

Prepared in cooperation with the Montana Department of Environmental Quality

# Surface-Water Monitoring in Watersheds of the Powder River Basin, 2005

## Powder River Basin Interagency Working Group

The Powder River Basin (PRB) is a geologic structural basin that contains an extensive natural gas resource associated with regional coal deposits. This coalbed natural gas (CBNG) is located beneath millions of acres of private and public land in southeastern Montana and northeastern Wyoming (fig. 1). The PRB Interagency Working Group (IWG) was established in June 2003 as a forum to identify, discuss, and find solutions to issues of common concern to government agencies involved in permitting and monitoring CBNG development. The PRB IWG is led by the Bureau of Land Management (BLM) and is composed of managers and technical staff from local, State, tribal, and federal government agencies with land management, conservation, or regulatory responsibilities in the PRB, as well as agencies like the U.S. Geological Survey (USGS) that provide technical support.

The mission of the PRB IWG is to: (1) provide for environmentally sound energy development, (2) develop coordinated and complementary best management practices, guidelines, and programs related to CBNG activities to conserve and protect resources, (3) monitor the impact of CBNG activities and assess the effectiveness of mitigating measures, (4) develop and integrate the databases and scientific studies needed for effective resource management and planning, and to make that information readily available, and (5) promote compatibility in the application of each agency's mission.

In order to more effectively address the technical issues presented by CBNG development, Task Groups that are staffed by technical specialists from the member agencies of the PRB

IWG were formed to address specific resource issues. The Task Groups include Air, Aquatics, Water, and Wildlife. More information about the PRB IWG and Task Group activities is available at URL <http://www.wy.blm.gov/bfo/prbgroup/index.htm>.

## Water Task Group

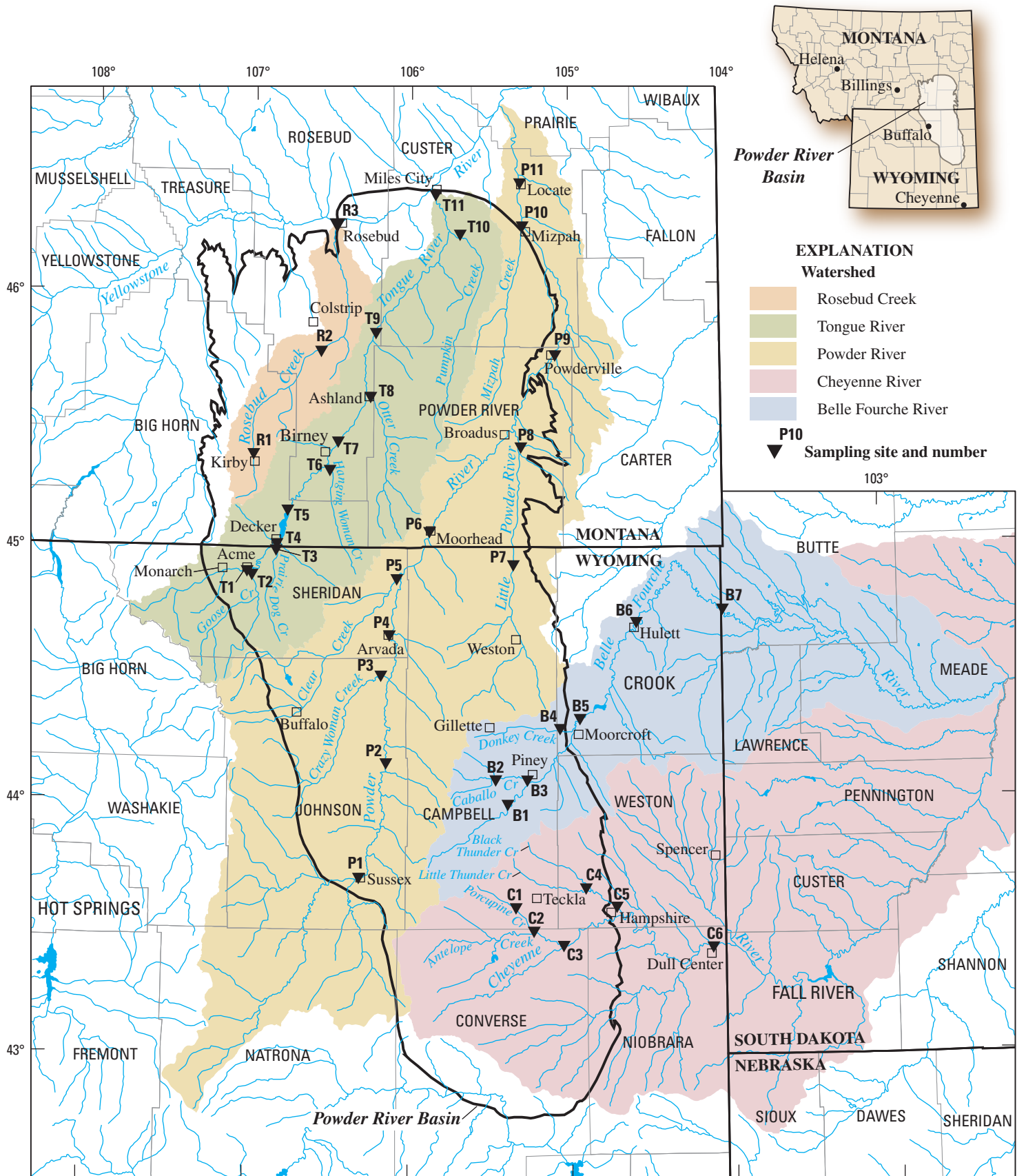
Substantial volumes of ground water are extracted from coalbeds in order to produce CBNG. The removal of ground water from aquifers and use or disposal of produced water on the surface have the potential to cause environmental impacts. One objective of the Water Task Group is to develop and implement monitoring plans for surface water and ground water at local and regional scales. This monitoring will help agencies make more informed decisions regarding CBNG permitting, and allow for dissemination of information to the public. This factsheet summarizes the surface-water-monitoring plan developed by the Water Task Group and describes the surface-water monitoring accomplished during 2005.

## Surface-Water-Monitoring Plan

The surface-water-monitoring plan is a proposed sampling network that is generally composed of sites where PRB IWG member agencies have been conducting surface-water monitoring. Sampling sites may be located on mainstems or selected tributaries in each watershed (fig. 1, table 1). Proposed sampling frequencies vary with stream type and constituent class (table 2). The constituent classes recommended for monitoring include:

- Streamflow
- Field measurements—pH, dissolved oxygen, specific conductance, and temperature
- Major ions—dissolved calcium, magnesium, potassium, sodium, alkalinity, chloride, fluoride, sulfate, and silica; dissolved solids; and sodium-adsorption ratio
- Nutrients—total and dissolved nitrogen and phosphorus species
- Trace elements (primary)—total and dissolved aluminum, arsenic, barium, beryllium, iron, manganese, and selenium
- Trace elements (secondary)—total and dissolved cadmium, copper, chromium, lead, nickel, and zinc.
- Suspended sediment





Base modified from Digital Chart of the World digital data, 2003  
 Drainage basins modified from USGS Hydrologic Unit Boundaries, 1999  
 Albers Equal-Area projection, standard parallels 20° and 60°,  
 central meridian -105°30'

**Figure 1.** Location of sampling sites proposed in the Water Task Group's surface-water-monitoring plan for the Powder River Basin.

**Table 1.** Sampling sites proposed in the Water Task Group's surface-water-monitoring plan for the Powder River Basin.

Map number	U.S. Geological Survey site number	Site name	Stream type
R1	06295113	Rosebud Creek at reservation boundary near Kirby, Mont.	Mainstem
R2	06295250	Rosebud Creek near Colstrip, Mont.	Mainstem
R3	06296003	Rosebud Creek at mouth, near Rosebud, Mont.	Mainstem
T1	06299980	Tongue River at Monarch, Wyo.	Mainstem
T2	06305700	Goose Creek near Acme, Wyo.	Tributary
T3	06306250	Prairie Dog Creek near Acme, Wyo.	Tributary
T4	06306300	Tongue River at State line near Decker, Mont.	Mainstem
T5	06307500	Tongue River at Tongue River Dam, near Decker, Mont.	Mainstem
T6	06307600	Hanging Woman Creek near Birney, Mont.	Tributary
T7	06307616	Tongue River at Birney Day School Bridge, near Birney, Mont.	Mainstem
T8	06307740	Otter Creek at Ashland, Mont.	Tributary
T9	06307830	Tongue River below Brandenburg Bridge, near Ashland, Mont.	Mainstem
T10	06308400	Pumpkin Creek near Miles City, Mont.	Tributary
T11	06308500	Tongue River at Miles City, Mont.	Mainstem
P1	06313500	Powder River at Sussex, Wyo.	Mainstem
P2	06313605	Powder River below Burger Draw, near Buffalo, Wyo.	Mainstem
P3	06316400	Crazy Woman at Upper Station, near Arvada, Wyo.	Tributary
P4	06317000	Powder River at Arvada, Wyo.	Mainstem
P5	06324000	Clear Creek near Arvada, Wyo.	Tributary
P6	06324500	Powder River at Moorhead, Mont.	Mainstem
P7	06324970	Little Powder River above Dry Creek, near Weston, Wyo.	Tributary
P8	06325500	Little Powder River near Broadus, Mont.	Tributary
P9	06325650	Powder River near Powderville, Mont.	Mainstem
P10	06326300	Mizpah Creek near Mizpah, Mont.	Tributary
P11	06326500	Powder River near Locate, Mont.	Mainstem
C1	06364300	Porcupine Creek near Teckla, Wyo.	Tributary
C2	06364700	Antelope Creek near Teckla, Wyo.	Tributary
C3	06365900	Cheyenne River near Dull Center, Wyo.	Mainstem
C4	06375600	Little Thunder Creek near Hampshire, Wyo.	Tributary
C5	06376300	Black Thunder Creek near Hampshire, Wyo.	Tributary
C6	06386500	Cheyenne River near Spencer, Wyo.	Mainstem
B1	06425720	Belle Fourche River below Rattlesnake Creek near Piney, Wyo.	Mainstem
B2	06425800	Caballo Creek near Gillette, Wyo.	Tributary
B3	06425900	Caballo Creek at mouth, near Piney, Wyo.	Tributary
B4	06426400	Donkey Creek near Moorcroft, Wyo.	Tributary
B5	06426500	Belle Fourche River below Moorcroft, Wyo.	Mainstem
B6	06428050	Belle Fourche River below Hulett, Wyo.	Mainstem
B7	06428500	Belle Fourche River at Wyoming-South Dakota State line	Mainstem

**Table 2.** General sampling strategy proposed in the Water Task Group's surface-water-monitoring plan for the Powder River Basin.

Stream type	Sampling frequency	Constituent class
Mainstem	Continuous	Streamflow
	12 times per year	Field measurements
	12 times per year	Major ions
	2 times per year	Nutrients
	12 times per year	Trace elements, primary
Tributary	2 times per year	Trace elements, secondary
	12 times per year	Suspended sediment
	Continuous	Streamflow
	6 times per year	Field measurements
	6 times per year	Major ions
Tributary	2 times per year	Nutrients
	6 times per year	Trace elements, primary
	2 times per year	Trace elements, secondary
	6 times per year	Suspended sediment

## Monitoring Summary, 2005

Because of funding shortfalls for surface-water monitoring, only part of the proposed sampling in the surface-water-monitoring plan was accomplished during 2005 (table 3). For the sites where the sampling was partially completed, either the sampling frequency was less than the proposed sampling frequency or not all of the constituent classes were analyzed. The Tongue River watershed was the only watershed where the sampling proposed in the surface-water-monitoring plan was fully completed.

Several of the agencies that participate on the PRB IWG contributed funding for monitoring and reporting, including:

- BLM,
- Montana Department of Environmental Quality,
- Montana Department of Natural Resources and Conservation,
- Northern Cheyenne Tribe,
- U.S. Environmental Protection Agency,
- USGS,
- Wyoming Department of Environmental Quality, and the
- Wyoming State Engineer's Office.

Streamflow data and water-quality samples were collected by USGS personnel using standard USGS field methods (<http://water.usgs.gov/owq/FieldManual/>). Samples were analyzed at the USGS National Water Quality Laboratory in Lakewood, Colorado.

**Table 3.** Monitoring accomplished for surface-water-monitoring plan during 2005.

[●, completed; ○, partially completed; and ◯, not completed.]

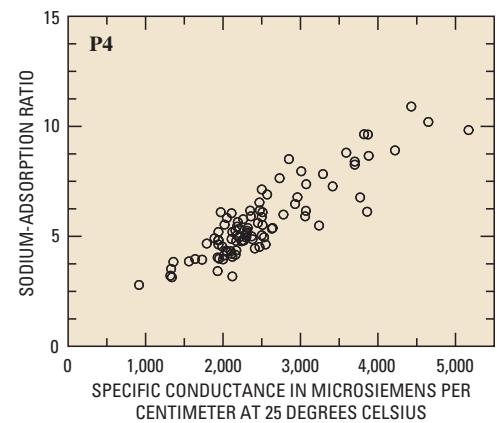
Map number	Stream-flow	Field measurements	Major ions	Nutrients	Trace elements, primary	Trace elements, secondary	Suspended sediment
R1	●	●	●	●	●	○	●
R2	●	○	○	○	○	○	○
R3	●	○	○	○	○	○	○
T1	●	●	●	●	●	●	●
T2	●	●	●	●	●	●	●
T3	●	●	●	●	●	●	●
T4	●	●	●	●	●	●	●
T5	●	●	●	●	●	●	●
T6	●	●	●	●	●	●	●
T7	●	●	●	●	●	●	●
T8	●	●	●	●	●	●	●
T9	●	●	●	●	●	●	●
T10	●	●	●	●	●	●	●
T11	●	●	●	●	●	●	●
P1	●	●	●	○	○	○	○
P2	○	●	●	○	○	○	○
P3	●	●	●	●	○	○	○
P4	●	●	●	○	○	○	○
P5	●	●	●	○	○	○	○
P6	●	●	●	●	●	●	●
P7	●	●	●	●	○	○	●
P8	○	●	●	●	●	●	●
P9	○	○	○	○	○	○	○
P10	○	○	○	○	○	○	○
P11	●	●	●	●	●	●	●
C1	●	●	●	○	○	○	○
C2	○	●	●	○	○	○	○
C3	●	●	●	○	○	○	○
C4	○	●	●	○	○	○	○
C5	○	●	●	○	○	○	○
C6	●	●	●	○	○	○	○
B1	○	●	●	○	○	○	○
B2	○	●	○	○	○	○	○
B3	○	●	●	○	○	○	○
B4	○	●	●	○	○	○	○
B5	●	●	●	●	○	○	○
B6	○	●	●	●	○	○	○
B7	●	○	○	○	○	○	○

## Data Availability

Data collected as part of Water Task Group surface-water-monitoring plan are stored electronically in the USGS National Water Information System. Continuous streamflow and water-quality data are available to the public at URL: <http://waterdata.usgs.gov/nwis/>. Other USGS data for Montana and Wyoming can be accessed at <http://mt.water.usgs.gov/>, <http://tonguerivermonitoring.cr.usgs.gov/>, and <http://wy.water.usgs.gov/>.

## Future Work

Another objective of the Water Task Group is to interpret the surface-water-monitoring data that are collected. Until more data are collected, much of the initial interpretive analysis may focus on sites with historical data that were collected for previous monitoring programs. For example, the Powder River at Arvada, Wyoming has been sampled for many years, and relations between constituents, such as specific conductance and the sodium-adsorption ratio, have been established (fig. 2). If the monitoring data indicate that water quality is changing, managers can use adaptive management and appropriate mitigation measures to address environmental concerns.



**Figure 2.** Specific conductance and sodium-adsorption ratio relation for the Powder River at Arvada, Wyo.

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