Water Quality Effects and Beneficial Uses of Wyoming Produced Water Surface Discharges

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Executive Summary

In addition, associated social and economic impacts of reduced water discharges and/or reduced exploration and development would be harmful to Wyoming residents.

Geomega reviewed literature-based toxicity studies and published guidelines for each of the constituents of interest, and gathered empirical data from several Wyoming ranchers who use produced water sources for their livestock. The ecological risk assessment followed US Environmental Protection Agency guidelines (US EPA 1998).

Ranchers' experiences indicate that water containing sulfates up to 3,100 mg/L and TDS up to 5,390 mg/L do not pose adverse risk to livestock in Wyoming. The ranchers' experiences were evaluated in conjunction with published literature; as a result, the following water quality benchmarks were recommended for each constituent as an alternative to the petitioner's proposed limits:

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

Table E-1. Summary table of recommended water quality benchmarks for barium, sulfate and TDS that are protective of livestock and wildlife receptors, compared to the current WDEQ effluent limits and the petition's proposed effluent limits. All results in mg/L.

These recommended water quality benchmarks are consistent with current WDEQ effluent limits, other published local and national established benchmarks, and ranchers' experiences. They are not, however, consistent with the proposed limits in the petition. The recommended benchmarks are protective of wildlife and livestock such that ingestion of surface water with TDS concentrations up to 5,600 mg/L, sulfate concentrations up to 3,010 mg/L, and barium concentrations up to 13 mg/L will not result in injury to the animals. Thus, reducing effluent limits of sulfate and TDS to the petitioners' proposed limits will not result in any incremental reduction in risk to wildlife or livestock.

In the larger picture, however, CBNG and conventional oil extraction industries that surface-discharge produced water have additional social and economic value to residents in

Wyoming. Reductions in exploration/development and produced water surface discharge, due to unnecessarily stringent effluent limits, could result in substantial injury to the social and economic well-being of many Wyoming residents.

Numerous landowners in the Powder River and Bighorn basins benefit from produced water surface discharges through irrigation and/or livestock watering. This statement is supported by the many letters of beneficial use, rancher interviews, and other literature sources. Produced water surface discharges also support wildlife populations that may not otherwise be viable, including wild horse populations in the Bighorn basin, and migratory and waterfowl bird species at the Loch Katrine wetland complex. In addition, produced water discharges in certain circumstances improve water quality of natural drainages, as evidenced by the increased livestock capacities cited by several ranchers in the Salt Creek area of the Powder River basin.

To analyze the social and economic impacts of produced water surface-discharge in Wyoming, Geomega gathered US Census Bureau and US Department of Agriculture information on livestock use and economic indices in the Bighorn, Powder River and Platte River basins, and reviewed use attainability analyses and economic analyses authored by Gene R. George and Associates (2005), RETEC (2004), SWWRC et al. (2002), Taylor (1999). Economic effects of reduced exploration and development include lost revenue from oil and gas extraction facilities in the form of jobs and associated earnings, and basic oil and gas export revenue. Case studies include the following:

- Elimination of the South Casper Creek field in the Platte River basin would result in annual losses of $3 million (in 2002 dollars) to the basic exports of Natrona County, with additional losses of associated jobs with annual earnings that totaled $487,142 in 2002.

- Elimination of the Hamilton Dome oil field in the Bighorn basin would result in losses of $28.7 million (in 1997 dollars) in state total annual economic output, with associated losses of 136 jobs in Hot Springs county alone with earnings totaling $4.1 million in annual labor.

- Elimination of operations in the Salt Creek area in the Powder River basin would result in losses of jobs directly and indirectly related to oil and gas production, that result in an estimated $4.6 million in annual earnings for Natrona and Johnson Counties (in 1997 dollars).

Social impacts of reduced exploration/development include loss of financial contributions that go toward the improvement of local communities. County income from these operations supports various public facilities including schools, hospitals, libraries, fire departments, environmental programs, and the county general fund. Examples include the following:

- Elimination of the South Casper Creek field would result in reduced social contributions to Natrona County such as:
    - county property tax income by 2.5%,
    - severance taxes of 0.04%,
    - sales and use taxes of 0.16%, and
    - 2.5% of federal royalties for the county (on average, between 1997 and 2002).
    - State severance taxes; in 1997, severance taxes from the Salt Creek fields were estimated at $2.4 million. 2.6% ($62,257) of the total severance tax was received by Natrona County, and 0.2% ($4,789) was received by Johnson County.
- Elimination of the Hamilton Dome oil field would reduce social contributions to Hot Springs County (in terms of fiscal contributions) totaling:
    - 29% of total property taxes
    - 9% of total general fund revenues,
    - 27% of the library system's total revenues,
    - 2% of county hospital revenues,
    - 9% of county weed and pest management program,
    - 29% of the rural fire district budget, and
    - additional funds for school districts, averaging $1.4 million annually.

- Elimination of operations in the Salt Creek area in the Powder River basin would reduce social contributions to Natrona and Johnson Counties totaling (in 1997 dollars):
    - School funding of $2 million annually;
    - County government funding of $500,000 annually;
    - Community college funding of $300,000 annually.

Even with continued industry presence, lost opportunity to surface-discharge water would have a negative impact on Wyoming landowners and ranchers in many counties in the form of lost jobs and income from livestock and farming businesses. Additional negative impacts would result for the State general fund and federal mineral revenues. The following are examples of estimated economic losses from lost opportunity to surface-discharge water:

- In the Bighorn basin:
    - 15 to 20% loss of cattle in the Cottonwood Creek area, corresponding to an estimated $2 million in lost annual livestock sales for the Bighorn basin;
    - economic losses of 1.7% ($3.3 million) of total annual economic output in Hot Springs County, plus job losses totaling $645,000 in annual labor income;
    - an 8% loss of irrigated pastureland in the Cottonwood Creek area, corresponding to a loss of 1,600 acres of irrigated cropland and 4,000 tons of annual hay production;
    - livestock losses estimated between 30 and 50% by some ranchers in the Bighorn basin, resulting in estimated losses $387,000 to $645,000 in annual livestock sales;
    - lost access to federal funding and associated employment at the Loch Katrine wetland complex, which was created from produced water sources.

- In the Powder River basin:
    - livestock losses estimated between 20 and 40% in the Salt Creek area, corresponding to estimated losses of $590,175 to $1.1 million in annual livestock sales;

- All counties affected by loss of opportunity to surface discharge produced water would face:
    - Estimated herd losses between 15% and 50%, corresponding to lost annual livestock sales between $57 million and $192 million.
    - additional costs to ranchers to develop alternative water sources such as wells, water hauling and breaking ice;
    - associated job losses related to ranching and farming; and
    - lost revenue from hunting, fishing and tourism due to declining wildlife populations.

Economic and social injury of reduced exploration/development and loss of opportunity to surface-discharge produced water would not be limited to the case studies provided in this report. State-wide, the oil and gas industry supported 2,995 employees in 2002, with a total annual payroll of $162 million (US Bureau of the Census 2002). In addition, support activities for oil and gas operations, including drilling of oil and gas wells, employed an additional 9,200 employees with earnings totaling $332.6 million in 2002. The value of shipments, sales and receipts for oil and natural gas industries in Wyoming totaled $3.9 billion (in 2002), representing ~14% of the total sales, shipments and receipts for the state. At least a portion of the jobs, earnings and state revenue is expected to be negatively impacted by unnecessarily stringent effluent limits across Wyoming. A state-wide analysis of economic and social benefits and injury upon loss of produced water surface discharge, exploration and development is recommended to evaluate the total impact of the petitioners' proposed water quality amendments.

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