

ATTACHMENT II-E

GEOLOGY

The Shannon, LLC, Shannon Mine No. 4 is a proposed surface mine site and is located in southwestern Jefferson County and northeastern Tuscaloosa County approximately 1.3 miles northeast of the community of Abernant. More specifically the proposed permit area is located in parts of Sections 1, 2, 3, 4, 9, 10, and 11, Township 20 South, Range 6 West and Sections 34, 35, and 36, Township 19 South, Range 6 West, Jefferson and Tuscaloosa Counties, Alabama as seen from the 1980 Abernant and McCalla, Alabama USGS 7.5 minute quadrangles. The proposed permit area lies to the northwest of Blue Creek Road, northeast of Rockhouse Road, southwest of Sumpter/Lawsontown Road and southeast of the C.S.X. Railroad ([See Hydro-Geo Map](#)).

The proposed mine site will occupy approximately 2039 acres of which approximately 1913 will be mining area and 126 acres will be coal stockpiles, haulroads, basins, drainage courses and access roads. Previous mining has occurred within and adjacent to the proposed permit area and includes pre-law surface disturbance, permanent program surface disturbance and underground mines ([See Hydro-Geo Map](#)). Approximately 1250 acres within the proposed permit area have been previously disturbed by pre-law operators, Black Diamond Coal Mining Co., and by Alabama Land & Mineral Corp. Alabama Land & Mineral Corp.'s Shannon Mine (P-3224), Oswayo #3 Mine (P-3438), Oswayo #4 Mine

(P-3483), Area 6 Mine (P-3699) and Shannon, LLC Shannon Mine (P-3859) lie within the proposed boundaries of the Shannon Mine No. 4. As shown on the [Hydro-Geo Map](#) the proposed permit area is underlain by the abandoned works of Black Diamond Coal Mining Company.'s Shannon Mine and Sumter Mine. Both the Shannon and Sumter underground mines are within the Blue Creek Seam. There were no records found on the pre-law surface mining activities. Five (5) coal seams currently proposed to be mined, in descending order, are the Upper New Castle, Lower New Castle, Mary Lee, Blue Creek and Jagger Coal Seams. A rim cut has been taken on all seams within the proposed permit and adjacent areas. The Blue Creek Seam has been extensively underground mine within the proposed permit and adjacent areas.

Structurally, the proposed mine is located within the Cumberland Plateau Section of the Appalachian Plateau Physiographic Region. The proposed permit area is located within the southeastern most section of the Warrior Coal Basin know as the Blue Creek Basin. The Blue Creek Basin is a relatively narrow, canoe-shaped synclinal area approximately 12 miles long and up to 4 miles wide and is separated from the main Warrior Basin by the steeply dipping strata of the Blue Creek Anticline. The general structure of the Blue Creek Basin is dominated by several northeast-southwest trending folds that plunge to the southwest. The proposed permit area is influenced by two (2) prominent regional structure features, the Blue Creek Anticline approximately 0.25 miles to the northwest and the Blue Creek Syncline which centers the proposed permit area. Both the Blue Creek Anticline

and the Blue Creek Syncline have a northeasterly trend and are generally parallel to the southeastern boundary of the Warrior Coal Basin. The Blue Creek Syncline is an asymmetrical syncline that plunges to the southwest. Along the northwestern limb of the syncline the strata dips 15 degrees to 18 degrees to the southeast and along the southeastern limb strata dips 9 degrees to 12 degrees to the northwest.

Local structural features in the proposed permit area consist of five (5) normal faults which have a northwesterly trend. The northwesterly trending faults have vertical displacements of 15 feet to 125 feet or more. See the [Hydro/Geo Map](#) for the location of the regional and local structure features.

The strata which underlies and outcrops in this region is of the Pottsville Formation of the Pennsylvanian Age. The Warrior Basin is the southern most of a series of Pennsylvanian basins of the Appalachian Plateau. The Pottsville Formation in this area consists of thin to thick bedded sandstones, siltstones, shales, clays, and coal seams. Structurally, the Warrior Basin is formed by a large gentle syncline that extends from north-central Mississippi in the west to north-central Alabama in the east. The syncline is tilted southwestward with a regional dip of 30 to 200 feet per mile. Toward the interior of the Warrior Basin, the regional southwest dip of Pottsville strata is modified by a series of three synclines and two anticlines. Of these, the major structures are the Warrior and Coalburg synclines, and the

Sequatchie anticline. The fold axes are parallel to the Appalachian system in a northeast-southwest direction and plunge to the southwest with the regional dip.

Locally, the strata which outcrops in the immediate vicinity of the proposed mine site is the coal-bearing Pennsylvanian aged Pottsville Formation which includes siltstones, shales, sandstones, underclays, and coal seams associated with the Mary Lee Coal Group. According to 'Depositional Settings of the Pottsville Formation in the Black Warrior Basin', the Mary Lee Group lies approximately 40 to 130 feet above the Black Creek Coal Group and from 140 to 400 feet below the Pratt Coal Group. The proposed permit area is located within a anticline and syncline system as shown on the [Hydro/Geo Map](#).

As stated earlier there are five (5) mineable coal seams located within the proposed permit area. The entire permit area has been rim cut and reclaimed. None of the seams outcrop within the proposed permit area. The overburden above the Upper New Castle ranges between 113 to 353 feet, the innerburden between the Upper New Castle and Lower New Castle ranges between 30 to 46 feet, the innerburden between the Lower New Castle and the Blue Creek ranges between 35 to 84 feet, the innerburden between the Blue Creek and Lower Blue Creek ranges between 3 to 17 feet, and the innerburden between Blue Creek and Jagger ranges between 18 and 48 feet within the proposed permit area. The thickness of the Upper New Castle Seam averages approximately 14 inches. The thickness of the Lower New Castle Seam averages approximately 38 inches thick.

The thickness of the Blue Creek Seam averages approximately 84 inches. The thickness of the Lower Blue Creek Seam averages approximately 15 inches thick and the Jagger Seam averages approximately 30 inches. The Upper New Castle, Lower New Castle, Mary Lee and Jagger Coal Seams are solid within the proposed permit area. The Blue Creek Coal Seam has been extensively underground mined. Only pillars of Blue Creek Coal that were not recovered by the previous underground mining operations will be surface mined at this site.

This site is an area mine located on several complex trending ridges whose relief are approximately 260 ft. above the receiving streams. The rocks outcropping within the proposed permit area belong to the upper Pottsville Formation and consist of clastic sediments of a deltaic environment. According to the "Hydrologic Assessment, Eastern Coal Province Area 23, Alabama" generally the coals are separated by sequences of gray sandstone, conglomerate, siltstone, shale underclays.

Seven (7) overburden geochemistry sites ([DH-14092](#), [DH-14095](#), [DH-12575](#), [DH-12608](#), [DH-1725](#), [DH-1726](#), and [DH-1727](#)) and numerous exploratory drill holes were used to describe the lithology within and surrounding the proposed permit area. Personnel of Twin Pines, LLC drilled overburden geochemistry sites [DH-1725](#), [DH-1726](#), and [DH-1727](#) in June of 2011, utilizing a Failing 1500 air rotary drill with a 4-3/4 inch drill bit. Samples were collected from drill cuttings every 5 ft. or change in lithology and a log was kept of the lithology encountered by

personnel of Twin Pines, LLC. Collected samples were cataloged and stored in plastic gallon size ziploc bags for later inspection and testing. These samples were transported to PERC Engineering Co., Inc.'s Laboratory where collected samples were utilized for geochemical analysis, including paste pH, total sulfur, and neutralization potential was conducted according to ASTM guidelines. Personnel of Costain Coal, Inc. drilled overburden geochemistry sites [DH-14092](#), [DH-14095](#), [DH-12575](#), and [DH-12608](#) in June, August, and November of 1991. Samples were collected from drill cuttings every 5 ft. or change in lithology and a log was kept of the lithology encountered by personnel of Costain Coal, Inc.

Lithologic logs were constructed from the seven (7) overburden geochemistry drill holes mentioned above by qualified personnel of Twin Pines, LLC and Costain Coal, Inc. The average total sulfur content from of the Upper New Castle was analyzed as 1.28 to 1.66 percent, the Lower New Castle was analyzed as 1.42 to 1.79 percent, the Mary Lee was analyzed as 0.90 to 1.13 percent, the Blue Creek was analyzed as 0.90 to 1.03 percent, the Lower Blue Creek was analyzed as 0.82 percent, and the Jagger was analyzed as 1.09 to 1.32 percent.

Information provided in the [Weighted Average Overburden Analysis sheets](#) for this site revealed that only one interval in DH-1727 at a depth of 380.0' - 385.0' was tested as being potentially acid-forming other than intervals located below the coal seams in DH-1726 and DH-1727 which were contaminated with coal. With timely reclamation, excess neutralization potential of the overburden material, and the

location of these intervals within the stratigraphic column these intervals should not pose a problem.

Due to the fact that all overburden at this site does not occupy similar areas, intervals shown in the attached results of geochemical analysis which are located in the upper portions of the drill logs occupy a smaller volume than intervals which are located closer to the bottom, consequently, their acid-base accounts do not contribute as substantially to the overall chemistry of the overburden. In an attempt to more accurately describe the acid-base potential of the overburden at the Shannon Mine No. 4 site, a spreadsheet which was developed at the Pennsylvania Dept. of Environmental Resources, Bureau of Mining and Reclamation was employed. This spreadsheet not only takes into account the volume occupied by each interval tested, but also the amount of coal lost into the spoil. The results of the [Volumetric Overburden Analysis](#) method from overburden geochemistry sites [DH-12575](#), [DH-12608](#), [DH-14092](#), [DH-14095](#), [DH-1725](#), [DH-1726](#), and [DH-1727](#) are favorable: overburden at the Shannon Mine No. 4 contain an average of 18.77 (tons CaCO₃/1000 tons overburden) excess neutralization potential.

Numerous exploratory drill holes within and adjacent to the proposed permit area were utilized to construct a Structure Contour Map for the bottom of the Jagger Coal Seams. See attached [Hydro-Geo Map](#).

The strike of strata within the proposed permit area ranges between 45 degrees and 50 degrees to the Northeast. The northwest portion of the proposed permit area has a more gentle dip of 15 to 18 degrees on the northwest limb and the southeast limb has a steeper dip of 9 to 12 degrees. The southeast portion of the proposed permit area will mine the southeast limb of an unnamed anticline which has a dip of approximately 25 degrees. The strike and dip of the local strata was determined by utilizing the Structure Contour Map for the Jagger Seam. [Geologic Cross-sections A-A', B-B', C-C', D-D' and E-E'](#) were taken perpendicular to the strike of the coal seams to show the variations in dip within the proposed permit area. See the [Major Structures Map](#) for the location of the regional structure features.

Both small scale and large scale faulting are present in the Blue Creek Basin. According to 'Engineering Geology of Jefferson County' Geological Survey of Alabama, Atlas 14 there is a north trending fault with the east block downthrown and an unknown displacement, located approximately ½ mile to the west of the proposed mine site. The Opossum Valley Thrust Fault is located on the eastern side of the proposed mine site. It trends to the north in the immediate area and has a maximum displacement of approximately 350 feet with the upthrown block on the east side. Most faults in the adjacent area trend perpendicular to the fold axis but some faults trend parallel to the fold axis. There are no known faults known to occur within the immediate mine site area.

Aquifers encountered which could be affected due to mining at this site are discussed in The Determination of Probable Hydrologic Consequences (Part II-H).

CERTIFICATION STATEMENT:

The preceding geologic section was prepared for Shannon, LLC at the Shannon Mine No. 4 site by me or under my supervision and I hereby certify that it is true and correct to the best of my knowledge or belief.

W. Keith Madison, P.G.
Alabama Reg. No. 0122

Date: _____