

EXECUTIVE SUMMARY

Tongue River Hydrology Report

Tongue River Information Program

May 2008

The Tongue River valley of Wyoming and Montana has over 60,000 acres of irrigated land which has supported cattle ranching and farming operations for more than 100 years. The Tongue River runs through the coal-rich Powder River geologic basin which has experienced growth in coal bed natural gas development since 1999, along with surface coal mining since the early 1970's. The Tongue River Information Program (TRIP) has been funded by the Montana Board of Oil and Gas Conservation since 2006 in response to concerns by irrigators, environmental regulators and policy makers that the discharge of produced water from coal bed natural gas (CBNG) production in the upper Tongue River basin could be affecting the water quality of the river and, in turn, soil properties and crop production. TRIP includes an agronomic and soils monitoring program called the Agronomic Monitoring and Protection Program (AMPP), and a hydrologic component, which is summarized in this Tongue River Hydrology Report. All TRIP reports may be accessed on-line at:
<http://www.bogc.dnrc.state.mt.us/CoalBedMeth.asp>

The findings of the hydrology evaluation begin with the understanding that water supply available to the Tongue River is directly related to the amount of precipitation falling in the upper basin. Further, it is well-documented that water quality indicators, in particular Specific Conductance (SC) (a measure of total dissolved solids equivalent to Electrical Conductivity (EC)) and sodium adsorption ratio (SAR), are inversely related to flow; that is, the river typically has higher SC and SAR at lower flows, and vice versa (USGS, 2007). Except for water year 2007, the average annual flows at the U.S. Geological Survey State Line gauging station for all water years since 2000 have all been less than the median flow based on 47 years of measurements (448 cubic feet per second (cfs)). Four of the past eight water years have been among the lowest average flows of record.

After accounting for differences in average flow, comparisons of SC and SAR data indicate comparable readings at all USGS monitoring stations on the Tongue River before and after the onset of CBNG development. An increase of salinity and sodium in the downstream direction is a common occurrence for the Tongue River and other western streams, due to a combination of natural and human-caused factors. The largest salinity increases in the Tongue River typically occur between the USGS stations at Monarch, Wyoming and the State Line, and between the T&Y Diversion and Miles City, based on data from water years 2006 and 2007. CBNG discharges contribute salts and sodium in the upper reach, but have no role in the lower reach since the lowermost CBNG discharge is about 1 mile below the Tongue River Dam. Significant influences on water quality in these stream reaches are changes in geologic weathering and the amount of water diverted for irrigation. In a 2007 report (Clark and Mason, 2007), the U.S. Geological Survey, in cooperation with the Wyoming Department of Environmental Quality, evaluated eight sites in the Tongue, Powder, and Belle Fourche River drainage basins, including the USGS stations on the Tongue River at the State Line and Goose Creek below Sheridan, for trends in SC during water years 1991–2005. There were no

trends found in SC at the eight sites when values were flow-adjusted for streamflow variability.

The Tongue River basin is home to approximately 25,000 people, 88 percent of whom live in and around Sheridan, Wyoming. There are at least 60,000 irrigated acres in the basin, 73 percent of which are in Wyoming. Water rights filing information demonstrates that claims for water from the basin are far in excess of its historic delivery capability. Just over 6,000 private water wells are drilled in the basin, 64 percent of which are in Montana, with the majority being used for agricultural purposes.

Through 2007, approximately 3,175 CBNG wells were installed in the basin, 72 percent of which are in Wyoming. The quantity of CBNG-produced water within the Tongue River basin averaged about 3.4 gallons per minute (gpm) per well during 2007 in both states, for an equivalent total average of 23.5 cubic feet per second (cfs). Approximately 87 percent of this total was discharged to impoundments, beneficially used, or treated prior to discharge, with the remainder discharged to the river untreated via MPDES or WYPDES permits.

There are seven permits for discharge of CBNG-produced water to the Tongue River, three are located in Montana and four in Wyoming, with a total of 36 outfalls. These permits are authorized for discharge ranging from 1,640 to 2,630 gpm (3.6 – 5.9 cfs) of untreated CBNG water, and 4,438 gpm (9.9 cfs) of treated CBNG water. Actual CBNG discharges have been significantly less than the permitted discharges. The discharge rates and/or water quality authorized by permits are seasonally adjustable in order to meet irrigation water standards set by the State of Montana. During the April-September 2007 irrigation season, total CBNG discharges comprised from 0.3 to 1.6 percent of the flow released from the Tongue River dam, with untreated discharge ranging from 0.1 to 0.8 percent.

Agricultural non-point sources discharged to the Tongue River have not been quantified. Agricultural non-point contributions include irrigation tailwater, flow to the river via shallow groundwater from irrigated fields, and canal seepage losses. In 2002, the NRCS identified 20 visible irrigation return flows exclusive of those in Rosebud County. The portion of the Tongue River immediately downstream from the T&Y diversion dam to the mouth is listed as impaired on the MDEQ's current (2006) 303(d) list. The impairment is primarily due to a combination of the diversion of relatively good quality water from the Tongue River at the T&Y diversion dam, and the inflow of water from irrigation returns, groundwater and tributaries that are poorer in quality than the Tongue River.

This study indicates that the water quality of the Tongue River basin varies directly with the quantity of stream flow, and that salinity and sodium levels since the beginning of coal bed natural gas development in 1999 are comparable to pre-development levels. Based on the combination of lengthy drought conditions, energy development and concerns over irrigation water supplies, continued monitoring of the river's flow and quality, and an improved accounting of basin-wide point and non-point sources of salinity and sodium loads is warranted.