

**Combined  
Geologic and Engineering Report (GER)  
and  
Maximum Economic Recovery Report (MER)  
for  
Sage Creek Lease by Application COC74219  
Applied for by  
Sage Creek Coal Co. (SCCC),  
a Peabody Energy Company**



For the Lands Described as:

**T. 5 N., R. 87 W., 6<sup>th</sup> P.M.  
N $\frac{1}{2}$  Sec. 22  
NW $\frac{1}{4}$ SW $\frac{1}{4}$  Sec. 22  
NE $\frac{1}{4}$ NE $\frac{1}{4}$  Sec. 21**

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## GEOLOGIC AND GEOGRAPHIC SECTION

### A. Legal description of the area

#### 1. Legal location

The proposed lease application area has been studied by the BLM in response to a lease application submitted by Peabody Energy, Inc. for the SCCC on December 8, 2009. The proposed lease tract boundary includes 400 acres within Sections 21 and 22 of Township 5 North, Range 87 West, for the Wadge seam of coal only. The tract is legally described as all federal coal reserves contained within the Wadge seam located in the following area:

T. 5 N., R. 87 W. 6<sup>th</sup> P.M.

Section 22, N $\frac{1}{2}$

Section 22, NW $\frac{1}{4}$ SW $\frac{1}{4}$

Section 21, NE $\frac{1}{4}$ NE $\frac{1}{4}$

containing 400 acres more or less in Routt County, Colorado. The tract contains 400 acres of federally administered mineral estate; the overlying surface is owned by Cross-Mountain Ranch, L.P.

The tract is contiguous to the northern boundary of Federal Lease COC-72980, which is being be mined by Twentymile Coal Company's Foidel Creek Mine. If acquired by SCCC, the 400-acre tract would be mined by the Peabody Sage Creek Mine (PSCM) in the southern portion of the mine reserve area, under the initial development mine plan. SCCC is a subsidiary of Peabody Energy Corporation.

#### 2. Map showing general affected area

The general location of the tract is shown on Figure 1. The proposed lease tract is located approximately 15 miles southeast of Hayden, Colorado and 16 miles northwest of the town of Oak Creek, Colorado.

### B. Geologic characteristics

#### Overburden

1. Overburden ranges from 800 feet to 1700 feet above the top of the Wadge seam. See Plate 6. Overburden in the immediate lease application area varies from 1200 to 1600 feet.

#### 2. Interburden

The generalized stratigraphy of the area is shown in Figure 2.

C. Coal quality

High heating values and volatile content place the Wadge Seam in a high volatile, group C, bituminous coal classification. The lower one-foot of the Wadge Seam is comprised of a higher ash “bony coal” which is relatively uniform across the mine property (Figure 4). This unit commonly forms a gradational contact with the underlying carbonaceous mudstone. No significant amounts of acid-forming, toxic forming, or alkalinity-producing materials have been identified within the coal seam or associated overburden units. Lateral continuity and consistency of the Wadge Seam is good to excellent. Lithologic and geophysical logs of the seam are on file at the BLM Little Snake Field Office in Craig Colorado.

D. Coal quantity by bed

1. Average Thickness

Thickness of the Wadge Seam varies from 8.0 to 13.5 feet with an average of 10.0 feet throughout the lease application area. See Plate 4 (Coal Thickness drawing).

2. Tonnage

a. In - Place Coal

The total estimated in-place coal reserves, within the lease application area, are calculated to be approximately **7,404,000 tons**. In-place tonnage calculations are based on an average ten foot seam thickness having a density of 1.35 g/cc (84.24 lbs/ft<sup>3</sup>) which yields 1851 tons per acre foot. Refer to Plate 4 (Coal Thickness drawing) and Plate 6 (Mine Plan drawing).

The mineable reserves are estimated to be 5,147,000 tons within a 278-acre portion of the tract. This is due to steep coal grades on the southwest portion of the 400-acre tract. This estimate was calculated by subtracting roof and floor material, and reflects mining in only the initial proposed longwall panels.

b. Recoverable Coal

The Wadge seam in the lease application area has an estimated total of **3,243,000** tons of underground recoverable coal. Recoverable reserves

were calculated by the BLM and checked against the SCCC estimate. The BLM calculation used the proposed mining plan submitted by SCCC in order to arrive at this recoverable reserve figure. Pillar areas were first subtracted from the total and a 10.0 foot average recoverable thickness was applied. A recovery factor of 90% was used for the longwall areas and a recovery factor of 35% was used for the areas of the gate entries. Overall recovery (tons recovered/tons in-place) in the lease area should be around 63%, a reasonable recovery ratio for the same combination of underground methods employed by Peabody's Twentymile Coal

	<b>TOTAL MINABLE TONS</b>	<b>RECOVERY</b>	<b>TOTAL RECOVERABLE TONS</b>
<b>TOTAL</b>	<b>5,147,000</b>	<b>63%</b>	<b>3,243,286</b>

E. Additional Data

1. Hydrologic data and problems

Hydrologic conditions within the proposed lease area are similar to those existing in the areas mined by TCC to the south and east, with limited ground water occurring in a water table environment, and surface water occurring in several small ephemeral drainages and isolated small stock ponds. There are several areas mapped as alluvial valley floor (AVF) areas south of the lease application area within the TCC, Foidel Creek Mine mining area, but do not extend into the proposed lease area.

2. Geologic data and problems

a. Isopachs – overburden, inter-burden, coal. Refer to Plate 5 for overburden thickness, Figure 2 for inter-burden and local lithology and Plate 4 for coal thickness.

b. Structure

These coal reserves are located at the southeast tip of the Yampa Coal Field in the Green River Coal Region. The Yampa Coal Field is a synclinal extension of the Washakie-Sand Wash structural basin situated in northwestern Colorado and south-central Wyoming. The main axis of the basin is highly modified by numerous smaller anticlines, synclines and faults. The boundary of the Yampa Coal Field is defined to the southwest by the Axial Basin anticline, and is defined on the east by the Park Range uplift.

The permit area is within the northwest corner of the Twentymile Park (Figure 5), a structural and topographic basin located in Routt County. The basin is underlain by a large, high-quality coal reserve which is mineable in many areas by underground methods. The geology and prominent structural features are illustrated on Figure 5.

Strata in Twentymile Park have undergone a long history of structural deformation which formed large folds and faults. Three large, north-trending, asymmetrical folds are the most prominent structural features which form the Twentymile Park basin. They cause the strata to dip in excess of 15 percent near the periphery of the basin and form the outer boundaries of the mine area. The coal seams are also disturbed by northwest trending normal faults.

Detailed site-specific stratigraphy of the area is shown on Figures 2 and 3. The main coal reserved mined by the planned underground operations is the Wadge Seam. The Wadge Seam lies within a sequence of sedimentary rocks characterized by shales, claystone, mudstones, siltstones, sandstones and minor coal stringers in the Upper Cretaceous Mesaverde Group. This sedimentary sequence is approximately 75 million years old and is composed of terrigenous clastic rock deposited in offshore, shallow, and near-marine environments at the western edge of an epeiric seaway. This seaway was located in interior western North America during the later part of the Early Cretaceous and most of Late Cretaceous time.

The sandstones were formed in beach environments and are generally very fine to fine-grained, of low porosity and are well-cemented. The very thick shale formations, such as the 590-foot shale member below the Twentymile Sandstone are offshore marine deposits and are characterized by their lateral continuity, extremely fine in nature and extremely low horizontal and vertical permeability.

The youngest rocks exposed in the planned mining area belong to the massive, marine-deposited Lewis Shale. Near the base of the Lewis Shale is the Fish Creek Coal Seam at approximately four feet thick. Approximately 165 feet of interbedded shale, siltstone and fine-grained sandstone separate the Fish Creek Seam from the underlying massive Twentymile Sandstone.

The Twentymile Sandstone is a key mapping unit and can be identified and traced throughout most of the Yampa Coal Field. The rock immediately below the Twentymile Sandstone is another massive marine shale member, a "tongue" of the Lewis Shale, with an average thickness of approximately 590 feet.

The Fish Creek Seam, the Twentymile Sandstone and the thick marine shale make up the majority of the Williams Fork Formation. The lower portion of the Williams Fork Formation consists of the coal bearing sequence. This sequence is the “Middle Coal Group” of the Mesaverde Group. The “Middle Coal Group” contains the Lennox Seam, Wadge Seam, and the Wolf Creek Seams.

The Lennox Seam is located 10 to 15 feet below the marine shale member and ranges in thickness from zero to four feet. The low thickness, poor chemical quality and inferior lateral continuity of the seam render it unmineable. In the proposed mine area, the strata below the Lennox Seam consist mainly of a stacked deltaic sequence. Four distinct sequences have been mapped throughout the mine area. They are characterized by a coarsening of mean grain size upwards within each sequence. The lithology consists of mudstones and claystones, siltstones, and very fine grained interbedded sandstones. The combined thickness of these sequences range from sixty to ninety feet. These rocks directly overlie the Wadge Seam, which is the target of the planned underground mining operation.

The Wadge Seam ranges in thickness from 8.0 feet to 13.5 feet throughout most of the proposed mining area (Plate 4). Overburden depths to the Wadge seam in the planned permit area range from 800 feet to 1400 ft. as illustrated on Plate 5.

Lateral continuity of the seam appears to be good in the lease area. Geologic structure data was modeled on both the top and bottom of the Wadge Seam and there was virtually no discrepancy in the overall geologic structural trend. The structure map illustrated on Plate 3 is drawn on the bottom of the Wadge Seam. The extremely steeper grade, on the south end of the proposed leased area, is shown in the profile drawn on the bottom of the Wadge seam labeled A to A' (Plate 3).

Directly below the Wadge Seam in the planned mine area is a persistent and laterally continuous claystone. Beneath this is a section of alternating thick shale, claystone, siltstone, and intermittent lenticular sandstone. The shale is generally continuous while the sandstone is discontinuous. Near the base of this section is the Wolf Creek Seam. Within the planned mine area, the Wolf Creek Seam splits into two or more individually distinct and separate seams. The seam thickness ranges from zero to twelve feet and displays extremely poor lateral continuity. Exploration holes drilled within and near the planned permit area are identified on Plate 2.

The proposed underground mining operations within the planned

permit area should have the same geologic hazards as in the current underground mining areas in the West Mining District of TCC's Foidel Creek Mine. Minor variations in lithology and structure may result in localized areas with unstable roof and rib conditions, which will require additional mechanical support. Methane gas is not a problem in this area and, along with water management problems, has been mitigated in the existing mine areas.

3. Recommendation of the Field Office on company data

None.

4. Verification provided by the State Office that the coal requested by the company does not exceed the regulatory allowance when leasing by application.

Colorado State Office function.

5. Mining Sequence

See Mine Plan Section.

6. Special stipulations

None.

II. MINE PLAN SECTION

A. Mine plan scenario

1. Possible Mine Plans

The depth of the coal deposit precludes cost-effective surface mining. Conventional room and pillar mining would be acceptable only if the tract were to be bypassed otherwise. The most efficient underground method currently in widespread use is the continuous miner and shuttle car system used for entry development combined with longwall equipment for coal production. The depth and thickness of the Wadge seam is well-suited for the existing longwall equipment and conventional underground development methods used by TCC at the Foidel Creek Mine.

Briefly, conventional continuous miner sections develop a main entry system off which the three entry headgate and three entry tailgate are driven at right angles to the mains. The gate entries will be separated by 1000 feet in this mine and are designed to be as long as possible in order to maximize the efficiency of the longwall. The longwall equipment is

moved in and installed in a setup room mined between the headgate and tailgate entries. The longwall mining method mines the block of coal between the headgate and tailgate entries by cutting the coal with a rotary shear while supporting the roof temporarily with movable hydraulic shields. The back, or roof, caves in behind the shields as the longwall face advances. A chain conveyor transports coal from the longwall face to a stage loader and conventional rubber belt conveyor. The conveyor belt transports the coal outside for processing, shipping, and sale. As the coal is cut and removed, the shields automatically move forward, and the process is more or less continuous, Recovery within the actual longwall panel itself is nearly 100%.

## 2. Company data provided

To date, a total of 16 SCCC exploration holes have been drilled on federal coal. Digital data for these holes was submitted in December, 2009. This data consisted of Wadge Seam thickness (both mineable and total), top and bottom elevations of the Wadge Seam, collar elevations, drill hole numbers, coordinates of each drill hole location, total depth (TD), and complete lithology from the surface to TD. Also, natural gamma, resistivity, density, and caliper curves.

This digital data was checked against available data on file with the LSFO office. Both the geophysical and lithologic data corresponded well with the submitted digital data and was completely adequate for this analysis.

## 3. Evaluation and recommendations

The methods and mine plan proposed by SCCC (see Plate 6) will result in the Maximum Economic Recovery (MER) of the Wadge seam coal on this tract and, in addition, will enhance recovery and Maximum Economic Recovery on the adjacent federal, state, and private coal leases. We recommend that this lease be issued.

# III. MINE ENGINEERING SECTION

## A. Type of mine

Underground, conventional continuous miner development with retreating longwall.

## B. Equipment list

Major Operational Underground Equipment at the Foidel Creek Mine as of July 31, 2005:



<u>Quantity</u>	<u>Manufacturer and/or Model</u>	<u>Nomenclature</u>
2	Joy 12CM12	Continuous Miner
4	Joy 10SC32	Shuttle Car
4	Fletcher Twin Boom	Roof Bolter
2	Stamler	Feeder-Breaker
4	Kubota	Utility Tractors
150	DBT	1300 Ton Longwall shields
1	DBT	Longwall shear
1	Joy	Longwall shear
2	DBT	Longwall conveyor systems
2	DBT	Longwall stageloader systems
Misc.	Wagner	Scoops
Misc.	Eimco	Utility vehicles
Misc.	Assorted	Pumps
Misc.	Assorted	Fans
Misc,	Assorted	Electrical distribution equip.
Misc.	Assorted	Conveyors and related equip.

C. Manpower requirements

Initially, approximately 120 hourly employees and 35 salaried employees will be working PSCM. At full production, there will be approximately 150 hourly employees and 45 salaried employees.

D. Financial data

1. Equipment costs
2. Manpower costs
3. Other financial data

This information to be provided by the Colorado State Office

E. Transportation information

1. Type of transportation

Coal will be transported to the surface by a 60-inch and 72-inch conveyor systems where it will be either stockpiled or transferred to a truck load-out facility, or it will be transferred to an overland conveyor when the mine reaches full production capacity. The truck load-out facility would load trucks for transport to the Hayden Station Power Plant.

The potential future overland conveyor would transfer the coal to TCC's existing 1,400 ton-per-hour wash-plant. Processed coal from TCC's wash-plant is transferred to storage stockpiles, and then to either TCC's trains load-out or truck load-out. Coal is loaded into rail cars or trucks for

transportation to coal consumers.

2. Railroad spur - loop existence at or near site

There is a railroad spur and loop at the Foidel Creek Mine site. The spur ties to the mainline at Milner Colorado (Crain Branch-line), approximately 10 miles west of Steamboat Springs, Colorado.

3. Access issues and problems

No access problems are anticipated.

F. Facility sites and improvements

The lands applied for are located approximately fifteen miles southeast of Hayden, Colorado, Routt County. Sage Creek Coal Company (SCCC), a subsidiary of Peabody Energy, will operate the Peabody Sage Creek Mine (PSCM). The mine portals will be constructed adjacent to the reclaimed highwall of the former Seneca Mine. Surface facilities will include a bathhouse, heavy equipment shop / warehouse, modular buildings for support and maintenance functions, stacking tubes, conveyors and associated coal-handling equipment, storage areas, and various support and ancillary facilities. The area covered by the lease application is located to the south of the portals and facilities area.