BURRON: Mixing?

MR. MORRIS: Yeah, who turns on this mixer?

MR. BURRON: Mother Nature. The mixing that I'm referring to is, as Mr. Lowham described yesterday, when these lands, if you want to call them naturally irrigated, which is a term DEQ used, receive water, it occurs during a flood event. And I think the science for that was submitted by Mr. Lowham yesterday.

The point is that flows that are not -- that are in the channel but never reach the land should not be subject to an irrigation standard 365 days a year because they're not going to be on the land 365 days a year. They should be subject to an effluent limit when they are mixed with a natural flood event that does, in fact, reach the land.

MR. MORRIS: But it's still a concern how -- how the mix --

MR. BURRON: Correct. And that can be addressed through water balances and through mixing calculations. That's information that can be modeled and can be verified on a field level by sampling.

MR. MORRIS: But who controls this? Who --

MR. BURRON: Who controls --

MR. MORRIS: The mixing, you know, as to whether this water's going to runoff or flood control or if it's going to be dunking into a stream or -- what control does people downstream have?

MR. BURRON: I believe they'd have the same control they have now, which is in a flood event the water comes.

MR. MORRIS: It happens.

MR. BURRON: It happens.

CHAIRMAN GORDON: We're approaching 9:00, John.

MR. MORRIS: Pardon?

CHAIRMAN GORDON: We're approaching 9:00.

MR. MORRIS: Okay. I still have couple questions I'd like to have figured out.

On this advisory -- you bring up this advisory thing -- this went to the advisory board how long ago?

MR. BURRON: It went to the advisory board at various points over the last two years as a policy.

MR. MORRIS: Two years or five years?

MR. BURRON: Two years.

MR. MORRIS: So you had all this time to work on this thing and to come up with --

MR. BURRON: The advisory board has looked at this as a policy on numerous occasions. The advisory



board looked at it as a rule on February 5th and said we don't like it as a rule, unanimously. And also said if we're going to do it as rule, let's go back out and take more comments.

MR. MORRIS: Okay. I guess I just got one other kind of a quick statement. Did you ever try to bale hay under water?

MR. BURRON: I haven't done a lot of hay baling in my life, Mr. Morris. I certainly haven't done any under water.

MR. MORRIS: With this flooding that you're talking about with no control, this actually could happen.

MR. BURRON: I don't believe that it would happen by the influence of man under that circumstance. What I'm talking about with mixing is mixing during a flood event, which otherwise occurs by virtue of what Mother Nature dictates.

MR. MORRIS: Thank you, Keith.

CHAIRMAN GORDON: Any further questions?

MS. HUTCHINSON: Just one. Okay. I hate to ask the obvious question here.

It seems to me that there's something wrong when we have a lot of comments about, you know, policy, rule, whatever, but if you say it's a policy, it's been in front of the advisory board or in our records five years, Keith,



is when it first came to the advisory board.

So my question is everybody keeps saying it's a bad policy. What is wrong with the system that after five years and five meetings in front of the advisory board that everybody still thinks it's a bad policy? What is wrong with the advisory board systems that it's not a good policy after that much time?

MR. BURRON: The issues that we have pointed out, and principally today with naturally irrigated lands and the implication that we're dealing with end-of-pipe limits predominantly, rather than the actual circumstances under which irrigation of naturally irrigated lands occurs, is a problem and it's a big problem. And that is the principal concern.

Obviously the default limits have been a subject of great debate, and all I would say in regard to that is that Petro-Canada concurs with the information Mr. Harvey's provided. I won't go into that in any depth. That is the issue, but I would, for clarification, also tell you that I don't believe this has been in front of the advisory board for five years. It's been -- I believe January of 2005 was when the first ag use draft came out.

MS. HUTCHINSON: Still been a while.

MR. BURRON: It's been a while.

CHAIRMAN GORDON: Further questions?



Okay. Thank you, Keith.

MR. BURRON: Thank you, Mr. Chairman.

CHAIRMAN GORDON: I guess I'd like to recognize John. It was nice of you to be available this morning. Thanks.

MR. CORRA: Thank you, Mr. Chairman. I'm glad you can -- that the prior speaker didn't influence you to send me away without me having something to say at the end.

The first -- just a bit of history, I think. and I will try to keep my comments short. This has been around -- dealing with Section 20 is a five-year issue. This Council was very concerned and expressed that concern to the DEQ about a narrative standard. And, in fact, you asked us to make sure that we were able to explain to you how we were going -- how we were going to administer that narrative standard.

So, consequently, there's been a lot of work on the content of that standard by meetings before the advisory board, for example, and two very intense years on the part of some of my staff.

When you look at the narrative standards, and you look at the policy and how significant that policy is to so many different stakeholders, I think it is important that you get a lot of conversation and a lot of debate about it