

Exhibit A

Scope of Work

WATER ACTIVITY NAME – Sand Wash Basin Coalbed Methane Production Depletive Effects on Water Resources Study

GRANT RECIPIENT – Moffat County

FUNDING SOURCE – Statewide Account (\$98,837) and Yampa/White Basin Account (\$20,000)

Introduction

This document outlines a scope of work for carrying out analyses relating to current and potential future levels of stream depletion generated by removal of water by coalbed methane (“CBM”) production wells in the Sand Wash Basin of Colorado (see attached map). This study is an effort led by the Colorado Geological Survey (“CGS”) in collaboration with the Colorado Oil and Gas Conservation Commission (“OGCC”) and the State Engineer’s Office Division of Water Resources (“DWR”). These agencies are part of the Colorado Department of Natural Resources (“DNR”).

Note that while most of the tasks described below are in narrative format, there are a few items that are assumed to be self-explanatory in nature and not requiring narrative discussion. These items are simply listed by heading and enumerated in accord with the overall structure of this scope.

Purpose and Goals

The purpose of this study is to develop a quantitative assessment of the levels of stream depletion or reduction in formation outflows (spring flows or flowing stream systems gaining from contact with formations) that may be occurring as a result of the removal of water by CBM wells, or that may occur if CBM development expands in the basin. It is recognized that CBM production in the Sand Wash Basin is in the early stages of development and that there currently may be little impact; accordingly, this study will characterize the target CBM formations with respect to water resources in anticipation of future CBM production. In other basins CBM production water has historically has been disposed by one or more methods, including re-injection into deep formations, discharge to the surface stream system, and ponding/evaporation. The concern has been raised that the removal of significant volumes of water from aquifers that may be tributary to the surface stream system could be resulting in stream depletions or a reduction in spring flows and/or formation outflows (accretions) that are of a magnitude sufficient to cause injury to senior water rights holders on over-appropriated stream systems throughout Colorado. An additional concern has also been raised that removal of this water may negatively impact local ground water users tapping the same stratigraphic intervals as targeted for CBM production. This study seeks to develop a reliable assessment as to the levels of depletion, definition of the areas where CBM is ongoing that might be classified as nontributary, definition of any potential correlations of water quality, geology, aquifer geometry, or formation/well depth that could lead to general guidelines about the potential for stream depletion. These results will be useful in either prompting or avoiding more detailed studies, and the development of recommendations for further data collection or investigations.

Scope/Focus Area

The analysis carried out under this scope of work will focus in the Sand Wash Basin of Colorado (see attached map). The overall analysis tasks to be included in this study are outlined below. The work product will be a comprehensive report presenting all analyses carried out, methods applied, assumptions, results, conclusions, and recommendations.

Sources of data that will be useful in carrying out the tasks involved in this study include, but are not

limited to the following: OGCC website, databases, and library; DWR maps, publications and data bases; USGS maps, reports and other publications; Colorado Geological Survey maps and publications; Bureau of Land Management maps and publications; and Colorado Department of Public Health and Environment data. Similar studies of stream depletions from CBM production have been completed for the Piceance, San Juan, and Raton Basins (see <http://geosurvey.state.co.us/Default.aspx?tabid=488>). Content and approach from these other studies may be instructive for the present study. It is likely that other useful information will be available from other sources, but those listed herein are considered as being most applicable and are expected to significantly reduce the amount of additional data development necessary to conduct the needed analyses. As part of the work on this project, the data sufficiency and quality and the need, if any, for additional data to effectively carry out the study will be clearly assessed and described.

At this time, an analysis of a two-phase (i.e., gas and water) system will not be considered. Depending on the results of this study, it may be recommended that an additional study be performed using a two-phase model.

Methodology

The depletion determination methodology applied to these analyses will be the analytical "Glover" methodology available in several formats. While it is recognized that the Glover methodology was developed for alluvial applications, it is considered to be the most easily applied tool for the level of study contemplated. The IDS "AWAS" program developed by Colorado State University is one acceptable tool for this analysis. If the hydrogeologic setting is appropriate, the methodology developed by S.S. Papadopoulos and Associates for the DNR study, "Coalbed Methane Stream Depletion Assessment Study – Northern San Juan Basin, Colorado" may also be useful. The report generated for this study will include a discussion of the assumptions and limitations of the Glover methodology and the applicable programs as applied to the determinations that are the subject of this study. A comparison of these assumptions and limitations to the actual conditions and geometries encountered will be required.

Scope Details

This section of the scope details the analyses that will be required for the Sand Wash Basin in Colorado. The study report will document the analysis, presenting the data utilized, the limitations of such data, if any, the methodologies applied, the results, and a thorough discussion of any problems or issues encountered during the analysis that would have a bearing on the outcome of the analysis.

The analysis will include as a minimum the following tasks.

1. CBM Gas Production and Associated Water Production

The levels of CBM production will be researched and assessed. As CBM production in the Sand Wash Basin is in the early stages of development analogies may need to be drawn for other basins where CBM development is more mature. This will include the following specific aspects:

1. Current Levels
 - a. Gas and Water Production
 - b. Development of Correlations between Gas and Water Production
2. Estimated Future Production Levels
 - a. Recent Production Trends and Projections
3. Well Densities and Distribution

2. Characterize Basin Stratigraphy and Structure

The geology will be adequately characterized to facilitate the depletion analyses for as many wells as will be required to sufficiently determine the overall levels of depletion in rate and annual volume and the location or locations of nontributary areas within the basin. As a minimum the following items will be addressed and summarized in the report:

1. Basin Stratigraphy
2. Target Producing Formations
3. Formation Gas Pressures and Areas of Gas Discharge
It is recognized that the existence of higher gas pressure in the formations and gas discharge from the formation water can have an impact on the ability of water to infiltrate into the formation in any such areas. Accordingly, the study will require identification of any such areas and an assessment of the potential for elevated gas pressures or gas discharge to reduce or eliminate stream depletion where it otherwise might be occurring, based on all other factors.
4. Basin Geologic Structure
5. Formation Outcrop Areas and Configuration
6. Spatial Variation in Lithologies or Characteristics Bearing on CBM Production

3. Characterize Regional Ground-water Flow Systems;

The hydrogeologic characteristics pertinent to the depletion analyses will be thoroughly assessed for each differing hydrologic regime so that reliable depletion analyses can be carried out within the basin. With respect to the aquifer characteristics noted below, it is required that, --assuming a range of values is developed -- the values utilized in the actual depletion analyses runs, and ultimately applied, will be assessed for reasonableness and appropriateness. In addition, there will be required sensitivity analyses on each characteristic used in the analyses so that the level of potential variation in the results can be understood. The work under this category will include assessments, at a minimum, of the following items:

1. Identification of Regional Ground Water Flow Systems:
 - Characterize Regional Ground Water Flow Systems;
 - Identify Target Intervals to be De-watered in Relation to Regional Ground Water Flow Systems;
 - Identify Potential Flow Pathways Between Target Intervals and Aquifers or Tributary Surface Water Systems;
 - Rank Potential Flow Pathways according to Potential to Impact to Tributary Water Within Regulatory Time Constraints.
2. Aquifer (or identified pathway) Characteristics:
 - Hydraulic Conductivities;
 - Saturated Thicknesses;
 - Porosities and Specific Yield Values.
3. Aquifer Extent and Boundary Conditions:
 - Lateral and Spatial Extent;
 - Nature of the Boundary, e.g., Outcropping at Surface or Fault Truncated, Etc.;
 - Discharge Areas (springs or streams gaining via formation contact);
 - Recharge Areas.
4. Water-Level Conditions
 - Confined/unconfined;
 - Pre-CBM flow conditions;
 - Surface Discharge:
 - Location;
 - Amount;
 - Rate;
 - Annual Volume.

4. Relate CBM Producing Formations to Local Ground-Water Resources;

The relationship between water production associated with CBM development and local ground-water resources will be assessed. This entails establishing the three-dimensional relationship of the target CBM stratigraphic intervals with those tapped by permitted water wells, both exempt and non-exempt, are completed. The proximity of water wells to CBM production will be assessed and water production rates evaluated for potential impacts to the permitted water wells. The work under this category will include assessments, at a minimum, of the following items:

1. Compile location and depth of production data for existing water wells within the basin;
2. Compare depths of completion for the water wells with coal-bearing stratigraphic intervals that are, or have the potential to be, intervals of CBM production;
3. Compare CBM water production rates associated with CBM development with water production rates from permitted water wells, providing sufficient data are available.

5. Relate Target CBM Intervals to Surface Water Systems

The surface hydrology shall be characterized with respect to identification of the streams involved and the drainage basins associated with any such streams. The nature of the streams and their associated alluvial aquifers will be assessed with respect to flow conditions (perennial or intermittent), the nature, thickness and extent of the associated alluvial aquifer, the losing or gaining nature of the stream, and the alluvial water table. This work will also include identification of the administrative stream basins and whether or not these basins are considered by the Division of Water Resources as over- or under-appropriated. Discussion of whether any of the stream administration basins identified as under-appropriated might be reclassified as over-appropriated in the reasonable future is required. To carry out the depletion analyses, it is required that the stream-aquifer contact areas be accurately and thoroughly delineated. This work will also include determination as to whether any stream reaches may exhibit hydraulic break conditions. The work under this category will include assessments, at a minimum, of the following items:

1. Map surface drainage basins:
 - o Map primary watershed boundaries relative to the basin;
 - o Identify perennial and intermittent stream segments.
2. Map stream-CBM target contact areas;
3. Evaluate potential pathways between CBM production and stream contact areas.

6. Characterize Water Quality of CBM Intervals, Local Aquifers, and Surface Water

Water quality is a factor with respect to any current or future discharge to the stream system and with respect to the potential for utilizing water quality parameters, and total dissolved solids ("TDS") in particular, as an indicator of possible recharge to the target formations from surface waters. Accordingly, this study will include characterization of the CBM production water quality and the water quality of the local stream systems identified and ground water resource aquifers as being in contact with the target formations. The data will be assessed with respect to any similarities or differences and with respect to whether the data indicates a potential recharge interconnection between the two sources. The work under this category will include assessments, at a minimum, of the following items:

1. Characterize quality of CBM production water, particularly total dissolved solids (TDS) and major ion content;
2. Characterize water of local stream systems;
3. Characterize water of local aquifer systems.

7. Identify Data Insufficiencies and Devise Plan to Fill Critical Data Gaps

CBM production in the Sand Wash Basin is in the early stages of development and ground-water usage is concentrated in areas of private land ownership in the eastern part of the basin. Accordingly, available aquifer data may be very limited in detail and geographic distribution. These data are valuable for both evaluating and modeling possible depletive effects from CBM development as well as establishing a bench mark against which future impacts can be measured. Assessments of CBM development impacts in the Raton and San Juan Basins were performed after considerable CBM development had already occurred. While this provided geological data and historic production data from existing wells, there was a notable lack of baseline data against which to compare to see if impacts to aquifers and streams were indeed happening. In this emerging CBM basin it will be invaluable to identify data insufficiencies early on so that critical baseline data collection can begin. This task will address types of data that may be lacking to adequately characterize the basin as well as what type of baseline data should be collected to evaluate possible impacts from CBM development and will identify priority areas for gathering these additional data. Based on the identification of data insufficiencies in Task 7, a plan will be developed to fill those priority gaps needed to complete the modeling.

8. Obtain New Field Data

This scope provides for collection of limited field data anticipated to be necessary for characterizing the aquifer(s) and potentially impacted ground water as they pertain to CBM target intervals and production water. Specifics about the data that will be collected will not be ascertained until the study is well underway and will be guided by the results of previous tasks; however, it is anticipated that data collection will focus on the eastern side of the basin in areas where permitted water wells are most likely to be impacted by CBM development. The types of data to be collected include, but are not limited to, the following:

1. Collect water level data from existing water wells;
2. Collect aquifer test data at existing water wells;
3. Water quality data (TDS, pH, Temperature, and major ions) from the following sources:
 - Existing water wells;
 - Surface water bodies near contact areas with CBM target intervals.

Collecting these data will require access to existing wells that can be allowed to equilibrate for a period of time prior to measuring water level depths and conducting aquifer tests. Modifications may be necessary to the well pumps and pump controls so that aquifer tests can be performed. Part of this task will be identification of wells that would be suitable for these tasks with assistance from Moffat County.

9. Depletion Modeling

Apply the "Glover" methodology in one of its formats to determine the amounts of depletion from surface water (alternate methods may be applied if the Glover method is unsuitable for the hydrogeology of the basin). The Glover depletion analyses shall include a sufficient number of runs to adequately characterize the current and estimated future levels of depletions to the surface stream system, and to identify, as appropriate, any areas within the target formations that could be considered to be nontributary. The analysis may also require sensitivity analyses of various input values as part of the tests of guiding assumptions. The analyses and report will identify and fully describe the following items:

1. Geometry and Setup;
2. The Aquifer Parameters Applied in Each Run;
3. Magnitude of Depletions - Current Levels of Production;
 - a. Depletions vs. Reduction in Accretion (Outflow);

4. Magnitude of Depletions - Estimated Future levels of Production;
5. Estimate of Post-Pumping Depletions and Estimate of Recovery Time to Pre-CBM Conditions;
6. Definition of Nontributary Areas.

The assessment of areas determined to be nontributary under current conditions will also examine the possibility that such areas will be enlarged over time or that additional areas may in the future be designated as nontributary due to the influence of hydraulic breaks or other changes in the system having a bearing on the depletions.

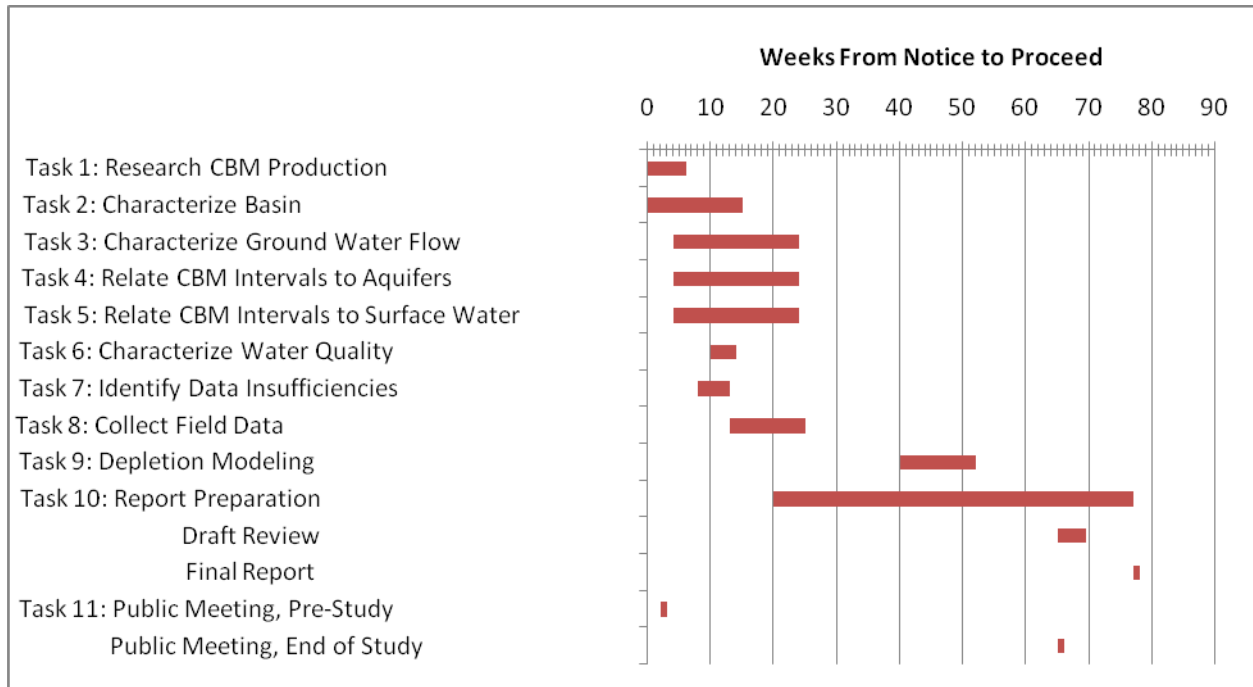
10. Report Preparation

The deliverables include a detailed report describing the geohydrologic characteristics of the Sand Wash Basin with respect to CBM development, current and anticipated future CBM activity with associated water production trends, local ground water uses within the basin, and an assessment of potential depletive effects by CBM to both the surface and ground water resources. The report will also describe methods and limitations of the depletive analysis. The report will include a summary of results, including maps of the geology, geologic structure, aquifer outcrop and stream contact areas, identified stream basins, Glover geometries and distances, locations of areas defined as nontributary, tables of depletions, water quality data for both the target formations and the surface stream waters, and any other data that would be useful and pertinent to the narrative discussions. The report shall also include discussions of changes to the systems as a result of water table or potentiometric head lowering, including ultimate limits to depletions as a result of hydraulic breaks and the potential for reductions in spring flows and any potential for water-quality related impacts on the surface stream system.

11. Public Meetings

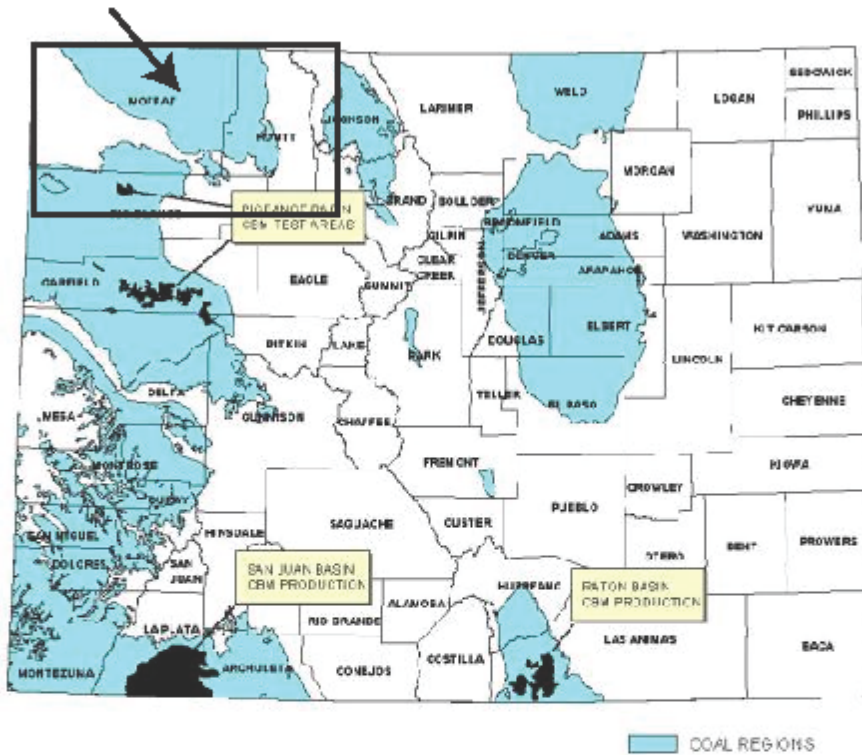
DNR strives to promote an open and honest communication that builds trust and respect with those we serve. This fosters continuous improvements and innovative thought, learning and shared leadership. The success of this study depends on the involvement of people in the water resources community, oil and gas industry, environmental organizations, and of Colorado citizens with DNR and its respective agencies. It is anticipated that there will be a minimum of two coordinated meetings, between industry, stakeholders, and the respective agencies of DNR: one at the beginning and one at the end of the study period.

Timeline



COALBED GAS IN COLORADO

Sand Wash Basin



Sources of Funding:

Moffat and Routt Counties	\$2,000
Yampa\White\Green Basin Roundtable WSRA Basin Account	\$20,000
WSRA Statewide Account	\$98,837
Total Project Cost ¹⁾:	\$120,837

1) See attached budget summary.

PAYMENT

Payment will be made based on actual expenditures and invoicing by the water activity sponsor. The request for payment must include a description of the work accomplished by major task, and estimate of the percent completion for individual tasks and the entire water activity in relation to the percentage of budget spent, identification of any major issues and proposed or implemented corrective actions. The last 5 percent of the entire water activity budget will be withheld until final project/water activity documentation is completed.

All products, data and information developed as a result of this grant must be provided to CWCB in hard copy and electronic format as part of the project documentation.

Budget

Total Costs			
	Labor	Other Direct Costs	Total Project Costs
Task 1 - Research CBM Production and Water Production	\$6,883		\$6,883
Task 2 - Characterize Basin Stratigraphy and Structure	\$5,768		\$5,768
Task 3 - Characterize Regional Ground Water Flow Systems	\$7,405		\$7,405
Task 4 - Relate Target CBM Intervals to Local Aquifers	\$4,041		\$4,041
Task 5 - Relate Target CBM Intervals to Surface Water Systems	\$1,840		\$1,840
Task 6 - Characterize Water Quality of CBM Intervals, Local Aquifers, and Surface Water	\$3,647		\$3,647
Task 7 - Devise Plan To Fill Data Gaps and Devise Plan to Fill Gaps	\$1,840		\$1,840
Task 9 - Collect Field Data (Water Levels, Water Samples, Aquifer Tests)	\$22,747	\$10,888	\$33,635
Task 10 - Depletion Modeling	\$32,878		\$32,878
Task 11 - Report Preparation	\$15,052	\$750	\$15,802
Task 12 - Public Meetings	\$6,039	\$1,060	\$7,099
In-Kind Contributions			\$0
Total Costs:	\$108,139	\$12,698	\$120,837

Hourly Labor Costs							
Example Project Personnel:	Project Manager	Modeler	Senior Geologist	GIS Specialist	Graphics/ Designer	Staff Geologist	Total Costs
Hourly Rate:	\$131	\$150	\$99	\$99	\$64	\$75	
Task 1 - Research CBM Production and Water Production	3		20			60	\$6,883
Task 2 - Characterize Basin Stratigraphy and Structure	2		24	24	12		\$5,768
Task 3 - Characterize Regional Ground Water Flow Systems	3		24	24	12	20	\$7,405
Task 4 - Relate Target CBM Intervals to Local Aquifers	2		20			24	\$4,041
Task 5 - Relate Target CBM Intervals to Surface Water Systems	2		16				\$1,840
Task 6 - Characterize Water Quality of CBM Intervals, Local Aquifers, and Surface Water	2		16			24	\$3,647
Task 7 - Identify Data Insufficiencies and Devise Plan to Fill Gaps	2		16				\$1,840
Task 8 - Collect Field Data (Water Levels, Water Samples, Aquifer Tests)	8		220				\$22,747
Task 9 - Depletion Modeling	22	200					\$32,878
Task 10 - Report Preparation	20		60	40	40		\$15,052
Task 11 - Public Meetings	16		40				\$6,039
Total Hours:	82	200	456	88	64	128	
Cost:	\$10,726	\$30,000	\$44,980	\$8,680	\$4,115	\$9,637	\$108,139

Other Direct Costs						
Item:	Copies	Materials	Equipment/ Supplies/ Samples	Mileage	Travel Lodging and Per- Diem	Total
Units:			Samples	Miles	Days	
Unit Cost:	\$30		\$175	\$0.52	\$140	
Task 1 - Research CBM Production and Water Production						
Task 2 - Characterize Basin Stratigraphy and Structure						
Task 3 - Characterize Regional Ground Water Flow Systems						
Task 4 - Relate Target CBM Intervals to Local Aquifers						
Task 5 - Relate Target CBM Intervals to Surface Water Systems						
Task 6 - Characterize Water Quality of CBM Intervals, Local Aquifers, and Surface Water						
Task 7 - Identify Areas Where Data Are Insufficient						
Task 8 - Devise Plan To Fill Data Gaps						
Task 9 - Collect Field Data (Water Levels, Water Samples, Aquifer Tests)			\$3,500	\$1,508	\$5,880	\$10,888
Task 10 - Depletion Modeling						
Task 11 - Report Preparation	\$750					\$750
Task 12 - Public Meetings				\$500	\$560	\$1,060
Total Units:	25		20	2900	46	
Total Cost:						\$12,698