Regional Surface Water Monitoring Plan

Prepared by the Coalbed Natural Gas Interagency Working Group - Hydrology Task Group

Purpose: Regional surface water monitoring is needed to assess the impacts of CBNG water discharges to surface waters quality and quantity (flow) in the Powder River Basin (PRB). This monitoring will be used to monitor overall regional conditions. This monitoring is not specific to any particular project.

Objectives:

- Establish baseline conditions for surface water flow and water quality.
- Determine the effects of CBNG water discharges on surface water quality and quantity.
- Monitor water quality for potential downstream impacts.

Scope: The Rosebud Creek, Tongue River, Powder River, Belle Fourche River, and Cheyenne River watersheds have been identified as needing monitoring for CBNG related effects. The Tongue and Powder Rivers flow from Wyoming into Montana, the Belle Fourche River and the Cheyenne River flow from Wyoming into South Dakota, and Rosebud Creek is located completely in Montana.

Methods: Streamflow and water quality information will be collected at USGS monitoring stations. The frequency of this data collection, and the specific parameters analyzed, will depend upon the specific station being considered and past monitoring results. The parameters analyzed may include common ions, metals, nutrients, total suspended solids, pH, EC, temperature, and dissolved oxygen, among others. The data will be compared to historical data to determine the trends associated with CBNG discharge to surface water. Water quality must be analyzed in direct relation to flow volume at the time of sample collection to assess changes in water quality under variable flow conditions. The stations included in the network, parameters analyzed, and the frequency of sampling will be evaluated annually to optimize the network.

Products: Surface water quality and quantity information will be tabulated, graphed, compared to historical conditions, compared to applicable surface water quality standards and compared to predictions made in the CBNG EISs. A monitoring summary report will be prepared annually. Recommendations concerning changes in stations, parameters and frequency of sampling will be included in the annual report. Following 3 years of data collection an interpretive report will be prepared and released in coordination with the TMDL process (305(b)/303(d) lists) (it is anticipated that this first interpretive report would need to be completed by approximately December 2007). An interpretive report will be prepared every 2 years thereafter in coordination with the TMDL process.

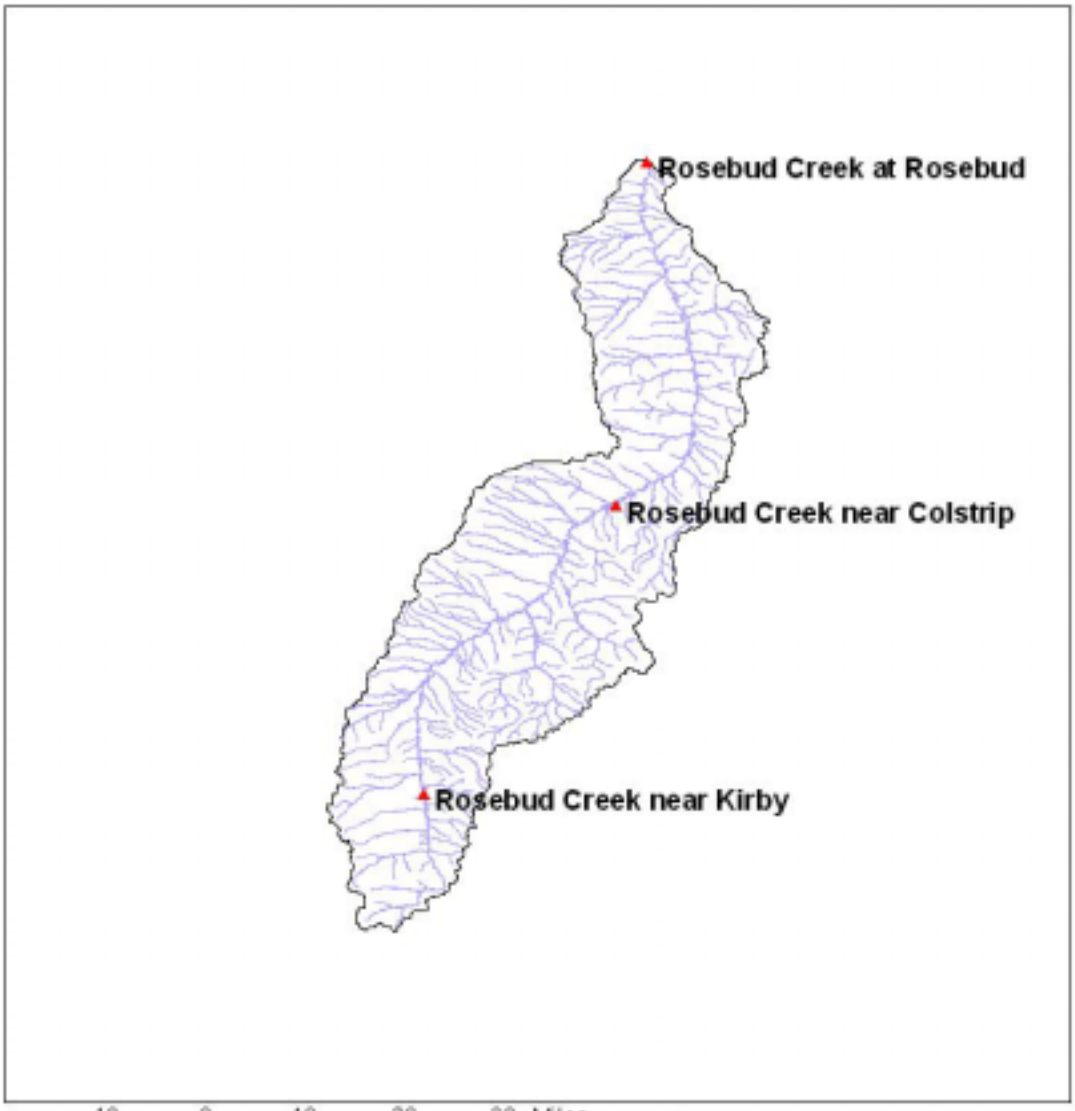
Responsibilities: The collection of surface water information will be a cooperative effort. Currently surface water monitoring stations are supported by the USGS, BLM, MDEQ, WDEQ, SDDENR, WYSEO, and the Northern Cheyenne Tribe. Annual reporting will be coordinated by the USGS with appropriate funding and input from other agencies.

Cost: Estimated cost per station is summarized on the attached spreadsheets.

Proposed Locations: See attached spreadsheets and maps.

Maps

Proposed Rosebud Creek Watershed
Regional Surface Water Monitoirng Network



10 0 10 20 30 Miles

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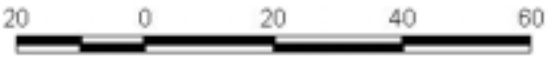
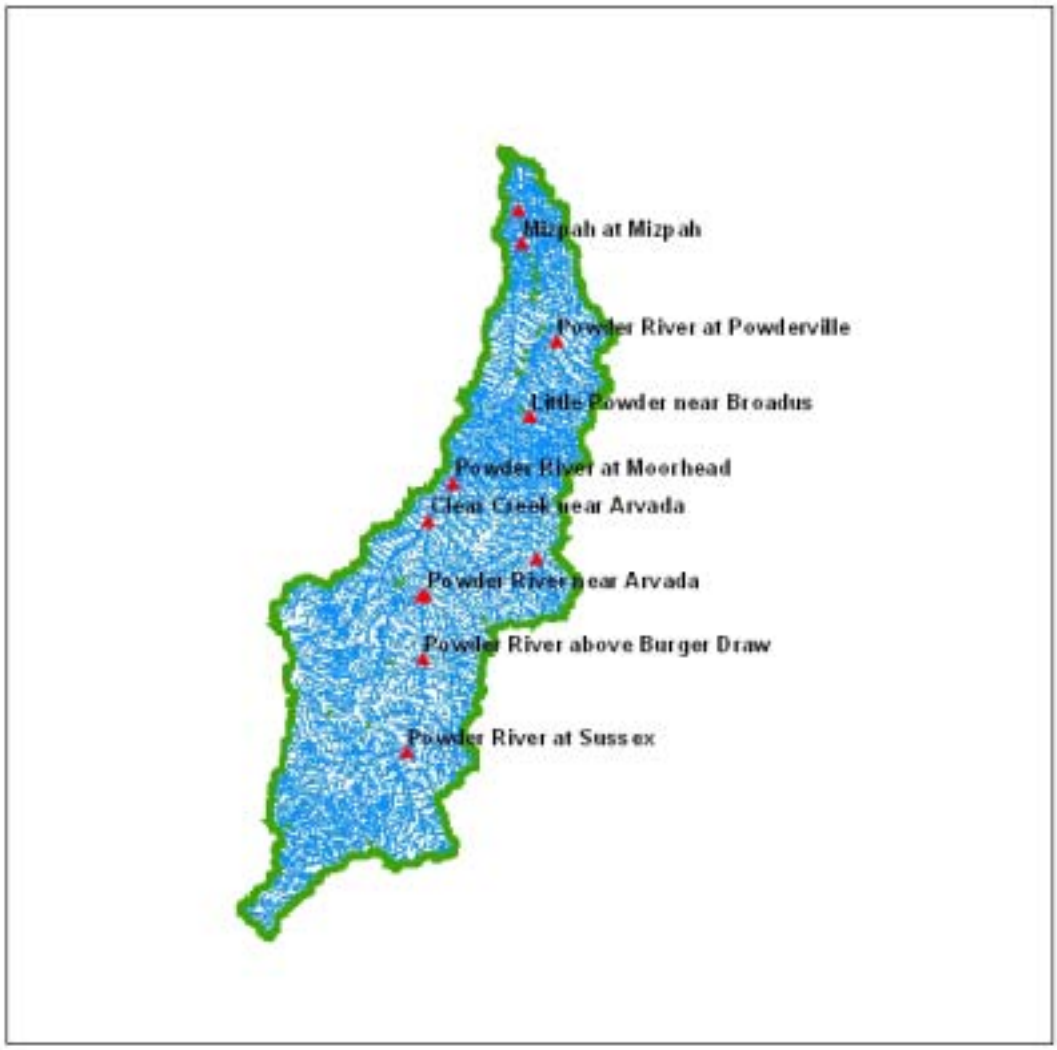
Proposed Tongue River Watershed
Regional Surface Water Monitoirng Network



Proposed Powder River Watershed
Regional Surface Water Monitoirng Network



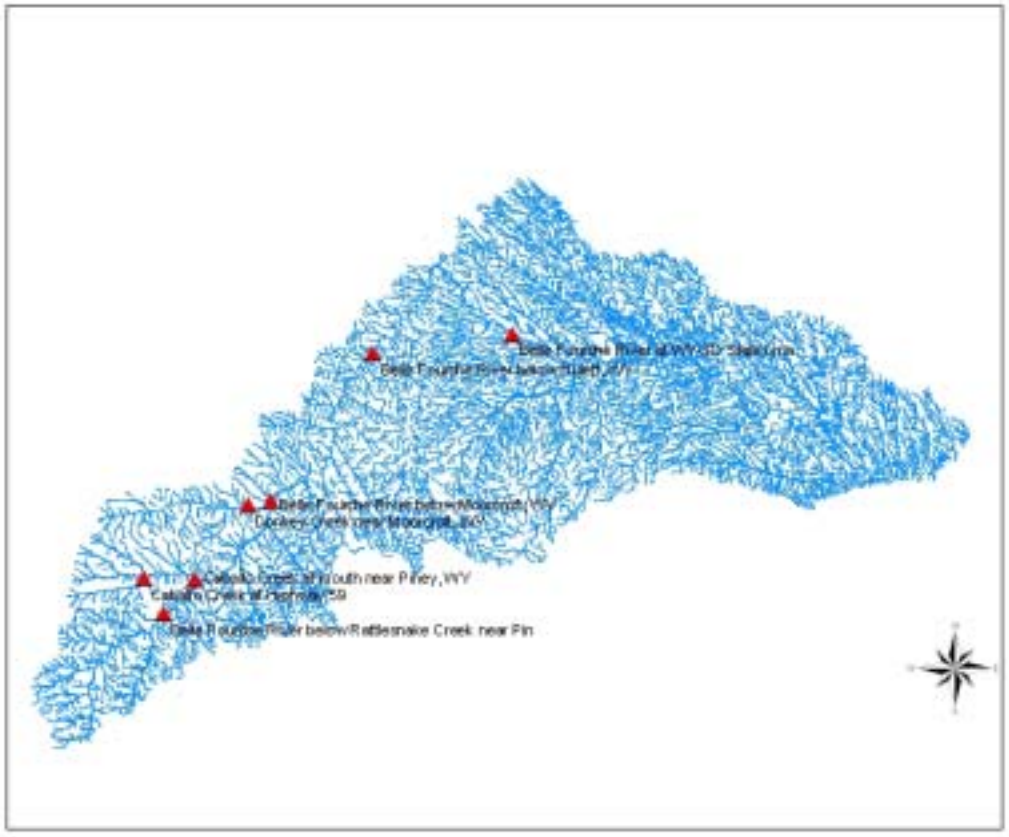
1:3,500,000

0 25 50 100 150 200 Miles

Legend

- Powder USGS Stations
- powder 3rd

Proposed Belle Fourche River Watershed
Regional Surface Water Monitoring Network



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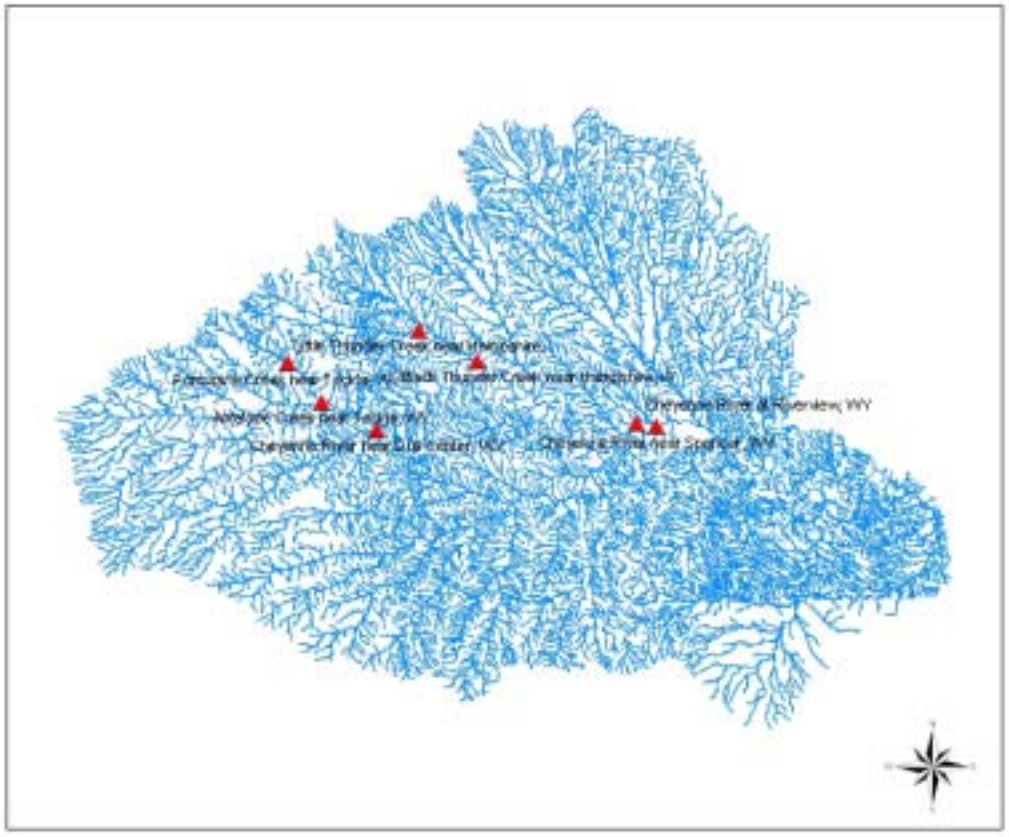
Legend

▲ Belle Fourche USGS Stations

Proposed Cheyenne River Watershed
Regional Surface Water Monitoring Network



1:1,413,412

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Legend

▲ Cheyenne USGS Stations

Comparison Tables

Comparison Matrixes

Annual Report Outline

Annual Monitoring Report Outline

Abstract (or Executive Summary)

This section of the report will provide the annual summary of data collected as part of the coalbed natural gas (CBNG) monitoring network developed by the Water Task Group.

Introduction

This section will include:
1) Background information on (CBNG) development in the following watersheds in Wyoming and Montana:

- Rosebud Creek,
- Tongue River,
- Powder River,
- Cheyenne River, and
- Belle Fourche River

2) Description of the monitoring networks by watershed; and

3) Discussion of constituents being monitored, including a discussion of trace-elements phases (dissolved and total) and relation with State water-quality standards for Wyoming and Montana.

Water-Quality Conditions by Watershed

This section is organized by watershed and generally is designed to parallel the 305(b) report format. Several data summaries were identified that would be beneficial to the compilers of the 305(b) reports. The data summaries include:

- Summary statistics for selected constituents;
- Comparisons to State water-quality criteria;
- Time-series plots of selected constituents of interest; and
- Comparisons of sodium adsorption ratios (SAR) and specific conductance to the Final Environmental Impact Statement (FEIS) model predictions.

The selected water-quality constituents to possibly be discussed in this section of the report are shown in table 1.

Table 1. Selected water-quality constituents for summary statistics.

Temperature, water, degrees Celsius
Temperature, air, degrees Celsius
Barometric pressure, millimeters of mercury
Discharge, instantaneous, cubic feet per second
Specific conductance, water, unfiltered, microsiemens per centimeter at 25 degrees Celsius
Dissolved oxygen, water, unfiltered, milligrams per liter
pH, water, unfiltered, field, standard units
Calcium, water, filtered, milligrams per liter
Magnesium, water, filtered, milligrams per liter
Sodium, water, filtered, milligrams per liter
Potassium, water, filtered, milligrams per liter
Chloride, water, filtered, milligrams per liter
Sulfate, water, filtered, milligrams per liter
Fluoride, water, filtered, milligrams per liter
Silica, water, filtered, milligrams per liter
Alkalinity, water, filtered, fixed endpoint (pH 4.5), in milligrams per liter as calcium carbonate
Residue on evaporation, dried at 180 degrees Celsius, in milligrams per liter
Aluminum, water, unfiltered, recoverable, micrograms per liter
Arsenic, water, filtered, micrograms per liter
Barium, water, unfiltered, recoverable, micrograms per liter
Beryllium, water, unfiltered, recoverable, micrograms per liter
Iron, water, filtered, micrograms per liter
Manganese, water, filtered, micrograms per liter
Selenium, water, unfiltered, micrograms per liter

Data summaries to be included in the report are for Rosebud Creek; Tongue River mainstem and selected tributaries; Powder River and selected tributaries; Cheyenne River and selected tributaries; and Belle Fourche River and selected tributaries. Descriptions of the summaries for each watershed follow:

Rosebud Creek

Rosebud Creek Mainstem

- Summary statistics for selected water-quality constituents
- Summary table of water-quality comparisons for constituents with Montana water-quality criteria
- Time Series plots for selected constituents of discharge, specific conductance, calcium, magnesium, sodium, and iron

Tongue River

Tongue River Mainstem

- Summary statistics for selected water-quality constituents

- Summary table of water-quality comparisons for constituents with criteria:
  for sites within Wyoming—data compared to Wyoming water-quality criteria
  for sites within Montana—data compared to Montana water-quality criteria
  for sites near Stateline—data compared to Wyoming and Montana water-quality criteria

- Time Series plots for selected constituents of discharge, specific conductance, calcium, magnesium, sodium, and iron

- Comparisons of SAR and specific conductance to FEIS model predictions

Goose Creek

- Summary statistics for selected water-quality constituents

- Summary table of water-quality comparisons for constituents with both Wyoming and Montana water-quality criteria (site near Stateline)

- Time Series plots for selected constituents of discharge, specific conductance, calcium, magnesium, sodium, and iron

Prairie Dog

- Summary statistics for selected water-quality constituents

- Summary table of water-quality comparisons for constituents with both Wyoming and Montana water-quality criteria (site near Stateline)

- Time Series plots for selected constituents of discharge, specific conductance, calcium, magnesium, sodium, and iron

Hanging Woman

- Summary statistics for selected water-quality constituents
- Summary table of water-quality comparisons for constituents with Montana water-quality criteria
- Time Series plots for selected constituents of discharge, specific conductance, calcium, magnesium, sodium, and iron

Otter Creek

- Summary statistics for selected water-quality constituents
- Summary table of water-quality comparisons for constituents with Montana water-quality criteria
- Time Series plots for selected constituents of discharge, specific conductance, calcium, magnesium, sodium, and iron

Pumpkin Creek

- Summary statistics for selected water-quality constituents
- Summary table of water-quality comparisons for constituents with Montana water-quality criteria
- Time Series plots for selected constituents of discharge, specific conductance, calcium, magnesium, sodium, and iron

Powder River

Powder River Mainstem

- Summary statistics for selected water-quality constituents
- Summary table of water-quality comparisons for constituents with criteria:
  for sites within Wyoming—data compared to Wyoming water-quality criteria
  for sites within Montana—data compared to Montana water-quality criteria

for sites near Stateline—data compared to Wyoming and Montana water-quality criteria

- Time Series plots for selected constituents of discharge, specific conductance, calcium, magnesium, sodium, and iron

- Comparisons of SAR and specific conductance to FEIS model predictions

Crazy Woman

- Summary statistics for selected water-quality constituents

- Summary table of water-quality comparisons for constituents with Wyoming water-quality criteria

- Time Series plots for selected constituents of discharge, specific conductance, calcium, magnesium, sodium, and iron

- Comparisons of SAR and specific conductance to FEIS model predictions

Clear Creek

- Summary statistics for selected water-quality constituents

  Summary table of water-quality comparisons for constituents with both Wyoming and Montana water-quality criteria (site near Stateline)

- Time Series plots for selected constituents of discharge, specific conductance, calcium, magnesium, sodium, and iron

- Comparisons of SAR and specific conductance to FEIS model predictions

Little Powder

- Summary statistics for selected water-quality constituents

- Summary table of water-quality comparisons for constituents with criteria:

for site within Montana—data compared to Montana water-quality criteria
for site near Stateline—data compared to Wyoming and Montana water-quality criteria

- Time Series plots for selected constituents of discharge, specific conductance, calcium, magnesium, sodium, and iron

- Comparisons of SAR and specific conductance to FEIS model predictions

Mizpah Creek

- Summary statistics for selected water-quality constituents

- Summary table of water-quality comparisons for constituents with Montana water-quality criteria

- Time Series plots for selected constituents of discharge, specific conductance, calcium, magnesium, sodium, and iron

- Comparisons of SAR and specific conductance to FEIS model predictions

Cheyenne River

Cheyenne River Mainstem

- Summary statistics for selected water-quality constituents

- Summary table of water-quality comparisons for constituents with criteria:
for sites within Wyoming—data compared to Wyoming water-quality criteria
for sites near Stateline—data compared to Wyoming and South Dakota water-quality criteria

- Time Series plots for selected constituents of discharge, specific conductance, calcium, magnesium, sodium, and iron

- Comparisons of SAR and specific conductance to FEIS model predictions

Antelope Creek

- Summary statistics for selected water-quality constituents
- Summary table of water-quality comparisons for constituents with Wyoming water-quality criteria
- Time Series plots for selected constituents of discharge, specific conductance, calcium, magnesium, sodium, and iron
- Comparisons of SAR and specific conductance to FEIS model predictions

Black Thunder

- Summary statistics for selected water-quality constituents
- Summary table of water-quality comparisons for constituents with Wyoming water-quality criteria
- Time Series plots for selected constituents of discharge, specific conductance, calcium, magnesium, sodium, and iron

Belle Fourche River

Belle Fourche Mainstem

- Summary statistics for selected water-quality constituents
- Summary table of water-quality comparisons for constituents with criteria:
  for sites within Wyoming—data compared to Wyoming water-quality criteria
  for sites near Stateline—data compared to Wyoming and South Dakota water-quality criteria
- Time Series plots for selected constituents of discharge, specific conductance, calcium, magnesium, sodium, and iron
- Comparisons of SAR and specific conductance to FEIS model predictions

Caballo Creek

- Summary statistics for selected water-quality constituents
- Summary table of water-quality comparisons for constituents with Wyoming water-quality criteria
- Time Series plots for selected constituents of discharge, specific conductance, calcium, magnesium, sodium, and iron

Donkey Creek

- Summary statistics for selected water-quality constituents
- Summary table of water-quality comparisons for constituents with Wyoming water-quality criteria
- Time Series plots for selected constituents of discharge, specific conductance, calcium, magnesium, sodium, and iron

Summary of Water-Quality Conditions

This section of the report will include an overall summary of water-quality conditions. This section may include general comparisons between watersheds.

Appendix 1—Data Tables

This section proposed to include data tables of discrete water-quality samples for each of the sites, in order by the drainage basins:

Rosebud Creek
Tongue River
Powder River
Cheyenne River
Belle Fourche River