GROUND WATER HYDROLOGY (880-X-8E-.06 (1))

1. Groundwater Hydrology Description

At No. 5 Mine, no distinct stratigraphic zones that consistently produce water were encountered during data collection. Groundwater within the permit area appears to be contained in a poorly connected fracture system of the alternating sequences of sandstone and shales in the Pottsville Formation. This system forms isolated perched water tables with little areal extent. Water in the Pottsville aquifer also occurs under confined conditions due to sharp contrast in permeability within the aquifer. As stated in the Geohydrology and Susceptibility of Major Aquifers to Surface Water Contamination in Alabama; Area 3; U.S.G.S. Water-Resources Investigations Report 88-4120, large water supplies generally are not available from the Pottsville Formation and no municipal wells tap the Pottsville Formation within the study area.

Typical geology associated within the coal bearing stratum in the Black Warrior Basin have minimal primary permeability, so typically coal beds are the principal aquifers owing to closely spaced cleats. Most other groundwater flow is through secondary conduits, such as joints and faults. The Pottsville Formation may be defined as a low yielding, fractured aquifer with water occurring in coal seams, along bedding planes, joints, fractures, and some sandstone. (Regional Analysis of the Black Creek-Cobb Coalbed Methane Target Interval, Black Warrior Alabama, U.S.G.S. Bulletin 145).

Major sources of groundwater in the adjacent areas are coal seams, bedding planes, joint fractures, lithologic or erosional contacts, and faults.

Groundwater flows from areas of higher elevation toward the surrounding stream valleys and surfaces as seeps or springs. Recharge for this area is direct rainfall. No seeps or springs were noted in the field.

Groundwater movement near the No. 5 Mine is believed to be in the direction of dip that is primarily to the southwest, based on the elevations obtained from drill holes.

2. Lithologic Description of Water Bearing Zone(s):

During the drilling of the monitoring wells and exploration holes at this mine, no stratigraphic horizons were observed to consistently produce water in usable quantities. For a more detailed description of the lithology of the water bearing zones see the attached Drill Log Drawings (H255, H256, and H257) in Part II-E.

3. Aquifer Test(s):

Aquifer tests have not been required at this time.

4. Well Inventory:

A well inventory was conducted by McGehee Engineering Corp. in April and May of 2012. Door to door interviews were conducted on occupied dwelling within one half mile of the permit boundary to determine if domestic wells were present. The inventory revealed five (5) active wells within the half-mile radius of the mine. Of the five (5) wells, only one (1) is used for a primary source of water. Four (4) wells are either used as a secondary source for outdoor purposes or are not used at all. House Id 46 utilizes their well as their primary drinking source. House Ids 36, 47A, 50, 51, and 52 utilize their wells as a secondary use for outdoor purposes. See Well Inventory and Hydro-Geo Map.

5. Groundwater Baseline Quality:

The quality of the groundwater in the monitored wells is summarized in Groundwater Baseline Analysis. See attached Monitoring Well Sites Additional Metals Data.

6. Geologic Structures that Influence Groundwater Movement:

Bedding planes in the area of this proposed mine dip gently to the southwest as seen in Attachment II-E. These structures may affect the movement of groundwater; however, at this time, no relationship has been determined. Small scale local folding influences the movement of groundwater within the permit and adjacent area. Groundwater movement within the permit area is believed to be in the direction of the primary dip of the strata, which is to the southwest. There are no faults within the permit area that may influence the movement of groundwater other than

minor folding or rolling of the coal seam. For maps and cross-sections to support the geological structures, see the Hydro-Geo Map and Geologic Investigation Cross-Section A-A' in Part II-E.

7. Groundwater Description Support Data:

All maps and cross-sections are certified under Attachment II-E, Certification Statement.

8. Groundwater Sampling and Analytical Methods:

Baseline data was taken from monitoring reports of H255, H256 and H257. Additional samples of these existing wells will be taken to see if there has been any significant change to ground water. Samples were taken by McGehee Engineering Corp. were taken with a hand bailer until a constant temperature, pH and Conductivity was reached, this assures the sample is from recharge Depth to the water, pH and Conductivity is measured in the field. Groundwater level measurements are determined by use of weighted tape prior to any bailing. The surface elevation has been predetermined by surveying the drill holes in. The groundwater levels were measured using the top of the casing as a reference point. Therefore, the depth to water was subtracted from the top of the casing to get the elevation of the groundwater.

All ground water samples were taken by the grab method was defined by the 17th Edition of Standard Methods for the Examination of Water and Wastewater, "1060 Collection and Preservation of Samples", pp. 1-30 through 1-40. Analysis of pH was performed in accordance with the Hach Water Analysis Handbook, "Electrode Method pp. 486-488. This method is EPA approved. Analysis of Conductivity, SpC, was performed in accordance with the 17th Edition of

Standard Methods for the Examination of Water and Wastewater, "2510 Conductivity", pp. 2-57 through 2-61. Analysis of Total Iron, Fe, was performed in accordance with the Hach Water Analysis Handbook, "FerroVer Method", pp. 321 – 325. This method is EPA approved and was adapted from Standard Methods for the Examination of Water and Wastewater. Analysis of Total Manganese, Mn, was performed in the accordance with the Hach Water Analysis Handbook, "Periodate Oxidation Method", pp. 361- 363. This method is EPA approved and was adapted from Standard Methods for the Examination of Water and Wastewater. Analysis of Sulfate, SO_4, was performed in accordance with the Hach Water Analysis Handbook, "SulfaVer 4 Method", pp. 567- 571. This method is EPA approved and was adapted from Standard Methods for the Examination of Water and Wastewater.

9. Groundwater Sampling and Analytical Information:

For sampling and analytical information see above statement 8 and the attached table entitled Groundwater Baseline Analysis.

GROUNDWATER BASELINE ANALYSIS

SAMPLE I.D.: H255
MONITORING SOURCE: WELL MONITORING ELEV. = 320.00

DATE	pH s.u.	Fe MG/L	Mn MG/L	COND. U-MHOS	SO_4 MG/L	ACIDITY MG/L	ALKA MG/L	WATER DEPTH	WATER ELEV.
09-17-08	6.96	13.72	0.29	137	8	39	33	23.42’	296.80’
10-03-08	6.47	0.66	0.12	121	20	21	60	26.00’	294.00’
11-01-08	6.47	1.62	0.26	103	14	21	129	27.00’	293.00’
12-02-08	6.30	3.04	0.47	267	39	0	17	27.00’	293.00’
01-09-09	5.66	0.27	1.11	187	49	86	35	21.42’	298.58’
02-20-09	6.06	0.08	0.33	140	24	62	4	22.50’	297.50’
04-08-09	6.26	0.52	0.49	157	16	66	119	22.00’	298.00’

SAMPLE I.D.: H256
MONITORING SOURCE: WELL MONITORING ELEV. = 305.00’

DATE	pH s.u.	Fe MG/L	Mn MG/L	COND. U-MHOS	SO_4 MG/L	ACIDITY MG/L	ALKA MG/L	WATER DEPTH	WATER ELEV.
09-17-08	6.46	6.70	0.12	161	44	19	31	12.58’	292.42’
10-03-08	6.25	0.77	0.04	162	102	32	84	13.42’	291.58’
11-01-08	6.48	0.33	0.03	137	37	41	84	14.00’	291.00’
12-02-08	6.12	2.03	0.15	310	116	53	13	9.50’	295.50’
01-09-09	6.17	3.20	0.15	323	105	47	69	5.08’	299.92’
02-20-09	6.47	3.14	0.15	349	111	31	9	10.00’	295.00’
04-08-09	7.05	0.90	0.13	332	84	56	80	5.67’	299.33’

SAMPLE I.D.: H257
MONITORING SOURCE: WELL MONITORING ELEV. = 281.00’

DATE	pH s.u.	Fe MG/L	Mn MG/L	COND. U-MHOS	SO_4 MG/L	ACIDITY MG/L	ALKA MG/L	WATER DEPTH	WATER ELEV.
09-17-08	6.17	14.98	0.80	112	18	33	37	12.17’	268.83
10-03-08	6.28	1.59	0.78	107	37	41	76	12.42’	268.58’
11-01-08	6.19	1.07	0.51	84	26	0	72	13.42’	267.58’
12-02-08	6.34	0.81	0.31	204	102	0	19	13.00’	268.00’
01-09-09	6.12	0.64	0.92	186	32	36	68	8.58’	272.42’
02-20-09	6.30	4.57	0.99	225	32	51	17	8.00’	273.00’
04-08-09	6.42	4.84	1.01	228	32	88	77	6.42’	274.58’

SEASONAL DATA

H255

SEASON	pH s.u.	Fe MG/L	Mn MG/L	COND. U-MHOS	SO_4 MG/L	ACIDITY MG/L	ALKA MG/L	WATER DEPTH	WATER ELEV.
SPRING	6.26	0.52	0.49	157	16	66	119	22.00’	298.00’
SUMMER									
FALL	6.58	5.33	0.22	120	14	27	74	25.47’	294.60’
WINTER	5.93	1.13	0.64	198	37	49	19	23.64’	296.36’
AVERAGE	6.18	3.23	0.43	159	26	38	47	24.56’	295.48’

H256

SEASON	PH s.u.	Fe MG/L	Mn MG/L	COND. U-MHOS	SO_4 MG/L	ACIDITY MG/L	ALKA MG/L	WATER DEPTH	WATER ELEV.
SPRING	7.05	0.9	0.13	332	84	56	80	5.67’	299.33’
SUMMER									
FALL	6.38	2.60	0.06	153	61	31	66	13.33’	291.67’
WINTER	6.23	2.79	0.15	327	111	44	30	8.19’	296.81’
AVERAGE	6.44	2.70	0.11	240	86	38	48	10.76’	294.24’

H257

SEASON	PH s.u.	Fe MG/L	Mn MG/L	COND. U-MHOS	SO_4 MG/L	ACIDITY MG/L	ALKA MG/L	WATER DEPTH	WATER ELEV.
SPRING	6.42	4.84	1.01	228	32	88	77	6.42’	274.58’
SUMMER									
FALL	6.21	5.88	0.70	101	27	25	62	12.67’	268.33’
WINTER	6.24	2.01	0.74	205	55	29	35	9.86’	271.14’
AVERAGE	6.28	3.95	0.72	153	41	27	49	11.27’	286.74’