

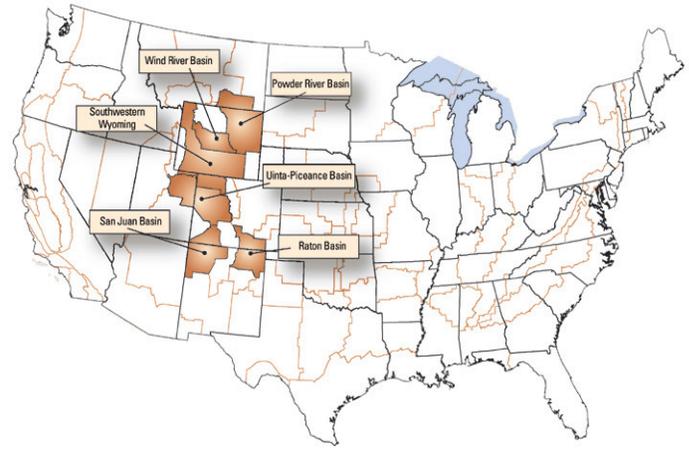


Research, Education, Extension

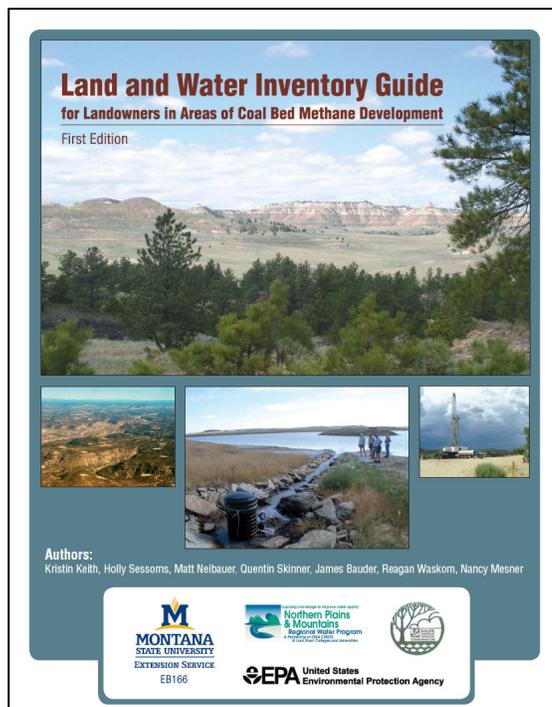
## Land and Water Resources Inventory Guide

### Educational programs to assist landowners in areas of coal bed methane development

Coal bed methane (CBM) is natural gas extracted from coal seams. CBM development requires extensive infrastructure and has the potential to produce large volumes of by-product water. This water can be discharged, re-injected, evaporated, or used for livestock and irrigation. To address the potential impacts to land and water resources associated with CBM development, the CSREES Northern Plains and Mountains Regional Water Program in Region 8 has developed an inventory guide for landowners and resource managers throughout the region. This guide was tested by landowners in Colorado, Montana, and Wyoming and served as the centerpiece for a landowner training session in Colorado in the fall of 2005. Future training sessions are being scheduled to assist landowners with resource monitoring.



Major coal bed methane fields in the Rocky Mountain Region. Source: USGS Fact Sheet 158-02



The purpose of this guide is to empower landowners, natural resource managers, and tribal members in CBM development areas to:

- Understand potential benefits, impacts, and issues of concern in areas of CBM development
- Understand rights and responsibilities of landowners and CBM developers
- Inventory the current condition of land and water resources using scientific protocol
- Use this inventory for negotiation during the CBM development process and as a baseline for tracking impacts from CBM development
- Understand management practices to protect land and water resources once CBM development begins
- Learn how to identify situations in which more detailed monitoring may be necessary

*The goal of the Northern Plains and Mountains Regional Water Program is to protect and improve the quality of water resources by facilitating development, delivery, and implementation of new and existing practices throughout the region.*

Instructions for collecting objective baseline data and for implementing a consistent monitoring program are outlined in the guide.

- **Photo-monitoring** creates permanent records using repeated photographs over time to observe and document changes in range, water, and cultural resources.
- **Well and infrastructure monitoring** creates a record of road, well, well pad, and other CBM infrastructure conditions.
- **Surface water monitoring** protocol and record sheets are for landowners in areas where large volumes of CBM product water are discharged onto the landscape.
- **Soil monitoring** may be necessary and prudent for landowners intending to irrigate with CBM product water.
- **CBM irrigation water quality monitoring** enables landowners to determine the suitability of CBM product water for irrigation purposes.
- **Crop production monitoring record sheets** are included to track the production of crops irrigated with CBM product water.
- **Ground water monitoring** is intended for landowners concerned about potential impacts of CBM development on the water table and on ground water quality.



**Example Record Sheets:**

**SOIL SAMPLE RECORD SHEET**

Field Name or Number: \_\_\_\_\_

**Soil Sampling:**  
 Person/company performing soil sampling: \_\_\_\_\_  
 Laboratory name, address and phone number: \_\_\_\_\_  
 Location of laboratory reports: \_\_\_\_\_  
 Sample location or GPS coordinates: \_\_\_\_\_

**Soil Sample Laboratory Data**

Date of test	Sample depth	pH	EC* in dS/m or mmhos/cm	Na	Ca	Mg	SAR

\* EC = TDS in parts per million / 640      \*\*see page 57 to calculate SAR

**Coal Bed Methane: Monitoring Instructions and Record Sheets**

**PHOTO-MONITORING RECORD SHEET**

Site name: \_\_\_\_\_      Location: \_\_\_\_\_  
 Position of sun to the camera: \_\_\_\_\_      Camera: \_\_\_\_\_  
 Direction of photo from camera: \_\_\_\_\_  
 GPS Coordinates: \_\_\_\_\_      Monitoring objective: \_\_\_\_\_

Description and location of specific permanent photo point: \_\_\_\_\_  
 Questions to be addressed by photo-monitoring: \_\_\_\_\_

Fixed landmark location: \_\_\_\_\_  
 Distance and direction to specific permanent photo point from fixed land mark: \_\_\_\_\_  
 Expected response to changes in landform associated with CBM extraction activities: \_\_\_\_\_

Record of repeat photo monitoring:

Date	Time	Photographer	Photo ID	Notes

**Coal Bed Methane: Monitoring Instructions and Record Sheets**

## **Best Management and Best Engineering Practices**

A variety of best engineering (BEP) and best management practices (BMP) can be used to minimize impact of development and product water disposal on the landscape. Being involved early in the planning process can help you identify potential situations of impact before development begins. It may be beneficial to involve an engineer or a resource professional from the NRCS or a private consulting firm in the planning process to better understand options of engineering and management practices for the life of the development process. Below are a few examples of best engineering and/or management practices used in areas of CBM development.

### ***Land and Vegetation Resource BMPs***

- **Road construction and maintenance** corridors should be designed, located, and maintained to minimize impacts and optimize benefits for all interested parties.
- **Pipeline and powerline installation** done properly, minimizes impacts to the landscape and ranching operations during installation.
- **Wells and compressor stations** should be designed and constructed to minimize impacts to the landscape, ranching operations, wildlife habitat, aesthetic values and noise sensitivities of nearby landowners.
- **Reseeding** is essential in reestablishing permanent vegetative cover, reducing wind and water erosion, and preventing undesirable or noxious weed infestation.
- **Weed and pest management** should be planned for the life of the development process in areas of CBM development activity.
- **Soil amendments** should be carefully managed on sites with land application of CBM product water.

### ***Water Resource BMPs***

- **Vegetative filter strips** are a cost-effective and ecologically sensitive option for protecting land and water resources on more gently sloping landscapes.
- **Geotextiles** are synthetic mats, webbing, and ground covers to prevent surface or channel erosion, facilitate infiltration, retain soil moisture, and promote establishment of natural or planted vegetative cover.
- **Riprap** is rock used to protect slopes or channels from erosion.
- **Drop structures** are used to prevent head cutting on more sloped reaches of a stream channel or at the base of culverts and pond discharge sites.
- **Bridges and culverts** can be used in some situations for temporary or permanent stream crossings to prevent streambed and banks from degradation and erosion.
- **Water bars** are used to direct water across roads and travel corridors while minimizing erosion.
- **Terraces** are used to prevent water erosion on long, steep slopes.



Riprap used on a CBM storage pond.



Erosion control for overland discharge using rock and geotextile fabric

### **Additional CBM information**

In addition to monitoring information, the inventory guide explains the CBM extraction process, outlines some of the benefits and impacts associated with CBM, and describes CBM product water chemistry and current management practices. The rights and responsibilities of landowners and developers section is designed to provide landowners with a framework for researching mineral, surface, and split-estate rights, as well as to prepare landowners for the negotiation process with CBM developer.

Inventory Guides are being distributed throughout Wyoming, Colorado, Montana, Utah, and New Mexico. Although these guides are targeted towards landowners with CBM development on their property, they are also appropriate for landowners without CBM and who want to begin a time-efficient monitoring program.

### **For more information or to obtain a copy:**

A downloadable version of the Land and Water Inventory Guide for Landowners in Areas of Coal Bed Methane Development is available at the USDS-CSREES Region 8 Water Program website: [www.region8water.org](http://www.region8water.org) (on the home page and under Water Management/Conservation)

Hard copies can be obtained by contacting one of the regional coordinators or from MSU Extension Publications (1-406-994-3273, publication #EB166).

### **Partners and funding sources:**

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