Lenexa, KS • (913) 648-4424
Lexington, KY • (859) 263-2855
Bossier City, LA • (318) 747-7734
Raleigh, NC • (919) 785-1414
Camp Hill, PA • (717) 730-7810
Cincinnati, OH • (513) 460-2521

MARSHALL MILLER & ASSOCIATES

Kingsport, TN • (423) 279-9775
Ashland, VA • (804) 798-6525
Bluefield, VA • (276) 322-5467
Beckley, WV • (304) 255-8937
Charleston, WV • (304) 344-3970

www.mma1.com
5480 Swanton Drive / Lexington, KY 40509 / Tel (859) 263-2855 / Fax (859) 263-2839

August 14, 2007

E. Forest Jones, *Esquire*
Jones & Associates
13 Kanawha Boulevard, West, Suite 200
Charleston, West Virginia 25302

Re: Coal Mining Related Issues – Regulatory and Operational
In the Matter of the Request by Chesapeake Appalachia, LLC and PetroEdge Resources, LLC
For an Order from the Oil and Gas Conservation Commission of the State of West Virginia
Establishing Special Field Rules to Reduce Well-Spacing
MM&A Project EFJ100

Dear Mr. Jones:

The following is a summary-styled report identifying the principal issues associated with coal mining activities within the area identified by the reduced well-spacing request filed by **Chesapeake Appalachia, LLC** ***(Chesapeake)***. The applicable Federal and West Virginia regulations cited in this letter report are included as an attachment.

A. Background and Scope of Work

1. Background

The matter arises from a series of filings by Chesapeake and **PetroEdge Resources, LLC** ***(PetroEdge)*** with the **Oil and Gas Conservation Commission** ***(OGCC)*** of the State of West Virginia, wherein, the petitioners requested a hearing before the commission for the establishment of special field rules covering a number of counties in that state. Chesapeake and PetroEdge wish to drill Marcellus Shale wells in the designated area. Although the Marcellus Shale is a shallow formation (pursuant to West Virginia Oil and Gas Code), the request is to allow drilling 75 feet into the top of Onondaga Limestone (the top of the Onondaga formation is the jurisdictional boundary between shallow and deep well classifications) to enable the logging and completion of the entire Marcellus Shale section.

The operators have stated that they will not perforate or complete any formation below the base of the Marcellus Shale. However, since the wells would be drilled in excess of 20 feet into the top of the Onondaga Limestone, they would be considered deep wells. Accordingly, the well operators are requesting that the commission set spacing for the proposed wells that conform to the following: 1,000 feet between wells and 50 feet from a lease line or unit boundary. This spacing adjustment (special field rulings) is available to well operators through deep well rules. A similar provision does not exist in the shallow well rules.

a. *With Respect to Shallow Gas Well Rules*

Shallow wells are governed by the **Shallow Gas Well Review Board**. The following definitions are relevant to this petition.

> WV Code, §22C-8-2. Definitions. Item (21). "Shallow Well" means any gas well drilled and completed in a formation above the top of the uppermost member of the "Onondaga Group": Provided, that in drilling a shallow well the well operator may penetrate the "Onondaga Group" to a reasonable depth, not in excess of twenty feet, in order to allow for logging and completing operations, but in no event may the "Onondaga Group" formation be otherwise produced, perforated or stimulated in any manner. (See also WV Code, §22C-9-2 (11))

The 1,000 foot spacing adjustment issue is moot with respect to shallow wells with a depth of less than 3,000 feet. In those cases, the minimum distance is set by statute to be 1,000 feet from the drilling location to the nearest existing well.[1]

In contrast, shallow wells with a depth of 3,000 feet or more (those extending through geological formations overlying the Onondaga Limestone) are limited to a well-spacing greater than 2,000 feet. Where the distance from a drilling location to the nearest existing well is less than 2,000 feet but more than 1,500 feet and a coal seam owner has objected, the gas well operator has the burden of establishing the need for the drilling location to be less than 2,000 feet from the nearest existing well.[2] No provisions exist in the shallow well rules for drilling at intervals less than 1,500 feet, including, but not limited to, the availability of the special field rule process.

b. *With Respect to Deep Gas Well Rules*

Deep gas wells are governed by the OGCC. The following definitions are relevant to the petition filed by Chesapeake and PetroEdge.

> W. Va. Code, §22C-8-2. Definitions. Item (8). "Deep Well" means any well other that a shallow well, drilled and completed in a formation at or below the top of the uppermost member of the "Onondaga Group." (See also WV Code, §22C-9-2 (12))

> W. Va. Procedural Rule §39-1-4 (4.2). "To prevent waste,...each deep well drilled shall be not less than 3,000 feet from a deep well drilling to or capable of producing hydrocarbons from the objective pool of the deep well and no deep well shall be less than 400 feet from a lease or unit boundary.

The OGCC has the authority to approve or deny applications for special field rules. Special field rules accommodate well-spacing other than the 3,000-foot standard set out in W. Va. Procedural Rule §39-1-4 (4.2). In this instance, both Chesapeake and PetroEdge are petitioning for the reduction of the 3,000-foot spacing to 1,000 feet, and the reduction of the 400-foot distance from a lease or unit boundary to 50 feet.

2. Scope of Work

Jones & Associates ***(J&A)*** of Charleston, West Virginia, is counsel for **Blue Eagle Land, LLC** ***(Blue Eagle)***, a land-holding entity with properties in Kanawha County lying within the boundaries of land for which Chesapeake and

---

[1] WV Code §22C-8-8. Distance Limitations. Item (a) (1). For all shallow wells with a depth less than three thousand feet, there shall be a minimum distance of one thousand feet from the drilling location to the nearest existing well as defined in subsection (b) of this section.
[2] WV Code §22C-8-8. Distance Limitations. Item (a) (2).

PetroEdge are requesting permission from the OGCC to drill gas wells at 1,000-foot intervals. Blue Eagle is in the business of leasing its coal-bearing estate to others for coal mining, processing, and marketing purposes. The Blue Eagle property of specific interest has already been leased to others, and that entity is in the process of developing comprehensive coal mining, processing and marketing plans.

At stake, is the safe and economically feasible coal mining on some 42,000 surficial acres of land. The underground mineable coal reserves of that property are summarized in the following table.

Potential Deep Mineable Reserves (Dry Basis)
(As of March 2002)

Coal Seam	Total Mineable Acres	Total Recoverable Reserves
No. 5 Block	5,700	16,190,000
Stockton	7,300	29,850,000
No. 2 Gas	15,600	44,150,000
Total	**28,600**	**90,190,000**

Source: Table 15, Geological Reserve Evaluation of the Blue Creek Property, Kanawha and Fayette Counties, West Virginia, April 2002, By Marshall Miller & Associates, Inc.

Coal quality characteristics of the currently estimated recoverable seams are summarized as follows.

No. 5 Block: This above-drainage seam is a high-volatile bituminous coal with a relatively high inherent ash and sulfur content. Although the No. 5 Block is not a compliance steaming coal, it nevertheless, is marketed to scrubbed power generating plants or used in blended coal shipments.

Stockton: This above-drainage seam is a high-volatile bituminous A coal with a relatively high inherent ash. The combination of high-heat value and low sulfur content indicates that this coal could make a near-compliance steaming coal. Seams of this quality are marketable on a stand-alone or blended basis.

No. 2. Gas: This below-drainage seam is a high-volatile bituminous A coal with some characteristics indicative of a metallurgical use coal. Alternatively, this coal has quality characteristics applicable to compliance or near-compliance steam coal markets.

Composite Summary of Quality
(Washed - 1.60 Float, Dry Basis, As of March 2002)

Coal Seam	% Ash	%Sulfur	BTU/lb.	lbs. SO_2/ mm BTU
No. 5 Block	14.66	1.32	12,700	2.07
Stockton	14.40	0.77	12,700	1.24
No. 2 Gas	5.05	0.83	14,400	1.16
Weighted Average	**9.34**	**0.89**	**13,600**	**1.33**

Source: Table 15, Composite Summary of Quality, Geological Reserve Evaluation of the Blue Creek Property, Kanawha and Fayette Counties, West Virginia, April 2002. By Marshall Miller & Associates, Inc.

Jurisdictional issues aside, J&A requested the assistance of **Marshall Miller & Associates, Inc.** ***(MM&A)*** in evaluating the basis for Chesapeake and PetroEdge calling the hearing before the OGCC. At this time, MM&A has been tasked with considering the consequences of the proposed change from a shallow well-spacing of 2,000 feet to 1,000 feet. The matter related to well placement 50 feet from the nearest lease line is not currently included in MM&A's scope of work.

B. Methodology

1. Gas Reservoir Management
   MM&A's oil & gas division engineers, familiar with the gas-bearing formation at issue, were tasked with evaluating the merits, if any, of drilling the shallow gas wells at intervals closer than 2,000 feet. Their report is filed under separate cover.
2. Mining Issues
   MM&A's mining engineering staff, with experience in mine planning and mine operations, was tasked with the assessment of the impact of the closer spacing (1,000 feet in lieu of 2,000 feet) on the recovery of the coal resources owned by Blue Eagle. To that end, MM&A was commissioned to examine the appropriate aspects of coal mining related surface operations (coal preparation, storage, and shipping), as well as surface and underground coal mining activities on the Blue Eagle properties.

C. Disclosure Statement

MM&A is familiar with the subject properties through prior assignments relating to geological evaluations for coal mining purposes. MM&A is also aware of the various shallow and deep gas bearing formations that underlay the subject properties, having conducted gas recovery estimations for others in and around the property. The foregoing disclosure not withstanding, MM&A has no interest in any of the entities associated with this assignment. Furthermore, MM&A has not entered into this engagement with any prior conclusions or opinions on the matters that will be addressed in the course of this assignment.

D. Sources and Qualification of Information

1. West Virginia Code Chapter 22C – Environmental Resources
   Article 8. Shallow Gas Well Review Board
   Article 9. Oil and Gas Conservation

MARSHALL MILLER & ASSOCIATES

2. West Virginia Regulations: West Virginia Office of Miners' Health, Safety and Training (*WV OMHST*)
3. West Virginia Regulations: Code of State Rules (*CSR*)
4. Title 30 Code of Federal Regulations, Parts 1-199, Mineral Resources, Department of Labor, Mine Safety and Health Administration (CFR)
5. Blue Creek Property, Stockton Seam, Life-of-Mine Timing Map. Provided by Blue Eagle Land, LLC
6. Geological evaluation of the Blue Creek properties. Provided by Blue Eagle Land, LLC
7. Interviews

E. Applicable Regulations

1. Surface Coal Mining

a. *West Virginia Code*

§22A-2-75. Coal operators-Procedure before operating near oil and gas wells. Prior to mining within 200 feet of a gas well, the coal operator must file updated mining maps and plans for the area located within the 200 foot boundary showing that the mining plans will not unreasonably interfere with access to, or operation of, the well and will not damage the well.

b. *West Virginia Surface Mining Reclamation Regulations – Code of State Rules, Title 38, Series 2*

38 CSR 2 - 2 – Definitions

Structures are defined as any "man-made" structure within or outside the permit boundary which include, but are not limited to: dwellings, outbuildings, commercial buildings, public buildings, gas lines, water lines, etc. The term does not include structures built and/or utilized for the purpose of carrying out the surface mining operation.

38 CSR 2 – 3 Permit Application Requirements and Contents

38 CSR 2 - 3.4 – Maps

3.4.d.17

Pre-plan map requirements for surface mine permits – the coal operator must show all gas wells located within the proposed permit boundary.

38 CSR 2 - 3.23 –Geology

Each permit application shall have the following geologic and related information:

The location and depth of all oil and gas wells within the proposed permit area for both surface and underground mines.

38 CSR 2 – 6 Blasting

6.6. Blasting Control for Other Structures

All structures in the vicinity of the blasting area which are not defined as protected structures (dwellings, public buildings, schools, churches, or community or institutional buildings) shall be protected from damage by establishing the maximum allowable limit on ground vibration, specified by the operator in the blasting plan and approved by the state.

38 CSR 2 – 14 Performance Standards

14.17 – Utility Installations

Surface mine operations must be conducted in a manner which minimizes damage, destruction, or disruption of services provided by oil, gas, and water wells; oil, gas and coal slurry pipelines, etc. which pass over, under or through the permit area unless otherwise approved by the owner of those facilities and the state.

c. ***Mine Safety and Health Administration (MSHA)***

30 CFR § 77.1200 – Mine Map

The operator must maintain an accurate and up-to-date map of the mine showing producing and abandoned oil and gas wells located on the mine property.

30 CFR § 715.19 – Use of Explosives

Except where lesser distances are approved by the regulatory authority, blasting shall not be conducted within 500 feet of gas-storage facilities or gas collection lines.

30 CFR § 779.24 – Maps: General Requirements

The permit application must include maps showing the location of all surface and subsurface man-made features within, passing through, or passing over the proposed permit area.

30 CFR § 779.25 – Cross sections, Maps, and Plans

The permit application must include the location, and depth if available, of gas and oil wells within the proposed permit area.

30 CFR § 816.180 – Utility Installations

Re-states the West Virginia performance standard.

2. Underground Coal Mining

a. *West Virginia Code*

§22A-2-75. Coal operators-Procedure before operating near oil and gas wells.

Prior to mining within 500 feet of a gas well, the coal operator must file updated mining maps and plans and notices with the **WV Office of Miner's Health, Safety and Training *(OMHST)*** and the well operator. Once the proper maps and plans have been filed, mining within 500 feet may begin.

Prior to mining within 200 feet of a gas well, the coal operator must file a petition with the OMHST and the well operator. Permission to mine within 200 feet of the well will only be granted if the well operator does not object to the petition and the OMSHT finds that the mine plan is in accordance to the law, or, if the well operator does object to the petition, the OMSHT rules in the coal operator's favor.

b. *West Virginia Surface Mining Reclamation Regulations – Code of State Rules, Title 38, Series 2*

38 CSR 2 – 3 Permit Application Requirements and Contents

38 CSR 2 - 3.4 – Maps

3.4.f.2.E

Underground supplemental mapping requirements – the coal operator must locate all gas wells on the mine development map.

38 CSR 2 – 3.12 - Subsidence Control Plan

Each underground coal mining application must include a subsidence control plan, which includes the following:

- A survey that identifies structures and a narrative indicating whether or not subsidence could cause material damage or diminution of value or use both on the permit area adjacent areas within an angle-of-draw of at least 30 degrees.
- Where longwall mining or room-and-pillar mining with 80% recovery or greater is proposed, a description of what measures will be taken to minimize material damage or reduction in value or reasonably foreseeable use and the location of those areas. Those measures may include exposing gas lines and relocating panels.

c. *MSHA*

30 CFR § 75.1700 – Oil and gas wells

The coal operator must maintain barriers around gas wells in accordance with State laws and regulations, except that the barriers cannot be less than 150 feet in radius, unless a smaller barrier, in accordance with State laws, is approved by MSHA.

MSHA can require a larger barrier if the depth of the mine, other geologic conditions, or other factors warrant the larger barrier.

30 CFR § 77.1200 – Mine Map

The operator must maintain an accurate and up-to-date map of the mine showing producing and abandoned oil and gas wells located on the mine property.

30 CFR § 783.24 – Maps: General Requirements

The permit application must include maps showing the location of all surface and subsurface man-made features within, passing through, or passing over the proposed permit area.

30 CFR § 783.25 – Cross sections, Maps, and Plans

The permit application must include the location, and depth if available, of gas and oil wells within the proposed permit area.

30 CFR § 817.180 – Utility Installations

Underground mine operations must be conducted in a manner which minimizes damage, destruction, or disruption of services provided by oil, gas, and water wells; oil, gas and coal slurry pipelines, etc., which pass

over, under or through the permit area unless otherwise approved by the owner of those facilities and the regulatory authority.

F. Expected Impacts on Surface Mine Operations

1. General Mine Safety Issues
   - **a.** *Wells, gathering lines, and transmission lines on the surface are a safety hazard to mobile equipment and personnel moving about in their vicinity.*
   - **b.** *Multiple buried gas lines are inherently dangerous for equipment operators.*
   - **c.** *Increased vehicular safety hazards due to increased traffic of inexperienced, untrained, non-mining personnel on mine roads, resulting in potential hazards to both mine personnel and non-mining individuals.*
2. General Impacts on Surface Mining Operations
   - **a.** *Wells interfere with efficient coal mine design and practical, safe mining operations and can result in lost coal, poor productivity, and a greater potential for safety hazards.*
   - **b.** *Wells on close spacing cause frequent interruptions to production and the necessity of closing wells, either temporarily or permanently or of mining around them and sterilizing even more coal.*
   - **c.** *Well sites, access roads, and pipelines are an environmental detriment due to erosion and damage to graded and seeded areas caused by vehicular traffic. Environmental concerns may include spills of brine and other well waste on permitted mine areas.*
3. Economic Impacts
   - **a.** *The presence of gas wells on close spacing, gathering lines and transmission lines can render a coal reserve unmineable.*
   - **b.** *Increased sediment loads on ponds, sumps, and other drainage structures due to well site disturbance, roads, and use of mine roads by gas company personnel resulting in increased pond cleaning costs.*
   - **c.** *Increased maintenance on both mine roads and reclaimed areas.*
   - **d.** *Wells in mineral removal areas are usually purchased, plugged and mined through at a cost of $90,000-$480,000 per well*[1]*. Gas lines are relocated, and in some cases are relocated multiple times.*
   - **e.** *Wells adjacent to mineral removal areas are considered "protected structures" for blasting purposes limiting "production blasting" to at least 100 feet away from the well. That observation, notwithstanding, the coal mine operator has to design the blasts to conform with acceptable ground vibration tolerances.*
   - **f.** *Wells located within the confines of valley fills or spoil disposal areas may be purchased and plugged, or may be "raised," as needed, during the valley fill building process.*

G. Expected Impacts on Underground Coal Mining

1. General Mine Safety
   - **a.** *There is increased risk of mining into mislocated and/or improperly mapped wells resulting in ignitions and mine explosions.*

[1] Recent telephone interviews with surface coal mine operators.

b. *The presence of gas and/or oil wells often compels the layout of mining entries for the purpose of avoiding wells rather than for an accounting for hazardous/difficult geologic conditions.*

c. *Slowing down a longwall face to allow for a regulatory sanctioned mining-through procedure can lead to stress-buildup at the face and difficult, less safe, mining conditions.*

d. *The regulatory mandated coal mine barrier sizes notwithstanding, ground movements induced by underground coal mining may intercept nearby gas/oil well bores. This movement may damage the well bore and release gas in a manner that is hazardous to areas above and/or below the zone of damage.*

2. General Impacts on underground mining

a. *Wells interfere with the design of efficient mining projections resulting in frequent changes of direction, increased mining and capital costs, and decreased efficiency and productivity.*

(1) Modern mines rely on the conveyor belt for coal haulage. Each change in direction of a coal haulage " main" in order to avoid a gas/oil well will require the installation of a complete conveyor belt drive group.

(2) Twists and turns in the orientation of the entries within a mining panel, in order to avoid gas/oil wells, can reduce the efficiency of a mine ventilation system.

b. *The closer the well-spacing, the greater the interference, and thus, the greater potential for rendering some (or all) of a coal resource unmineable.*

3. Economic Impacts

a. *A large amount of coal is sterilized due to protective barriers required around surface wellheads for subjacent support.*

b. *Wells in mining (longwall or room-and-pillar) areas are usually purchased, plugged, and subsequently mined-through at significant expense to the coal mine operator.*

(1) The procedures for mining-through oil and gas wells are detailed in MSHA approved proposed decision orders *(PDO's)*.

(2) PDO's are issued to mining companies upon petition to MSHA. These petitions typically elicit detailed and elaborate plans that set out the procedures to be followed for the plugging of a well, the mining-through procedures, the training needed prior to the mining-through, the notification procedures when the operation is imminent, and the follow-up inspections of the area.

(3) Each petition is treated as unique and so the particular sealing/plugging techniques have to be validated for each site based on examinations and surveys of the specific well to be mined-through.

c. *Large gas transmission lines on the surface may have to be protected from subsidence which results in loss of coal reserves.*

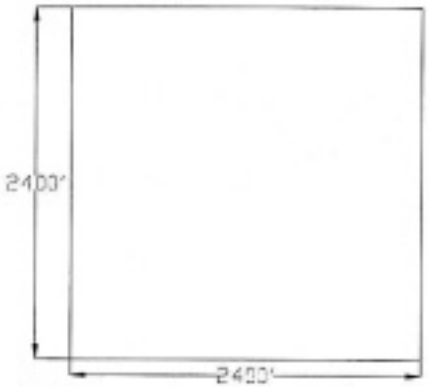
H. Examples Of Impacts on Underground Coal Mining

Underground Impact, Kanawha County, WV – Raw Coal Reserve Recovery

Assumptions:

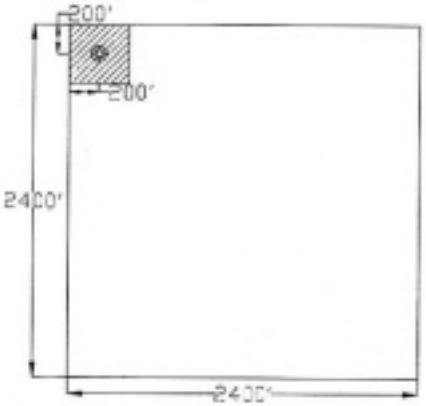
1. Protection barrier 400 feet x 400 feet square.
2. Stockton raw coal thickness 6.31 feet[4].
3. Raw coal bulk weight of 99 pounds/cubic foot (dry basis). [5]
4. Subject area dimensions 2,400 feet by 2,400 feet (using WV Code 22C-8-8. Distance Limitations).

1. No gas wells present in subject area.



= 1,799,100 raw tons in-place

2. One gas well present in subject area.

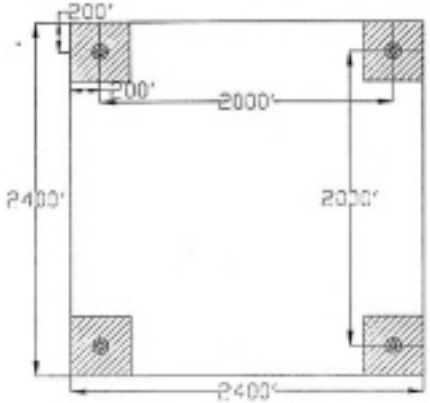


= 1,749,100 raw tons in-place remaining

Cumulative loss of 50,000 tons

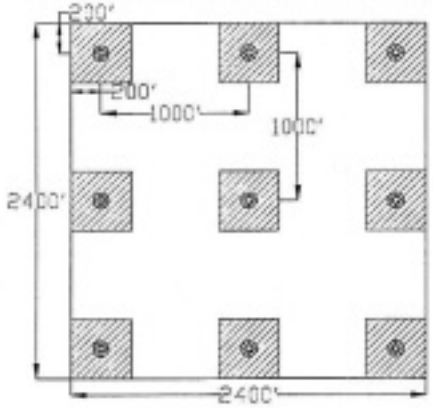
[4] Raw coal thickness based on core hole WV95-CC3.
[5] Based on the following linear regression-based formula : [Specific gravity = decimal ash content + 1.25], and … [bulk weight = specific gravity x 62.4]

3. Four gas wells present in subject area at 2,000 foot spacing (22C-8-8):



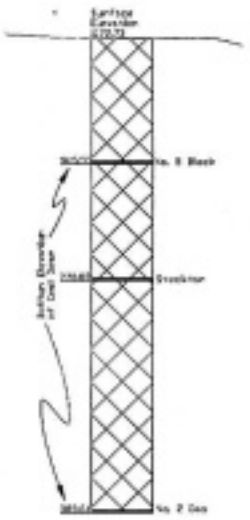
– **1,599,200** raw tons in-place remaining
Cumulative loss of **199,900** tons

4. Nine gas wells present in subject area at 1,000 foot spacing (proposed Field Rule)



– **1,349,300** raw tons in-place remaining
Cumulative loss of **449,800** tons

I. Example of Multiple Seam Underground Impact, Kanawha County, WV – Raw Coal Reserve Recovery



Assumptions:

1. Protection barrier 400 feet x 400 feet square.
2. No. 5 Block raw coal thickness 4.75 feet[6].
3. Stockton raw coal thickness 6.31 feet.
4. No. 2 Gas raw coal thickness 3.69 feet[7].
5. Raw coal bulk weight of 95 pounds/cubic foot (dry basis) – No. 5 Block
6. Raw coal bulk weight of 99 pounds/cubic foot (dry basis) – Stockton
7. Raw coal bulk weight of 84 pounds/cubic foot (dry basis) – No. 2 Gas
8. Example area dimensions 2,400 feet by 2,400 feet (using WV Code 22C-8-8. Distance Limitations).

Estimated Underground Mineable Raw Coal Loss (Dry Basis)
(As a result of gas well-spacing on 1,000-ft within a 2,400-ft x 2,400-ft underground mineable coal resource block.)

Coal Bed	Raw Coal Thickness (Feet)	Tons In-Place No Gas Wells	Tons In-Place Remaining After 1,000-ft Well-Spacing	Estimated Raw Tons In-Place Lost
No. 5 Block	4.75	1,299,600	974,700	324,900
Stockton	6.31	1,799,100	1,349,300	449,800
No. 2 Gas	3.69	892,700	669,500	223,200
Total	14.75	3,991,400	2,993,500	997,900

Comparative Table of Estimated Underground Mineable Raw Coal Losses (Dry Basis)
(Within a 2,400-ft x 2,400-ft underground mineable coal resource block.)

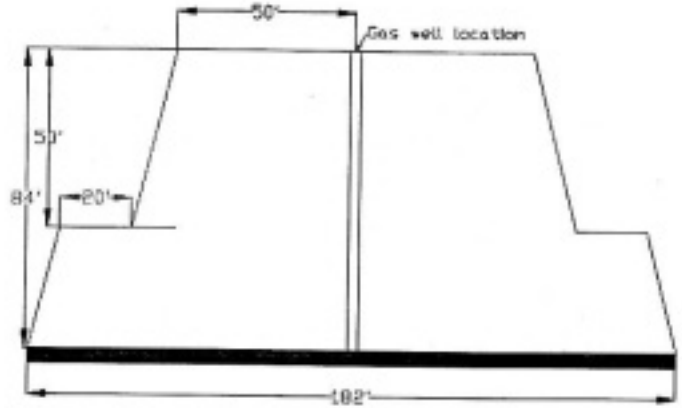
Coal Bed	Raw Coal Thickness (Feet)	Tons In-Place No Gas Wells	Tons In-Place Lost on 2,000-ft Well Spacing	Tons In-Place Lost on 1,000-ft Well-Spacing	Additionally Lost Coal, 2,000-ft vs. 1,000-ft Well-Spacing
No. 5 Block	4.75	1,299,600	144,400	324,900	180,500
Stockton	6.31	1,799,100	199,900	449,800	249,900
No. 2 Gas	3.69	892,700	99,200	223,200	124,000
Total	**14.75**	**3,991,400**	**299,100**	**673,000**	**554,400**

[6] No. 5 Block raw coal thickness based on core hole BC-3-01.
[7] No. 2 Gas raw coal thickness based on core hole WV95-CC3.

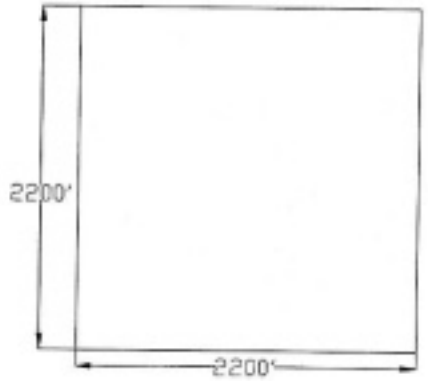
J. Examples Of Impacts on Surface Coal Mining – Special Agreements Plugged Well

Assumptions:

1. Protection barrier 182 feet x 182 feet square, rounded to 200 feet x 200 feet.
2. No. 5 Block raw coal thickness 4.75 feet.
3. Raw coal bulk weight of 95 pounds/cubic foot (dry basis).
4. Subject area dimensions using rounded barriers 2,200 feet by 2,200 feet (using 50 feet x 50 feet protection barrier at the surface and highwall slopes of 0.25:1 with a 20 feet safety bench every 50 vertical feet, see schematic).
5. Must be under "less than 100 feet" of cover for stripping ratio.

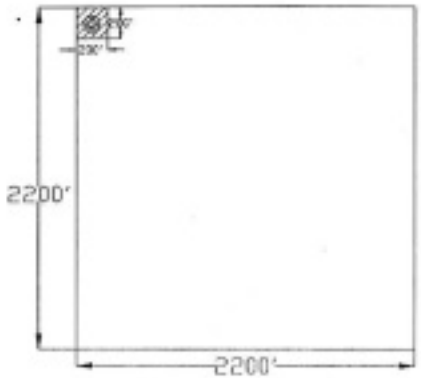


1. No Gas wells present in subject area.



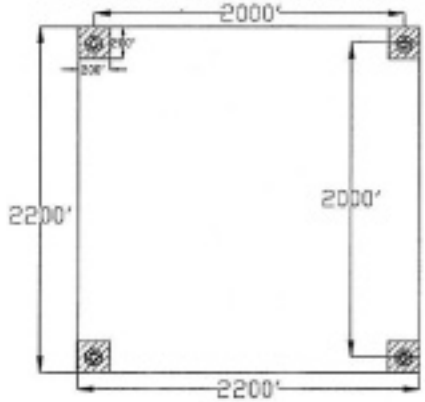
= **1,092,000** raw tons in-place

2. One gas well present in subject area.



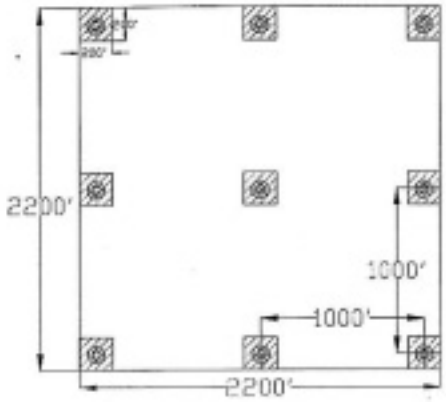
= **1,083,000** raw tons in-place remaining
Cumulative loss of **9,000** tons

3. Four gas wells present in subject area at 2,000 foot spacing (22C-8-8):



= **1,055,900** raw tons in place remaining
Cumulative loss of **36,100** tons

Nine gas wells present in subject area at 1,000 foot spacing (proposed Field Rule)



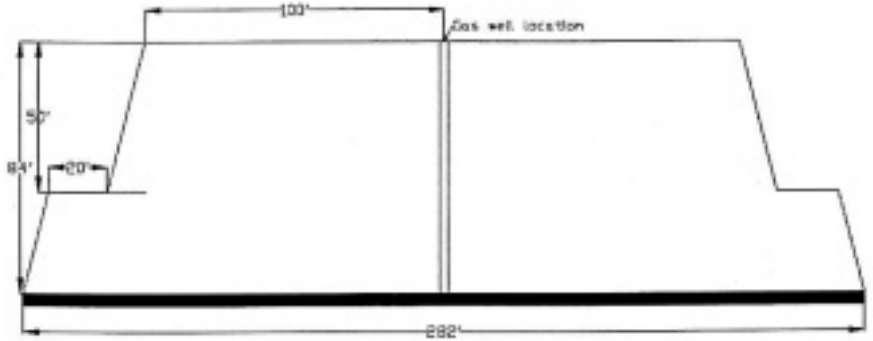
= **1,010,800** raw tons in-place remaining

Cumulative loss of **81,200** tons

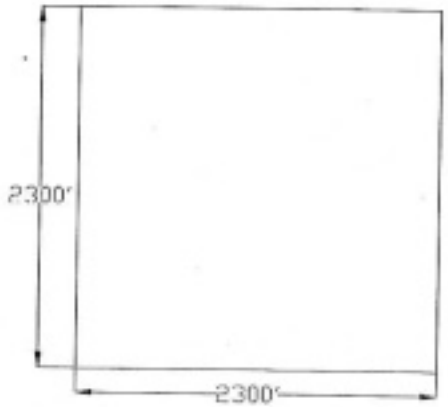
K. Examples Of Impacts on Surface Coal Mining – Typical Producing Well

Assumptions:

1. Protection barrier 282 feet x 282 feet square, rounded to 300 feet x 300 feet.
2. No. 5 Block raw coal thickness 4.75 feet.
3. Raw coal bulk weight of 95 pounds/cubic foot (dry basis).
4. Subject area dimensions using rounded barriers 2,300 feet by 2,300 feet (using 100 feet x 100 feet protection barrier at the surface and highwall slopes of 0.25:1 with a 20 feet safety bench every 50 vertical feet, see schematic).
5. Must be under "less than 100 feet" of cover for stripping ratio.

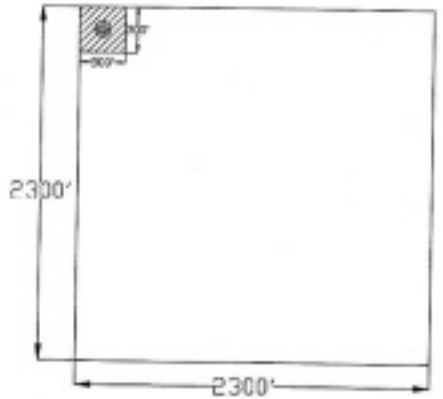


1. No gas wells present in subject area.



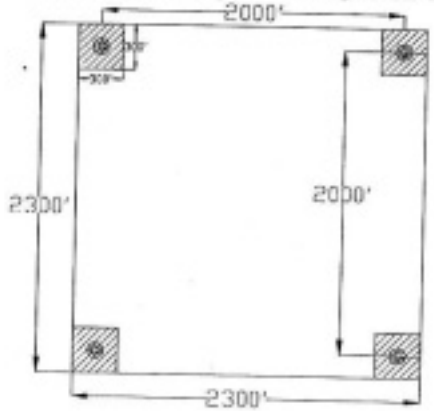
= **1,193,600** raw tons in-place

2. One gas well present in subject area.



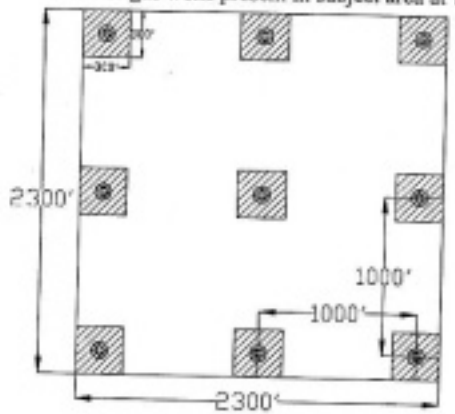
= **1,173,300** raw tons in-place remaining
Cumulative loss of **20,300** tons

3. Four gas wells present in subject area at 2,000 foot spacing (22C-8-8):



= **1,112,400** raw tons in place remaining
Cumulative loss of **81,200** tons

4. Nine gas wells present in subject area at 1,000 foot spacing (proposed Field Rule)



= **1,010,800** raw tons in-place remaining
Cumulative loss of **182,800** tons

L. Example Of Economic Impact of Coal Lost Around One Barrier Block - Multi-seam Underground

Assumptions:

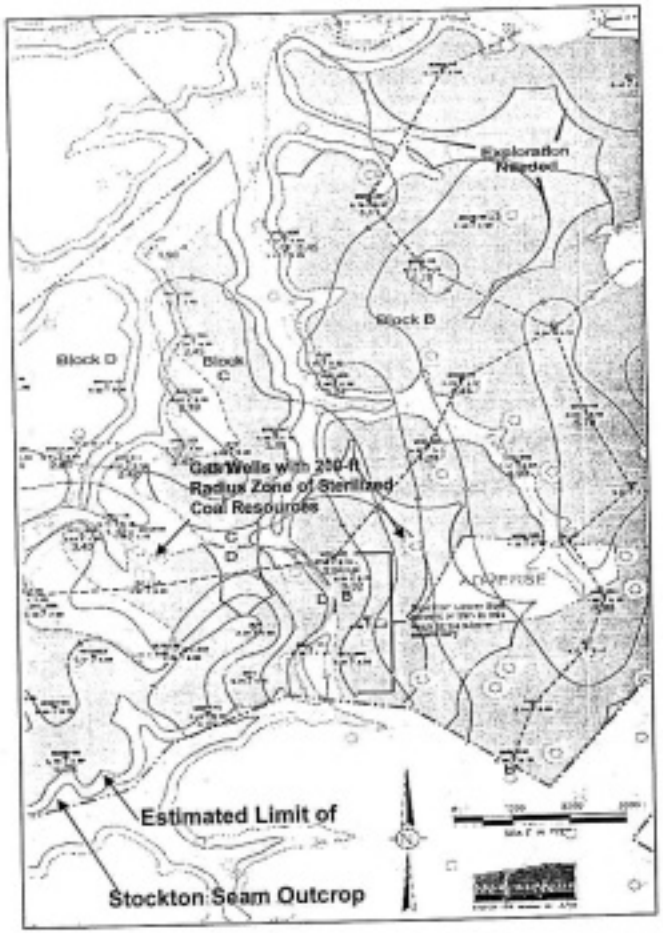
1. Protection barrier 400 feet x 400 feet square.
2. No. 5 Block raw coal thickness 4.75 feet.
3. Stockton raw coal thickness 6.31 feet.
4. No. 2 Gas raw coal thickness 3.69 feet.
5. Raw coal bulk weight of 95 pounds/cubic foot (dry basis) – No. 5 Block
6. Raw coal bulk weight of 99 pounds/cubic foot (dry basis) – Stockton
7. Raw coal bulk weight of 84 pounds/cubic foot (dry basis) – No. 2 Gas
8. Example area dimensions 2,400 feet by 2,400 feet (using WV Code 22C-8-8, Distance Limitations).
9. Mining recovery: 50% (Assuming "first mining" only)
10. Wash recovery: 70% - No. 5 Block
11. Wash recovery: 59% - Stockton
12. Wash recovery: 78% - No. 2 Gas
13. Moisture addition: 5%.
14. Current Sales Price: $50.00 per ton (as received *[AR]*).
15. Discount Rate of 15%

Example of Economic Impact Resulting from the Loss of Underground Mineable Coal Around One Gas Well

Coal Bed	Raw Coal Tons In-Place (Dry)	Raw Coal Tons Mineable (Dry)	Marketable Clean Coal Tons (AR)	Current Market Price ($/ton)	Estimated Years Until Mining	Estimated Present Value of Lost Revenue ($)
No. 5 Block	36,100	18,100	13,300	$50	10	$164,400
Stockton	50,000	25,000	15,500	$50	5	$385,300
No. 2 Gas	24,800	12,400	10,200	$50	15	$62,700
Total	**110,900**	**55,500**	**39,000**	**150**	--	**$612,400**

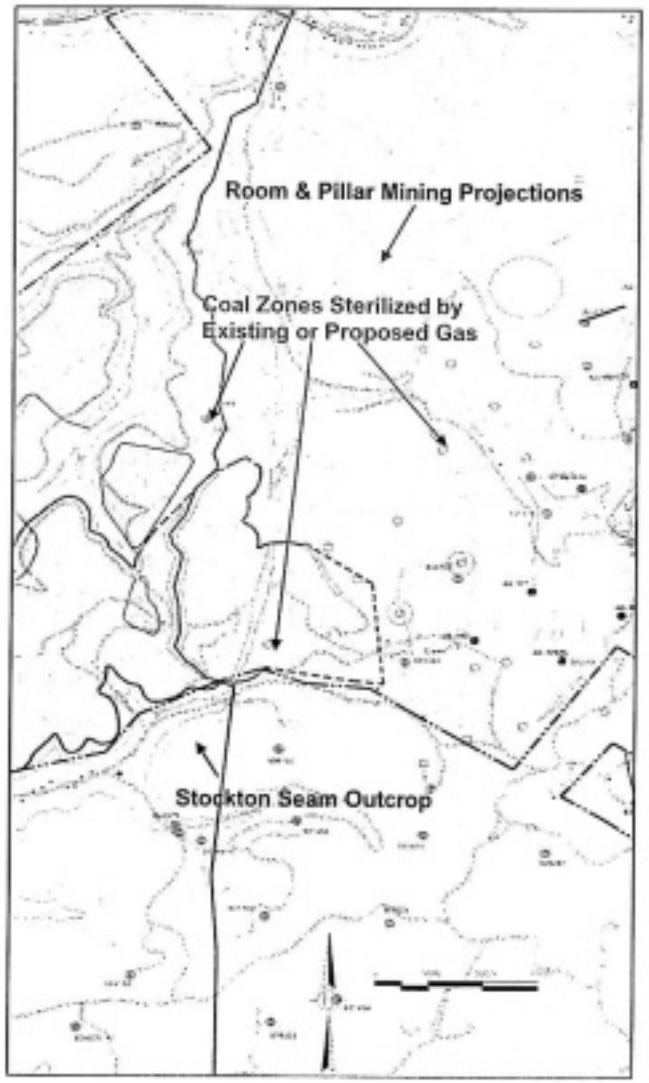
M. Example of the Impact of Gas Well Presence on Coal Resource Estimations

The following figure is based on a coal reserve estimate report filed on the subject property.



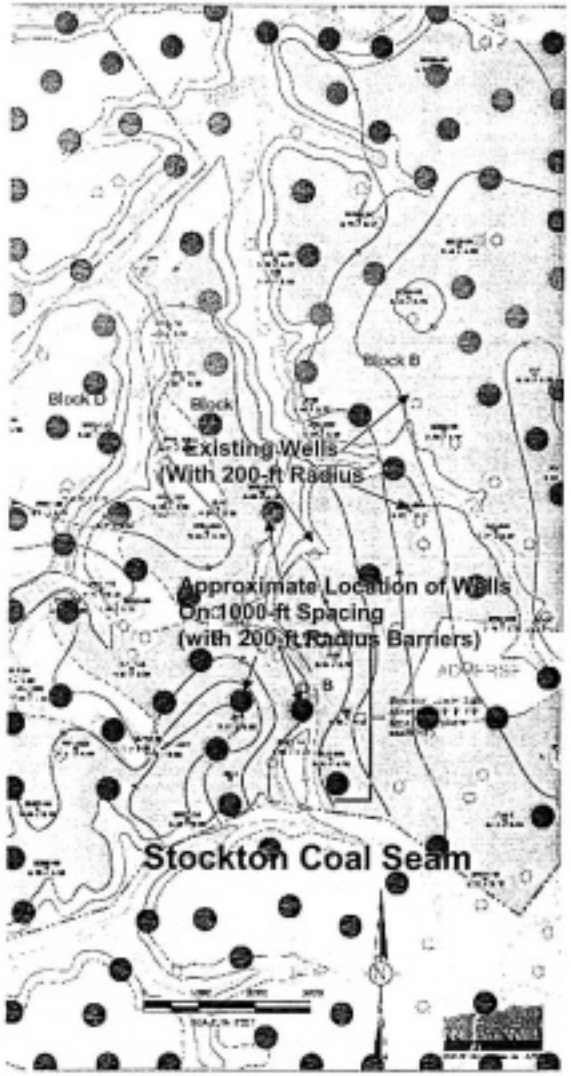
N. Example of the Impact of Gas Well Presence on Mining Projections

The following figure is based on a coal mine's projection prepared by the mine operator of the subject property.



O. Illustration of the Effect of Gas Wells Spaced on Approximately 1,000-foot Centers

The following figure is based on a coal reserve estimate report filed on the subject property. The red dots indicate the barriers around gas wells spaced approximately 1,000 feet from each other, as well as existing gas wells.



P. Conclusions

MM&A concludes that there is sufficient evidence to prove that the allowance of 1,000-foot spacing would be very detrimental to the coal reserves.

Q. Witness Qualifications

The qualifications of the expert witness can be found in the résumé, which is attached to this letter report.

If you have any questions or comments, please call us.

Regards,
Marshall Miller & Associates, Inc.
Energy • Environmental • Engineering

Hans E. Naumann

Hans E. Naumann, P.E.
Senior Vice President

Hilaria Swisher

Hilaria E. Swisher
Graduate Engineer

/cfn

Attachments: Naumann Résumé/Codes and Regulations

c: Scott Keim, C.P.G., President
Peter Lawson, Executive Vice President
John Feddock, P.E., Manager, Lexington Kentucky Office
Mike Miller, P.E., Vice President – Oil & Gas Division
File: EFJ100

Contributors

1. Joe Overbay, *Senior Mining Engineer*, Surface and Underground Mining Issues
2. Jeff Almond, *Senior Permit Manager*, Surface and Underground Mining Issues
3. Donnie Lumm, *Senior Geologist*, Geographic correlation of multi-seam underground mining
4. Larry Beck, *Senior Engineering Manager*, Contributor and Peer Reviewer.
5. Mike Miller, *Vice President*, Peer Review