

Data Collection for the Assessment of Aquatic Communities in Northeastern Wyoming and Southeastern Montana, 2005

Introduction

This fact sheet describes data collection for the assessment of aquatic communities in northeastern Wyoming and southeastern Montana. This assessment was conducted in 2005 in cooperation with the Bureau of Land Management (BLM), Montana Department of Environmental Quality (MDEQ), Montana Fish, Wildlife and Parks (MFWP), U.S. Environmental Protection Agency (USEPA), Wyoming Department of Environmental Quality (WDEQ), and Wyoming Game and Fish Department (WGFD). This fact sheet also describes groups with interests or responsibilities in monitoring the effects of coal-bed natural gas development within the Powder River Basin.

The Powder River Structural Basin (PRB) in northeastern Wyoming and southeastern Montana is an important source of energy resources for the United States. Resources produced from the basin include coal, oil, uranium, conventional natural gas, and within the last decade coal-bed natural gas (CBNG) that often is referred to as coal-bed methane. As of 2004, more than 10,000 CBNG wells had been drilled in northeastern Wyoming (Wyoming Oil and Gas Conservation Commission, 2005). An estimated 50,000 to 60,000 CBNG wells could be drilled and put into production in the PRB by 2012 (Wyoming Oil and Gas Conservation Commission, 2005). Throughout the PRB large volumes of ground water are removed from coal-bed aquifers and discharged on the surface in order to recover CBNG. This ground water, which can be slightly to moderately saline, is discharged to perennial, intermittent, and ephemeral streams and to surface impoundments. It is currently unknown what potential effects these discharges will have on aquatic communities (fish, macroinvertebrates, and algae) and their habitats.

Powder River Natural Gas Interagency Working Group

Over a million acres within the PRB are public lands managed by the BLM. Development of mineral resources on public lands requires leases and permits from the BLM along with permits, approvals, and reviews by several other Federal and State agencies. CBNG development in the PRB is affecting agencies involved in permitting and monitoring in two States and two Tribes. To enhance coordination among interested agencies and reduce duplication of effort, the BLM organized the Powder River Natural Gas Interagency Working Group (PRB IWG). The PRB IWG charter states that it “was established as the forum for government agencies to address, discuss,



and find solutions to issues of common concern to all parties involved in permitting and monitoring of CBNG development” (Powder River Natural Gas Interagency Working Group, 2004). Led by the BLM, the PRB IWG 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 vision of the PRB IWG is to provide for development of natural gas resources while protecting the cultural and natural resources of the PRB. 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 databases and scientific studies needed for effective resource management and planning, and (5) promote compatibility in the application of each agency’s mission.

In order to 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 (Clark and others, 2005). The task groups include air, aquatics, water, and wildlife.

Aquatics Task Group

The development of CBNG and subsequent disposal of ground water from CBNG wells into surface drainages and impoundments may degrade aquatic habitats, species, and populations. The Aquatics Task Group (ATG) was established to address issues related to aquatic biota in the PRB. The ATG's membership includes technical specialists from the Bureau of Indian Affairs (BIA), BLM, MDEQ, MFWP, USEPA, U.S. Forest Service (USFS), USGS, WDEQ, WGFD, and others. Objectives for this group were to (1) develop aquatic habitat and species monitoring plans for watersheds with current or anticipated CBNG development and (2) make recommendations to PRB IWG regarding measures to avoid or minimize effects of CBNG development on aquatic species. If preventing substantial development effects is not possible, the task group will make recommendations of measures to mitigate CBNG development effects and methods to assess the effectiveness of the measures.

The ATG developed an aquatic-biota monitoring plan that describes monitoring of aquatic biota and their habitat for drainage basins with current and anticipated CBNG development. The objectives of this monitoring plan are to (1) establish current conditions for aquatic biota and their habitat and (2) determine existing and potential effects of CBNG discharge waters on aquatic life. Although it is too late to establish a true baseline of conditions before CBNG development, the current condition of aquatic communities and habitat can be assessed.

Sampling to assess the current (2005) condition of aquatic communities was conducted by the USGS in cooperation with the BLM, MDEQ, MFWP, USEPA, WDEQ, and WGFD. A total of 47 sites were sampled (fig. 1). The scope of work varied according to the river system and the interests of the cooperators from Wyoming (26 sites) and Montana (21 sites) as shown in table 1 and described in this fact sheet.

Summary of Aquatic-Community Sampling in 2005

Data collected for the assessment of aquatic communities included measurements for habitat, fish community, algae, and benthic macroinvertebrates. Sampling and measurement techniques were derived from the USEPA Environmental Monitoring and Assessment Program (EMAP) protocols for habitat and fish community (with some modifications) and the USGS National Water-Quality Assessment (NAWQA) Program protocols for algae and benthic macroinvertebrates.

Habitat transects were established at all 47 sites (table 1) sampled in Montana and Wyoming. Reach lengths in all streams except the main stem Powder River were defined as 40 wetted channel widths (Peck and others, 2003), with a minimum reach length of 200 meters and a maximum reach length of 1,000 meters. Eleven transects, equally spaced along the reach, were established for measurement of variables such as wetted and bankfull width, bank and streambed substrate, embeddedness, bank angle, canopy cover, and fish cover. At Wyoming sites, a longitudinal profile of the streambed, water surface, bankfull stage and low terraces, if any, were surveyed as described by Harrelson and others (1994). Within each reach, two to four cross sections were monumented with rebar when possible for

Table 1. Sites sampled as part of aquatic-community monitoring program during 2005.

[X, data were collected; X¹, fish community data collected by Wyoming Game and Fish Department; X², cross-sections completed by the Wyoming Department of Environmental Quality; X³, data collected by the Wyoming Department of Environmental Quality]

Map number	USGS station identification number	Site name	Habitat transects and cross-sections	Longitudinal profiles	GPS Mapping	Algae	Invertebrates	Fish community	Major ion samples
R1	06295113	Rosebud Creek at Reservation Boundary, near Kirby, MT	X				X	X	
R2	06296003	Rosebud Creek at mouth, near Rosebud, MT	X				X	X	
T1	06299980	Tongue River at Monarch, WY	X	X		X	X	X	
T2	06305700	Goose Creek near Acme, WY	X	X		X	X	X	
T3	450137106595101	Youngs Creek near Reservation Boundary, near Decker, MT	X				X	X	X
T4	445832106551401	Youngs Creek above mouth, near Decker, MT	X				X	X	X
T5	445957106524701	Tongue River below Youngs Creek, near Decker, MT	X				X	X	X
T6	06306100	Squirrel Creek near Decker, MT	X				X	X	X
T7	450047106514201	Squirrel Creek above Mouth at Decker, MT	X				X	X	X
T8	06306250	Prairie Dog Creek near Acme, WY	X	X		X	X	X	
T9	06306300	Tongue River at State Line, near Decker, MT	X	X		X	X	X	
T10	451607106372801	Tongue River at Prairie Dog Creek, near Decker, MT	X				X	X	X
T11	06307570	Hanging Woman Creek below Horse Creek, near Birney, MT	X				X	X	X
T12	451340106295501	Hanging Woman Creek below Hay Gulch, near Birney, MT	X				X	X	X
T13	06307600	Hanging Woman Creek near Birney, MT	X				X	X	
T14	06307616	Tongue River at Birney Day School Bridge, near Birney, MT	X				X	X	
T15	451732106085001	Otter Creek below Taylor Creek, near Otter, MT	X				X	X	X
T16	452642106091201	Otter Creek below Tenmile Creek, near Ashland, MT	X				X	X	X
T17	06307740	Otter Creek at Ashland, MT	X				X	X	
T18	06307830	Tongue River below Brandenburg Bridge, near Ashland, MT	X				X	X	
T19	06308400	Pumpkin Creek near Miles City, MT	X				X	X	
P1	434056106244101	Powder River above Lone Tree Draw, near Sussex, WY	X		X	X	X	X ¹	X
P2	434124106192401	Powder River below Salt Creek, near Sussex, WY	X		X	X	X	X ¹	X
P3	435453106104701	Powder River below Willow Creek, near Sussex, WY	X		X	X	X	X ¹	X
P4	440919106091401	Powder River above Van Houghton Draw, near Buffalo, WY	X		X	X	X	X ¹	X
P5	442538106082001	Powder River below Mitchell Draw, near Arvada, WY	X		X	X	X	X ¹	X
P6	441532106251301	Crazy Woman Creek below I-90, near Buffalo, WY	X	X	X	X	X	X	X
P7	442817106133001	Crazy Woman Creek near Upper Station, near Arvada, WY	X	X	X	X	X	X	X
P8	443025106061601	Powder River below Crazy Woman Creek, near Arvada, WY	X		X	X	X	X ¹	X
P9	444857106030401	Powder River above Ivy Creek, near Arvada, WY	X		X	X	X	X ¹	X
P10	06324000	Clear Creek near Arvada, WY	X	X		X	X	X	
P11	445339106032501	Powder River below Clear Creek, near Arvada, WY	X		X	X	X	X ¹	X
P12	06324500	Powder River at Moorhead, MT	X		X	X	X	X	
P13	06324710	Powder River at Broadus, MT	X		X	X	X	X	
P14	06324790	Little Powder River at State Hwy 59, near Gillette, WY	X	X		X	X	X	X
P15	06324970	Little Powder River above Dry Creek, near Weston, WY	X	X		X	X	X	
P16	06325000	Little Powder River at Biddle, MT	X				X	X	X
P17	453209105201201	Powder River below Little Powder River, near Broadus, MT	X				X	X	X
P18	06326500	Powder River near Locate, MT	X				X	X	
B1	06425720	Belle Fourche River below Rattlesnake Creek, near Piney, WY	X	X		X	X	X	
B2	06425900	Caballo Creek at mouth, near Piney, WY	X	X		X	X	X	
C1	06364300	Porcupine Creek near Teckla, WY	X	X		X	X	X	
C2	06364700	Antelope Creek near Teckla, WY	X ²	X ³		X	X	X	
C3	06365900	Cheyenne River near Dull Center, WY	X ²	X ³		X	X	X	
C4	06375600	Little Thunder Creek near Hampshire, WY	X	X		X	X	X	
C5	06376300	Black Thunder Creek near Hampshire, WY	X ²	X ³		X	X	X	
C6	06386500	Cheyenne River near Spencer, WY	X ²	X ³		X	X	X	

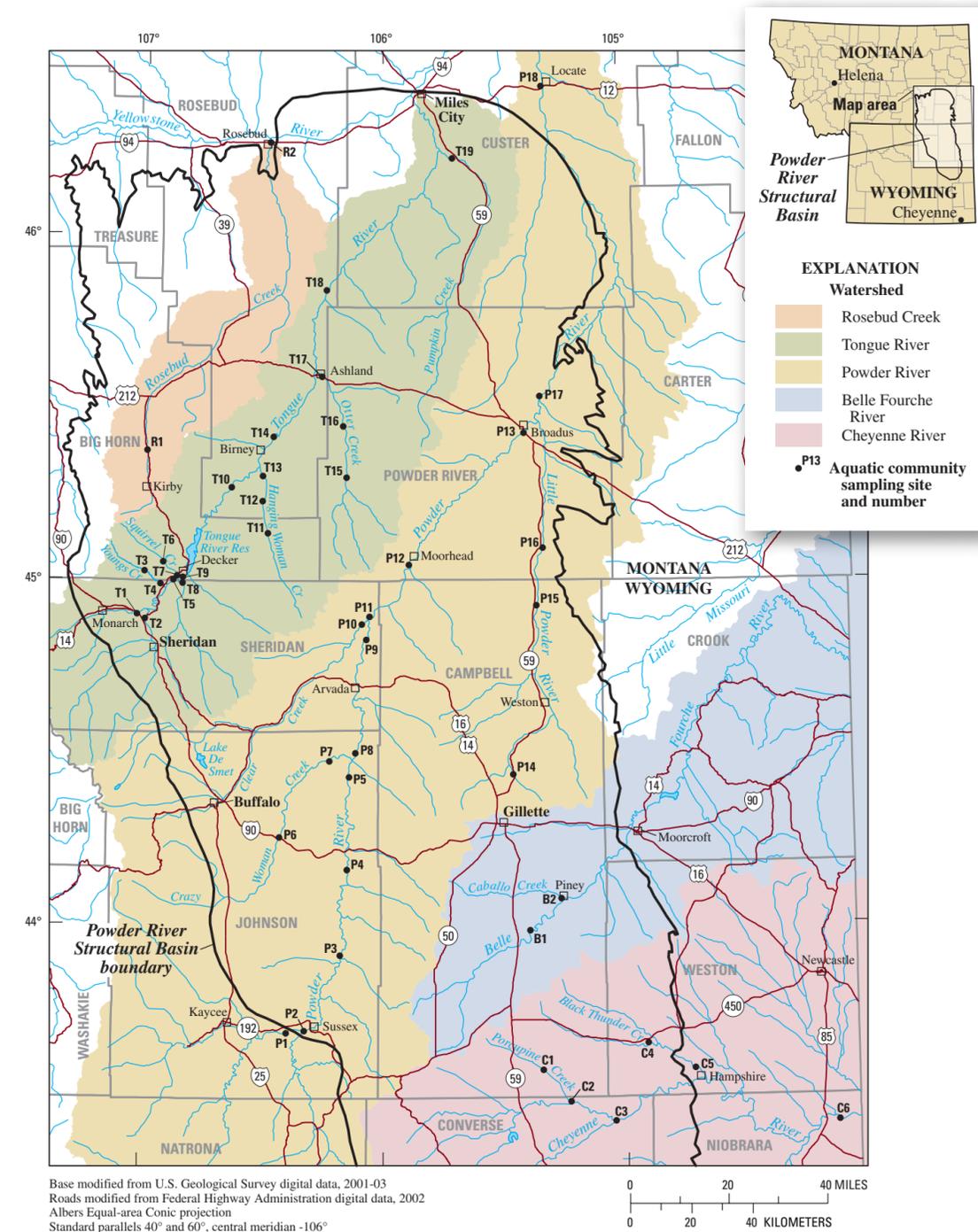


Figure 1. Sampling sites for aquatic communities in northeastern Wyoming and southeastern Montana.

long-term reference. A 100-particle pebble count was completed in at least one riffle cross section and one pool cross section (Wolman, 1954). At Montana sites, two to four cross sections were monumented and surveyed when possible; however, longitudinal profiles and pebble counts were not done.

Habitat data collection varied between the main stem Powder River and all other streams sampled (table 1). The Powder River was sampled differently than the other streams due to its continuously shifting sand habitats. The WGFD established 2-mile study reaches on the main stem Powder River in Wyoming during 2004. WGFD and USGS personnel coordinated field efforts and jointly sampled sites on the mainstem Powder River in Wyoming in 2005. Fish community and mesohabitat mapping was conducted in the spring of the year (pre-runoff) and during low-flow conditions in July. WGFD personnel collected fish samples and made warm-water stream assessments during both sampling periods following WGFD protocols (Dave Zafft, Wyoming Game and Fish Department, written commun., 2005). USGS personnel provided high-resolution global-positioning system mapping of mesohabitat types (riffle, run, shoal, pool, and isolated backwater) for both periods. During low-flow sampling of Powder River sites in Wyoming, habitat sampling was performed by USGS personnel using a modified version of the EMAP and Harrelson and others (1994) protocols. USGS personnel also collected samples for algae and benthic macroinvertebrates. Along the main stem Powder River in Montana, USGS personnel used WGFD protocols to determine sampling reaches and assess fish populations. Stream-habitat transects along the main stem Powder River were sampled in the same manner in both Wyoming and Montana. A transect was set across each habitat sampled for fish, and applicable features along each of these transects were recorded following the EMAP protocol.



Powder River above Lone Tree Draw, near Sussex, Wyoming (site P1) (photograph by Kendra Remley).

Benthic macroinvertebrates were collected at each of the 47 sites (table 1) following NAWQA protocols (Moulton and others, 2002). At sites where riffles were available in the stream reach, riffles were sampled as the richest targeted habitat (RTH). Each RTH sample was a composite, semi-quantitative sample from five points, with a total sampled area of 1.25 square meters. About 75 percent of the ATG sites sampled in 2005 had riffles and RTH samples. A qualitative multi-habitat (QMH) sample of macroinvertebrates was collected at all sites and func-



Invertebrate sampling at Prairie Dog Creek near Acme, Wyoming (site T8) (photograph by Kendra Remley).

tioned as the primary sample at sites where riffles were absent. The QMH sample was a timed collection (1 hour) of macroinvertebrates from the various microhabitats in the reach, such as logs, macrophytes, and soft substrates. The macroinvertebrate samples were sent to Utah State University for taxonomic analysis.

Algae samples were collected at 24 sites in Wyoming and 2 sites in Montana near the State line (table 1). At each site where riffles were available, semi-quantitative samples of periphytic algae were scraped from 25 rocks and composited into a RTH sample following NAWQA protocols (Moulton and others, 2002). At sites without riffles, periphyton samples were collected from depositional targeted habitat (DTH) in the euphotic zone of pools. A subsample of the RTH algae samples was frozen on dry ice and sent to the USGS National Water Quality Laboratory for analysis of chlorophyll-*a* and ash-free dry mass. The RTH and DTH algae samples were sent to a laboratory for taxonomic analysis following procedures described by Charles and others (2002).

Fish communities were sampled at each site from a reach length of 40 mean-wetted-channel widths following EMAP protocols (Peck and others, 2003) with the exception of sites on the Powder River that were described previously. Most fish samples



Fish community sampling at Tongue River at State line near Decker, Montana (site T9) (photograph by Mike Sweat).

were collected by seining, although sites on the main stem of the Tongue River and some of the tributaries to the Tongue River were sampled by electrofishing. Fish generally were released back to the stream after sampling, but voucher specimens of a few fish were retained for taxonomic confirmation and identification of unknown or difficult-to-identify specimens. A quality-assurance plan for fish taxonomy was developed for this project.

Data Availability

Additional information about the ATG project, including the data collected to date are available at URL: <http://wy.water.usgs.gov/projects/atg/>. Data which are currently available include chlorophyll-*a* and ash-free dry mass concentrations in algae samples and major-ion concentrations in water samples collected in conjunction with ecology samples. Water-quality samples were collected only at sites where water quality is not currently monitored (table 1) as part of the Water Task Group's surface-water monitoring program. All water-quality data collected by the USGS, including major-ion data collected as part of the monitoring plan are stored electronically in the USGS National Water Information System and are available at URL: <http://waterdata.usgs.gov/nwis/>. More information about the PRB IWG and Task Group activities is available at URL: <http://www.wy.blm.gov/bfo/prbgroup/index.htm>.



Hanging Woman Creek near Birney, Montana (site T13) (photograph by Stacey Kinsey).

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