

**CENTRAL REGION INTEGRATED SCIENCE PARTNERSHIP FUNDS
FY 03 Project/Activity Outcome Report**

Date: 9 January 2004
Project/Activity Title: Chemical and Physical Effects of a CBM Discharge Infiltration Impoundment
Account Number: AVS80
Principal Investigator: Myron Brooks
Partners/Collaborators and Affiliation: Mike McKinley, BLM
Total Funding Approved: \$50,000
Total Expenditures: \$50,000 (CRISP), \$82,000 (USGS in-kind), \$32,000 (BLM)

Objective of Project/Activity: *(Provide short description of project/activity goals and list outcomes/products.)*

The main goal for this project is to examine in detail the environmental consequences of disposal, via infiltration impoundments, of CBM-produced water. Two recently completed EIS's covering CBM development in the Powder River Basin in Wyoming and Montana project that infiltration impoundments will play a significant role in water disposal as development proceeds. Our approach is to support and foster interdisciplinary science at a common field site. Using water as the unifying factor, the ultimate objectives are to describe the flow paths and chemical evolution of water from an infiltration impoundment, describe how that water impacts and influences local ground and surface water quality, and, if feasible, to relate changes in hydrology to the functioning of nearby existing and newly created wetland plant communities. These objectives were beyond the reach of the initial effort that could be supported with available CRISP funds in FY'03. They also will require a multi-year data collection effort that greatly exceeded the available time in FY'03 (June through September). The team decided a reasonable approach would be to install instrumentation and collect samples and data as a start toward meeting larger project objectives with recognition that additional funding and time would be needed to fully meet those objectives. We were aware of interest from BLM in this work; in FY '03 BLM provided an additional \$38,000 to support USGS activities (primarily well installation) as well as in-kind assistance from their field technicians working at the site. An additional goal was to establish and promote the study site in a way that demonstrates USGS interdisciplinary capabilities to the BLM and other potential funding partners, hopefully providing a bridge to additional funding for work in subsequent fiscal years. The initial field site was chosen in consultation with BLM scientists located in the Buffalo field office. This site, known as Skewed Reservoir, was a compromise based upon BLM interests and needs, access to the site for heavy equipment such as drill rigs, landowner access and cooperation, and the willingness of the production company (Anadarko) to share operational data and to permit access for well installation and sampling. USGS science interests at the site were not fully met, as there were no existing wetland communities near the planned reservoir.

Project/Activity Accomplishments: *(What outcomes/products were achieved including what benefits were derived and by whom?)*

The initial goal of installing and sampling a series of monitoring points in and around a coalbed methane infiltration reservoir was achieved. Twenty monitoring wells were drilled and 4 lysimeters were installed in the June-September timeframe. Core material was collected during installation of selected monitoring wells and additional cores were collected at other locations.

Over 100 grab and continuous core samples were collected for further analysis. Some of those cores were collected from the reservoir bottom prior to completion of the dam and delivery of water to the reservoir. Water levels are being continuously recorded with pressure transducers in 6 of the monitoring wells; water levels in the remaining wells are measured monthly. Water level rises indicate movement of water from the reservoir into the surrounding subsurface system. Results of chemical analyses of water obtained from the monitoring wells and lysimeters indicates that the introduction of moderately saline (TDS ~ 2900 ppm) CBM water into the subsurface results in the dissolution of sulfate minerals and greatly increases the dissolved solids (TDS > 100,000 ppm) of the water as it infiltrates. This is an interesting preliminary result, as most concerns to date have been focused only on the chemical constituents in the CBM-produced waters. This preliminary finding is already being used by BLM in its efforts to identify sites for infiltration reservoirs that will minimize environmental degradation of existing water resources. Additional analyses planned for core samples include particle size analysis, moisture content, mineralogy, cation exchange capacity, unsaturated hydraulic conductivity, Cl^- and NO_3^- concentrations, and batch leach testing. Results from these analyses will help in defining recharge rates, and in explaining movement and geochemical evolution of the water as it travels from the infiltration reservoir through the shallow subsurface environment. An additional goal of establishing a site where USGS science capabilities could be demonstrated to DOI partners was achieved. Work at the site required significant coordination and collaboration with BLM scientists. BLM's interest in this work was evidenced by their contribution funds to increase the number of monitoring points and samples at the Skewed Reservoir site.

Final Results: *(Describe how funds awarded were used to promote Director's goals of integrated science)*

Fiscal year 2003 CRISP funding was \$50,000. In addition, the project was augmented by in-kind contributions of approximately \$82,000 provided by the four participating disciplines. These contributions were primarily salary time, but also included equipment, and laboratory and drilling services. Another \$38,000 was provided by BLM for well installation and equipment purchases. CRISP funds awarded to GD (\$6,000) were used to support salary and travel costs for site selection, coring and sampling, and to support salary costs of a student to perform laboratory analysis. CRISP funds awarded to Geography (\$7,000) were decreased by 72% to cover a fiscal shortfall in the Rocky Mountain Mapping Center. The remaining funds supported one site visit for two Geography scientists to meet with BLM personnel. They discussed the Skewed Reservoir site, presented Geography capabilities in landscape change analysis, and the functionality of the PRISAS web site. CRISP funds awarded to BRD (\$8,000) supported continuation of activities begun under the 2002 CRISP-funded effort that examined CBM related impacts to wetlands in Montana. These included redrafting a journal article describing a conceptual model for hypothetical effects of CBM development on wetlands, and presentations on this topic (seminars and a poster at AGU). CRISP funds awarded to WRD (\$29,000) supported salary and travel costs for field and laboratory work as well as drilling costs for monitoring well installation. Periodic conference call meetings to plan activities and discuss results, work at the field site, and interactions with BLM scientists have resulted in development of collaborative interdisciplinary relationships among the USGS scientists that were supported in FY '03 by the CRISP project. The dedication, professionalism and technical capabilities of team members have been noted by our BLM collaborators on several occasions. As work progresses at the site these relationships are expected to continue to grow, the quality and impact of USGS science will increase, and our visibility and relevance to the BLM will be enhanced.

