APPENDIX I

STREAM ASSESSMENT REPORT FOR THE PROPOSED LIBERTY FUELS MINE AND THE EXISTING RED HILLS MINE

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STREAM ASSESSMENT REPORT FOR THE PROPOSED LIBERTY FUELS LIGNITE MINE AND THE EXISTING RED HILLS LIGNITE MINE

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INTRODUCTION

In June, 2008 Barry A. Vittor & Associates, Inc. completed stream Rapid Bioassessment (RBA) studies at 8 sites in Kemper County, Mississippi. This work was performed on behalf of North American Coal and was designed to provide quantitative information necessary to characterize aquatic biological resources in the proposed lignite mine study area. Figure 1 depicts the locations of the stream study sites.

MATERIALS AND METHODS

Station Location Descriptions

Station locations are shown in Figure 1 (GPS locations given in Table 1). The 8 sampling stations are located within the 31,000 acre proposed lignite mine area in Kemper County, Mississippi.

Stream Habitat Quality and Biota

Physical/Chemical Conditions

Water quality (temperature, dissolved oxygen, pH, and conductivity) was measured with a YSI Model 6600 multiparameter sonde unit equipped with a 650 datalogger. The substrate type at each station was based on Wolman pebble count data.

Habitat Assessments

The Kemper County stream sampling sites can be roughly grouped based on their habitat assessment scores (HAS). Habitat assessments are used to characterize the quality of habitats found in a particular stream reach. The information obtained from a habitat assessment is necessary for the proper interpretation of water quality and benthic macroinvertebrate studies because the kinds of organisms present are dependent on the type of habitat available, as well as the quality of the water in a stream. The information used in obtaining a habitat assessment score for a particular stream reach includes epifaunal substrate/available cover, pool substrate characterization, pool variability, degree and type(s) of channel alteration, sediment deposition, channel sinuosity, channel flow status, bank vegetative protection, bank stability, and riparian vegetation zone width. The habitat assessments were conducted according to the Mississippi

Department of Environmental Quality (MDEQ) and U.S. Environmental Protection Agency's (EPA) Rapid Bioassessment (RBA) protocols (MDEQ 2001, Barbour *et al*. 1989). The HAS is derived from the MDEQ Surface Water Habitat Assessment Field Data Sheet. A higher HAS indicates a stream reach with more available biological habitat, little instream disturbance, and an undisturbed riparian zone.

Rapid Bioassessment and Benthic Communities

Macroinvertebrate sampling was conducted using the MDEQ's bioassessment protocols. D-frame dip nets were used to collect a composite macroinvertebrate sample from representative habitats in each reach. Each reach, approximately 100 meters (m) in length, was divided into discrete habitat types (*e.g.* gravel/rock/cobble, snags/leaf packs/detritus, vegetated banks, submerged macrophytes, sand/silt). The extent of each habitat type in each reach was estimated (*e.g.* 40% snags, 40% sand/silt, 20% vegetated banks). Twenty dip net sweeps were collected from each reach with the total number being apportioned among the representative habitat types with the exception that 5 jabs were taken from sand/silt for all stations. Material from the 20 sweeps was composited, preserved in 10% buffered formalin and returned to the laboratory for further processing. Composite samples were inventoried in the laboratory, rinsed gently through a 0.5 millimeter (mm) mesh sieve to remove preservatives and sediment, stained with Rose Bengal, and stored in a 70% isopropanol solution for processing. Each composite sample was randomly subsampled to a targeted level of 200 (± 20%) organisms according to MDEQ (2001) and Barbour *et al*. (1989). All macroinvertebrates were identified to the lowest practical identification level (LPIL), which in most cases was to species unless the specimen was a juvenile or damaged.

Fish Communities

Fish were collected at the sampling stations primarily with the use of a back-pack style electroshocker, although a seine net was used in combination with the shocker at some sites, as well.

RESULTS AND DISCUSSION

Stream Habitat Quality and Biota

Physical/Chemical Conditions

Physical/chemical data and Habitat Assessment Scores (HAS) for the eight sites are given in Table 1. Physical/chemical parameters were generally similar for the sampling sites. However, the three sites with the lowest HAS (Tompeat Creek, Dry Creek Tributary, and Penders Creek South) also had the lowest dissolved oxygen measurements at the time of sampling, with Tompeat Creek having, by far, the lowest measurement (1.37 mg/L, 16.4% saturation). Water temperature ranged from 22.6°C (Penders Creek South) to 25.8°C (Okatibbee Creek). Conductivity ranged from 22-µmhos/cm (Chickasawhay Headwaters) to 68-µmhos/cm (Dry Creek Tributary). Stream ph ranged from 6.71 (Tompeat Creek) to 7.82 (Penders Creek South). The substrate type was characterized as sand at six of the eight sampling sites. The Chickasawhay Plant site had a substrate characterized as sandy silt, and the Tompeat Creek site had a substrate characterized as silt/clay.

Habitat Assessments

Table 2 shows the habitat assessment scores (broken down by habitat parameter) for the North American Coal, Kemper County sampling sites. The maximum possible HAS for a stream site is 200 (Table 3). Five of the sites (Chickasawhay South, Chickasawhay Plant, Okatibbee Creek, Chickasawhay Headwaters, and Penders Creek North) earned scores of 94 or higher (with the highest score being 115 for the Chickasawhay South site), while the remaining 3 sites (Dry Creek Tributary, Tompeat Creek, and Penders Creek South) earned scores of 66 or lower (with the lowest score being 56 for the Penders Creek South site). Despite the variability in scores, bottom substrate/available cover scores (which measure the availability of actual substrates as refugia for aquatic organisms) were generally similar for all 8 sampling sites (ranging from a low score of 3, at the Chickasawhay Headwaters, Tompeat Creek, and Penders Creek South sites, to a high score of 7 at the Penders Creek North Site). These scores are relatively low, when compared to a maximum bottom substrate/available cover score of 20 (Table 2). The high and low assessment scores for these sites were primarily driven by parameters such as riparian vegetation zone width, bank stability and vegetative protection, pool substrate characterization, and channel sinuosity, and not by the availability of suitable bottom substrate or available cover.

Streams in the study area were generally diminished in habitat quality due primarily to a lack of legitimate riparian zones and the presence of steeply incised stream banks. These factors are likely the result of human interaction, primarily historic agricultural practices in those areas.

Rapid Bioassessment and Benthic Communities

A cluster analysis for the North American Coal sampling sites was performed using several metrics, including total number of taxa (taxa richness), percent dominant taxon (percentage of total individuals represented by the dominant taxon), number of Chironomidae taxa, percent Chironomidae, percent Tanytarasini Chrionomid taxa, number of EPT (Ephemeroptera + Plecoptera + Trichoptera) taxa, percent EPT taxa, EPT/Chironomidae taxa ratio, Shannon taxa diversity index (H'), and habitat assessment score. The metric data for each site are given in Table 3 and the cluster analysis is presented in Figure 2. The raw taxonomic data for each of the eight sites is archived at Barry A. Vittor & Assoc., Inc..

No unionid mussels were encountered at any of the eight sampling stations. The only bivalves observed during sampling were common fingernail clams (Family Sphaeriidae). Likewise, no crayfish species were observed during sampling at any of the eight monitoring stations.

Taxa richness data for the eight sampling sites are given in Table 3. Taxa richness typically declines with increasing stream perturbations. Taxa richness was lowest at the Tompeat Creek site, with 31 unique taxa identified at that site. All other sampling sites had higher numbers of taxa, with the highest number, 45, occurring at the Chickasawhay South site.

The numbers of Chironomidae taxa (midge larvae) for the eight sites are given in Table 3. The number of Chironomidae taxa typically declines with increasing stream perturbations. The number of Chrionomidae taxa was lowest at the Tompeat Creek site, with 12 taxa being collected. The highest numbers of Chironomidae taxa were collected at the Chickasawhay South and Chickasawhay Plant sites, with 21 taxa being collected at both sites. The percent dominance of chironomids typically increases with stream perturbations and ranged from 36% (Tompeat Creek) to 83% (Penders Creek South).

The percentage of chironomids in the Tribe Tanytarsini is given in Table 3. Tanytarsini chironomids are small midge larvae that are variously filter-feeders or collector-gatherers. Typically the number of Tanytarsini chironomids declines with perturbations to a stream habitat. The percentage of Tanytarsini chironomids was extremely variable with the lowest percentage collected at the Tompeat Creek site (2%) and the highest percentage collected at the Okatibbee Creek site (55%).

The number of EPT taxa and the percent of the assemblage represented by EPT taxa are given in Table 3. EPT taxa are composed of Ephemeroptera (mayfly larvae), Plecoptera (stonefly larvae), and Trichoptera (caddisfly larvae). EPT taxa are typically sensitive to stream perturbations and numbers decline with increasing disturbance. No EPT taxa were collected from the Dry Creek Tributary site. The highest number and percentage of EPT taxa was collected from the Okatibbee Creek site (8 taxa, 25% of the assemblage).

The EPT taxa/Chironomidae taxa ratio for each site is given in Table 3. Typically the relative abundance of EPT taxa to Chironomidae taxa decreases with increasing stream perturbation. The EPT/Chironomidae ratio was 0 for the Dry Creek Tributary (due to the lack of EPT taxa). The highest ratio, 24, was found at the Chickasawhay Plant site.

The percent dominant taxon data are given in Table 3. The percent dominance of a single taxon increases with increasing stream perturbation. The dominance of a single taxon was lowest at the Chickasawhay South site (11%), while a single taxon made up 47% of the assemblage at the Okatibbee Creek site. Taxa diversity (H') data are given in Table 3. Taxa diversity within a given assemblage is dependent upon the number of taxa present (taxa richness) and the distribution of all individuals among those taxa (equitability or evenness). Taxa diversity typically declines with increasing stream perturbation. Diversity was lowest at the Okatibbee Creek site (2.20) and highest (3.31) at the Chickasawhay South site. Habitat assessment scores ranged from 56 (Penders Creek South) to 115 (Chickasawhay South).

Based on HAS and RBA metrics it appears that the Tompeat Creek and Dry Creek Tributary sites are the most impacted sites, exhibiting those characteristics indicative of historic human

interaction (i.e. lack of legitimate riparian zone, and steeply incised stream banks). Cluster analysis was performed by calculating the Bray-Curtis similarity coefficient for all pairs of sampling stations utilizing the biological metrics (Clarke and Gorley 2003). Clusters were formed using the group-average linkage method between similarities. Cluster analysis is a multivariate technique that attempts to determine natural groupings (or clusters) of sites based on the biological metrics. Cluster analysis for the eight sampling sites shows separation of the Tompeat Creek and Dry Creek Tributary sites based primarily on a very low percentage of sensitive organisms (Tompeat Creek) or the lack of EPT taxa collected (Dry Creek Tributary) along with low HAS at both sites. Based on a high HAS, a high percentage of sensitive organisms, and a high number of EPT taxa, Okatibbee Creek appears to be the least impacted site. All other sites were generally similar with respect to the RBA metrics.

Available habitat for aquatic organisms varied little between these other sites, and was either generally low quality, or lacking in overall area of available habitat, illustrating the importance of taking into account overall RBA metrics as well as HAS when drawing conclusions concerning overall habitat quality in a given study area.

Fish Communities

Fish community data for the eight sampling sites are given in Table 4. Numbers of fish taxa, as well as numbers of individuals varied greatly between stations. However, the three sites with the highest HAS (Chickasawhay South, Chickasawhay Plant, and Okatibbee Creek) also had the highest numbers of taxa and individuals, with the Chickasawhay South site having the highest numbers (5 taxa, 28 individuals). Of these 28 individuals, the majority (20) was made up of two species of shiner. The dominant species at this site was Weed Shiner (*Notropis texanus*, 13 individuals) and Blacktail Shiner (*Cyprinella venusta*, 7 individuals). Other species collected at the Chickasawhay South site included Spotted Bass (*Micropterus punctulatus*, 4 individuals), Bluegill (*Lepomis macrochirus*, 3 individuals) and Clear Chub (*Notropis winchelli*, 1 individual).

Weed Shiner and Blacktail Shiner also dominated the fish community collected at the Chickasawhay Plant site with 16 and 6 individuals collected, respectively. The other species collected at this site was Bluegill (two individuals). The Okatibbee Creek fish community was

also dominated by Weed Shiner and Blacktail Shiner with 5 and 4 individuals collected, respectively. Other species collected at the Okatibbee Creek site included Blackspotted Top Minnow (*Fundulus olivaceus*, one individual) and Longnose Shiner (*Notropis longirostris*, one individual).

Very few fish were collected from the other sampling sites: 5 Bluegill were collected from the Penders Creek North site; 2 Bluegill and one Spotted Bass were collected from the Tompeat Creek Site; and 3 Western Mosquitofish (Gambusia affinis) were collected from the Penders Creek South site. One Week Shiner was collected from the Dry Creek Tributary site, and one Blacktail Shiner was collected from the Chickasawhay Headwaters site.

The number of fish collected can be a function of the amount of available cover at a particular site. However, fish collections are largely qualitative in nature and correlations between fish community data and stream condition should not be assumed.

STATION SPECIFIC SUMMARY

The following section summarizes the data obtained at each station during the field surveys. Stations were ranked by habitat assessment score and are described below in order from highest to lowest score.

Chickasawhay South

Habitat Assessment

Chickasawhay South was sampled on June 3, 2008 and scored a habitat assessment score (HAS) of 115. This station was distinguished by high scores on riparian vegetation zone widths for right and left banks, channel alteration, and channel flow status. The score for bottom substrate/available cover was relatively low.

Rapid Bioassessment/Benthos

Forty-five taxa were collected at this site during sampling. Twenty-one of these taxa, 70% of the total individuals collected, were from the family Chironomidae. Of the Chironomidae, 27%

were from the taxonomic tribe, Tanytarsini, an important indicator group due to their sensitivity to environmental impacts. Four of the total taxa collected (9%) were Ephemeroptera, Plecoptera, or Tricoptera (EPT) taxa. This site had a taxa diversity (H') of 3.31.

Physical/Chemical Data

Chickasawhay South had a stream width of approximately 5 meters in the sampling area, with an average stream depth of 0.5 meters. Water temperature at the time of sampling was 24.4°C. Conductivity and pH were 47 µmhos/cm and 7.3, respectively. Dissolved oxygen at this site was 5.67 mg/L (68% saturation) at the time of sampling. The substrate type (based on pebble count data) was sand.

Fish Collection

Five fish taxa (28 individuals) were collected at the Chickasawhay South site. The most numerous of these (13 individuals; 46% of total individuals) was Weed Shiner (*Notropis texanus*). Other taxa collected included Blacktail Shiner (*Cyprinella venusta*, 7 individuals), Spotted Bass (*Micropterus punctulatus*, 4 individuals), Bluegill (*Lepomis macrochirus*, 3 individuals) and Clear Chub (*Notropis winchelli*, 1 individual).

Chickasawhay Plant

Habitat Assessment

Chickasawhay Plant was sampled on June 4, 2008 and scored a HAS of 112. This station was distinguished by high scores on riparian vegetation zone width on the right bank, channel alteration, channel sinuosity, and channel flow status. The score for bottom substrate/available cover was relatively low.

Rapid Bioassessment/Benthos

Forty-one taxa were collected at this site during sampling. Twenty-one of these taxa, 66% of the total individuals collected, were from the family Chironomidae. Of the Chironomidae, 18% were from the taxonomic tribe, Tanytarsini. Five of the total taxa collected (12%) were EPT taxa. This site had a taxa diversity (H') of 3.13.

Physical/Chemical Data

Chickasawhay Plant had a stream width of approximately 5 meters in the sampling area, with an average stream depth of 0.5 meters. Water temperature at the time of sampling was 23.9°C. Conductivity and pH were 42 µmhos/cm and 7.17, respectively. Dissolved oxygen at this site was 5.9 mg/L (69.8% saturation) at the time of sampling. The substrate type (based on pebble count data) was sandy silt.

Fish Collection

Three fish taxa (24 individuals) were collected at the Chickasawhay Plant site. The most numerous of these (16 individuals; 67% of total individuals) was Weed Shiner (*Notropis texanus*). Other taxa collected included Blacktail Shiner (*Cyprinella venusta,* 6 individuals), and Bluegill (*Lepomis macrochirus*, 2 individuals).

Okatibbee Creek

Habitat Assessment

Okatibbee Creek was sampled on June 4, 2008 and scored a HAS of 100. This station was distinguished by high scores on riparian vegetation zone width for right and left banks, channel alteration, and channel flow status. This site received a lower HAS than previous sites based primarily on lower scores for bank stability and bank vegetative protection. The score for bottom substrate/available cover was relatively low, and similar to previous sites.

Rapid Bioassessment/Benthos

Thirty-two taxa were collected at this site during sampling. Sixteen of these taxa, 76% of the total individuals collected, were from the family Chironomidae. Of the Chironomidae, 55% were from the taxonomic tribe, Tanytarsini. Eight of the total taxa collected (25%) were EPT taxa. This site had a taxa diversity (H') of 2.20.

Physical/Chemical Data

Okatibbee Creek had a stream width of approximately 10 meters in the sampling area, with an average stream depth of 3 meters. Water temperature at the time of sampling was 25.8°C. Conductivity and pH were 46 µmhos/cm and 7.23, respectively. Dissolved oxygen at this site

was 6.71 mg/L (82.3% saturation) at the time of sampling. The substrate type (based on pebble count data) was sand.

Fish Collection

Four fish taxa (11 individuals) were collected at the Okatibbee Creek site. The most numerous of these (5 individuals; 45% of total individuals) was Weed Shiner (*Notropis texanus*). Other taxa collected included Blacktail Shiner (*Cyprinella venusta,* 4 individuals), Blackspotted topminnow (Fundulus olivaceus, 1 individual), and Longnose Shiner (*Notropis longirostris*, 1 individual).

Chickasawhay Headwaters

Habitat Assessment

The Chickasawhay Headwaters site was sampled on June 3, 2008 and scored a HAS of 98. This station was distinguished by high scores on riparian vegetation zone width for right and left banks, sediment deposition, and channel flow status. This site received a lower HAS than previous sites based primarily on low scores for pool substrate characterization and pool variability. The score for bottom substrate/available cover was relatively low, and similar to previous sites.

Rapid Bioassessment/Benthos

Thirty-eight taxa were collected at this site during sampling. Eighteen of these taxa, 80% of the total individuals collected, were from the family Chironomidae. Of the Chironomidae, 23% were from the taxonomic tribe, Tanytarsini. Five of the total taxa collected (13%) were EPT taxa. This site had a taxa diversity (H') of 2.78.

Physical/Chemical Data

The Chickasawhay Headwaters site had a stream width of approximately 2 meters in the sampling area, with an average stream depth of 0.2 meters. Water temperature at the time of sampling was 24.9°C. Conductivity and pH were 22 µmhos/cm and 7.08, respectively. Dissolved oxygen at this site was 7.78 mg/L (93.9% saturation) at the time of sampling. The substrate type (based on pebble count data) was sand.

Fish Collection

One fish taxon (1 individual) was collected at the Chickasawhay Headwaters site. This individual was a Blacktail Shiner (*Cyprinella venusta*).

Penders Creek North

Habitat Assessment

Penders Creek North was sampled on June 3, 2008 and scored a HAS of 94. This station was distinguished by high scores on riparian vegetation zone width for right and left banks, channel alteration, and channel flow status. This site received a lower HAS than previous sites based primarily on a low score for channel sinuosity. The score for bottom substrate/available cover was relatively low, and similar to previous sites.

Rapid Bioassessment/Benthos

Forty-two taxa were collected at this site during sampling. Eighteen of these taxa, 79% of the total individuals collected, were from the family Chironomidae. Of the Chironomidae, 15% were from the taxonomic tribe, Tanytarsini. Five of the total taxa collected (12%) were EPT taxa. This site had a taxa diversity (H') of 2.42.

Physical/Chemical Data

Penders Creek North had a stream width of approximately 5 meters in the sampling area, with an average stream depth of 0.75 meters. Water temperature at the time of sampling was 22.7°C. Conductivity and pH were 37 µmhos/cm and 7.82, respectively. Dissolved oxygen at this site was 7.04 mg/L (81.9% saturation) at the time of sampling. The substrate type (based on pebble count data) was sand.

Fish Collection

One fish taxon (5 individuals) was collected at the Penders Creek North site. These individuals were Bluegill (*Lepomis Macrochirus*).

Dry Creek Tributary

Habitat Assessment

Dry Creek Tributary was sampled on June 4, 2008 and scored a HAS of 66. This station was distinguished by high scores on riparian vegetation zone width for the left bank, and channel flow status. This site received a considerably lower HAS than previous sites based primarily on a low scores for right bank riparian vegetation zone width, channel sinuosity, bank vegetative protection, and bank stability. The score for bottom substrate/available cover was relatively low, and similar to previous sites.

Rapid Bioassessment/Benthos

Thirty-four taxa were collected at this site during sampling. Eighteen of these taxa, 57% of the total individuals collected, were from the family Chironomidae. Of the Chironomidae, 29% were from the taxonomic tribe, Tanytarsini. No EPT taxa were collected from this site, which had a taxa diversity (H') of 2.67.

Physical/Chemical Data

Dry Creek Tributary had a stream width of approximately 3 meters in the sampling area, with an average stream depth of 0.2 meters. Water temperature at the time of sampling was 23.4°C. Conductivity and pH were 68 µmhos/cm and 7.01, respectively. Dissolved oxygen at this site was 4.02 mg/L (47% saturation) at the time of sampling. The substrate type (based on pebble count data) was sand.

Fish Collection

One fish taxon (1 individual) was collected at the Dry Creek Tributary site. This individual was a Weed Shiner (*Notropis texanus*).

Tompeat Creek

Habitat Assessment

Tompeat Creek was sampled on June 4, 2008 and scored a HAS of 64. This station was distinguished by high scores on bank vegetative protection, and channel flow status. This site received a similar HAS to the Dry Creek Tributary site, and a considerably lower HAS than the

other sites. The lower HAS at this site was based primarily on a low scores for riparian vegetation zone width, channel sinuosity, pool substrate characterization, pool variability, channel alteration, and sediment deposition. The score for bottom substrate/available cover was relatively low, and similar to previous sites.

Rapid Bioassessment/Benthos

Thirty-one taxa were collected at this site during sampling. Twelve of these taxa, 36% of the total individuals collected, were from the family Chironomidae. Of the Chironomidae, 2% were from the taxonomic tribe, Tanytarsini. Two of the total taxa collected (6%) were EPT taxa. This site had a taxa diversity (H') of 2.52.

Physical/Chemical Data

Tompeat Creek had a stream width of approximately 1 meter in the sampling area, with an average stream depth of 0.2 meters. Water temperature at the time of sampling was 24.1°C. Conductivity and pH were 49 µmhos/cm and 6.71, respectively. Dissolved oxygen at this site was 1.37 mg/L (16.4% saturation) at the time of sampling. The substrate type (based on pebble count data) was silt/clay.

Fish Collection

Two fish taxa (3 individuals) were collected at the Tompeat Creek site. 2 of these individuals were Bluegill (*Lepomis macrochirus*) and the other was a Spotted Bass (*Micropterus punctulatus*).

Penders Creek South

Habitat Assessment

Penders Creek South was sampled on June 3, 2008 and scored a HAS of 56. This station was distinguished by a high score only on channel flow status. This site received a similar HAS to the Dry Creek Tributary and Tompeat Creek sites, and a considerably lower HAS than the other sites. The lower HAS at this site was based primarily on a low scores for riparian vegetation zone width, bank stability, bank vegetative protection, and channel sinuosity. The score for bottom substrate/available cover was relatively low, and similar to previous sites.

Rapid Bioassessment/Benthos

Thirty-two taxa were collected at this site during sampling. Twenty of these taxa, 83% of the total individuals collected, were from the family Chironomidae. Of the Chironomidae, 26% were from the taxonomic tribe, Tanytarsini. Three of the total taxa collected (9%) were EPT taxa. This site had a taxa diversity (H') of 2.80.

Physical/Chemical Data

Penders Creek South had a stream width of approximately 2.5 meters in the sampling area, with an average stream depth of 0.25 meters. Water temperature at the time of sampling was 22.6°C. Conductivity and pH were 50 µmhos/cm and 7.38, respectively. Dissolved oxygen at this site was 4.05 mg/L (45.6% saturation) at the time of sampling. The substrate type (based on pebble count data) was sand.

Fish Collection

One fish taxon (3 individuals) was collected at the Penders Creek South site. These individuals were Western Mosquitofish (*Gambusia affinis*).

RED HILLS MINE AREA

INTRODUCTION

In October, 2008 Barry A. Vittor & Associates, Inc. completed stream Rapid Bioassessment (RBA) studies at four sites at North American Coal's Red Hills Mine site in Choctaw County, Mississippi. This work was performed on behalf of North American Coal and was designed to provide quantitative information necessary to characterize aquatic biological resources at that site. RBA data from "natural" stream sections, as well as sections of stream diverted as a part of mining activity was used to gain a greater understanding of possible impacts of mining activities on streams near the proposed lignite mine area in Kemper County, Mississippi.

MATERIALS AND METHODS

Station Location Descriptions

Two "natural" stream sites were studied near the Red Hills Mine site. The R1 Headwaters site was located upstream of the mine area, while the Little Bywy station was located just downstream of the mine site, below the sediment retention basin at the north side of the mine. The other two sampling locations were located in areas that had been diverted due to mining activity. These two stations (Diversion 1 and Diversion 2) were located between the R1 Headwaters and Little Bywy stations. Figure 3 shows a map of the sampling locations.

Stream Habitat Quality and Biota

Physical/Chemical Conditions

Water quality (temperature, dissolved oxygen, pH, and conductivity) was measured with a YSI Model 6600 multiparameter sonde unit equipped with a 650 datalogger. The substrate type at each station was based on Wolman pebble count data.

Habitat Assessments

Habitat assessments are used to characterize the quality of habitats found in a particular stream reach. The information obtained from a habitat assessment is necessary for the proper

interpretation of water quality and benthic macroinvertebrate studies because the kinds of organisms present are dependent on the type of habitat available, as well as the quality of the water in a stream. The information used in obtaining a habitat assessment score for a particular stream reach includes epifaunal substrate/available cover, pool substrate characterization, pool variability, degree and type(s) of channel alteration, sediment deposition, channel sinuosity, channel flow status, bank vegetative protection, bank stability, and riparian vegetation zone width. The habitat assessments were conducted according to the Mississippi Department of Environmental Quality (MDEQ) and U.S. Environmental Protection Agency's (EPA) Rapid Bioassessment (RBA) protocols (MDEQ 2001, Barbour *et al*. 1989). The habitat assessment score (HAS) is derived from the MDEQ Surface Water Habitat Assessment Field Data Sheet. A higher HAS indicates a stream reach with more available biological habitat, little instream disturbance, and an undisturbed riparian zone.

Rapid Bioassessment and Benthic Communities

Macroinvertebrate sampling was conducted using the MDEQ's bioassessment protocols. D-frame dip nets were used to collect a composite macroinvertebrate sample from representative habitats in each reach. Each reach, approximately 100 meters (m) in length, was divided into discrete habitat types (*e.g.* gravel/rock/cobble, snags/leaf packs/detritus, vegetated banks, submerged macrophytes, sand/silt). The extent of each habitat type in each reach was estimated (*e.g.* 40% snags, 40% sand/silt, 20% vegetated banks). Twenty dip net sweeps were collected from each reach with the total number being apportioned among the representative habitat types with the exception that 5 jabs were taken from sand/silt for all stations. Material from the 20 sweeps was composited, preserved in 10% buffered formalin and returned to the laboratory for further processing. Composite samples were inventoried in the laboratory, rinsed gently through a 0.5 millimeter (mm) mesh sieve to remove preservatives and sediment, stained with Rose Bengal, and stored in a 70% isopropanol solution for processing. Each composite sample was randomly subsampled to a targeted level of 200 (± 20%) organisms according to MDEQ (2001) and Barbour *et al*. (1989). All macroinvertebrates were identified to the lowest practical identification level (LPIL), which in most cases was to species unless the specimen was a juvenile or damaged.

Fish Communities

Fish were collected at the sampling stations primarily with the use of a back-pack style electroshocker, although a seine net was used in combination with the shocker at some sites, as well.

RESULTS AND DISCUSSION

Stream Habitat Quality and Biota

Physical/Chemical Conditions

Water quality data for the Red Hills Mine stations are given in Table 5. Physical/chemical parameters were generally similar among the stations sampled at the Red Hills Mine. Dissolved oxygen ranged from 2.75 mg/L (26.7% saturation) at the Diversion 1 station to 8.73 mg/L (86.6% saturation) at the Little Bywy station. Water temperature ranged from 14.86°C (Diversion 1) to 17.0°C (R1 Headwaters). Conductivity ranged from 37- µmhos/cm (R1 Headwaters) to 61- µmhos/cm (Little Bywy). Stream pH ranged form 7.27 (Diversion 2) to 9.92 (R1 Headwaters). The substrate type was characterized as sand at the R1 Headwaters site, silt at Diversion 1, and silty/sand at both Diversion 2 and Little Bywy. Physical/chemical parameters observed at Red Hills were comparable to physical/chemical data obtained at the Kemper County sites. Some data (especially temperature) differed due to the difference in season that the sampling was completed (Red Hills was sampled in October, Kemper County in June).

Habitat Assessments

Scores for the Red Hills stations are given in Table 6. Scores were all similar at the Red Hills stations and ranged from 98 at Diversion 2 to 128 at Little Bywy. Each of the remaining stations (Diversion 1 and R1 Headwaters) received habitat assessment scores of 113. The lower HAS at the Diversion 2 station was primarily a function of lack of riparian zone vegetation at that station. HAS for the Red Hills sampling stations were generally similar to scores observed at the Kemper County sites (which ranged from 56 to 115). HAS for the two diverted sections of stream suggest that the diversion of these sections has been completed in a manner which retains relatively similar habitat quality to natural stream sections in the sampling area, as well as to stream sites located near the proposed Kemper County site.

Rapid Bioassessment and Benthic Communities

The biological metrics data for each of the Red Hills sampling stations are given in Table 7. For the purposes of comparison, the metrics data for the Kemper County stations are also presented in Table 7. The rapid bioassessment metrics vary among the Red Hills sampling stations. In general, the metrics for the Diversion 1 station were similar to the metrics observed at the R1 Headwaters station, while the Diversion 2 and Little Bywy sampling stations were highly variable. Based on the metrics data, it appears that benthic communities, while variable, did not experience significant impact as a result of mining activities (i.e. diversion of the natural stream system) in that area.

When compared to the metrics data for the Kemper County sampling stations, the four Red Hills stations exhibit similar metrics values, as well as similarly high variability as the Kemper County sampling stations.

For the purposes of comparison, MDEQ guidelines were followed to develop a multi-metric bioassessment score for the Red Hills Mine sampling sites as well as the Kemper County sampling stations (MDEQ 2001). Selected benthic macroinvertebrate metrics were used to calculate this bioassessment score. Results for each sampling site are given in Table 8. Bioassessment scores varied among sites at both the Red Hills and Kemper County sampling areas. Scores for the two diverted sections of stream varied from each other, but were generally similar to natural stream sections at both the Red Hills and Kemper County sampling areas.

A cluster analysis for the North American Coal sampling sites (Red Hills and Kemper County) was performed using several metrics, including total number of taxa (taxa richness), percent dominant taxon (percentage of total individuals represented by the dominant taxon), number of Chironomidae taxa, percent Chironomidae, percent Tanytarasini Chrionomid taxa, number of EPT (Ephemeroptera + Plecoptera + Trichoptera) taxa, percent EPT taxa, EPT/Chironomidae taxa ratio, Shannon taxa diversity index (H'), and habitat assessment score. The cluster analysis is presented in Figure 4. The cluster analysis shows all sites (Red Hills and Kemper County sites) grouped at greater than a 70% level of similarity. This cluster analysis further documents the conclusion that the diversion of natural stream sections by mining activity at the Red Hills

site has been completed in a manner which retains relatively similar habitat quality and benthic macroinvertebrate communities to natural stream sections in the same sampling area, as well as to stream sites located near the proposed Kemper County site.

Fish Communities

Fish collections at the Red Hills stations were similar to those at the Kemper County sites. The highest numbers and species diversity were collected from the two diversion sites at Red Hills. Sampling for fish communities at the R1 Headwaters and Little Bywy sites was logistically more difficult than at the diversion sites. Lack of fish species collected at these sites does not reflect poor conditions, but rather difficulty in sampling fish at those sites. Regardless, the number and diversity of the fish caught at Diversion 1 and 2 reflects a generally high degree of suitable habitat (i.e. submerged vegetation and rocky substrates) in the diverted area. Fish collection data for the Red Hills sampling stations are given in Table 9. No fish were collected at the R1 Headwaters site, reflecting the very narrow, shallow nature of this stream section. The most numerous fish species collected at the remaining stations were members of the genus *Lepomis* (sunfishes). Diversion 1 also contained *Gambusia affinis* (western mosquitofish) and *Fundulus olivaceus* (blackspotted topminnow). Diversion 2 contained *Notropis taxanus* (weed shiner), *F. olivaceus*, and *Erimyzon oblongus* (creek chubsucker) along with the various *Lepomis* species.

LITERATURE CITED

Barbour, M.T., J.L. Plafkin, K.D. Porter, S.K. Gross and R.M. Hughes. 1989. Rapid bioassessment protocols for use in streams and rivers: benthic macroinvertebrates and fish. EPA/440/4-89-001. Office of Water, US Environmental Protection Agency, Washington, D.C.

Clarke, K.R. and R.N. Gorley. 2003. PRIMER 5 (Plymouth Routines in Multivariate Ecological Research). Plymouth Marine Laboratory, Plymouth, United Kingdom.

Mississippi Department of Environmental Quality. 2001. Quality Assurance Project Plan for 303(d) List Assessment and Calibration of the Index and Biological Integrity for Wadeable Streams in Mississippi. MDEQ, Jackson, MS.

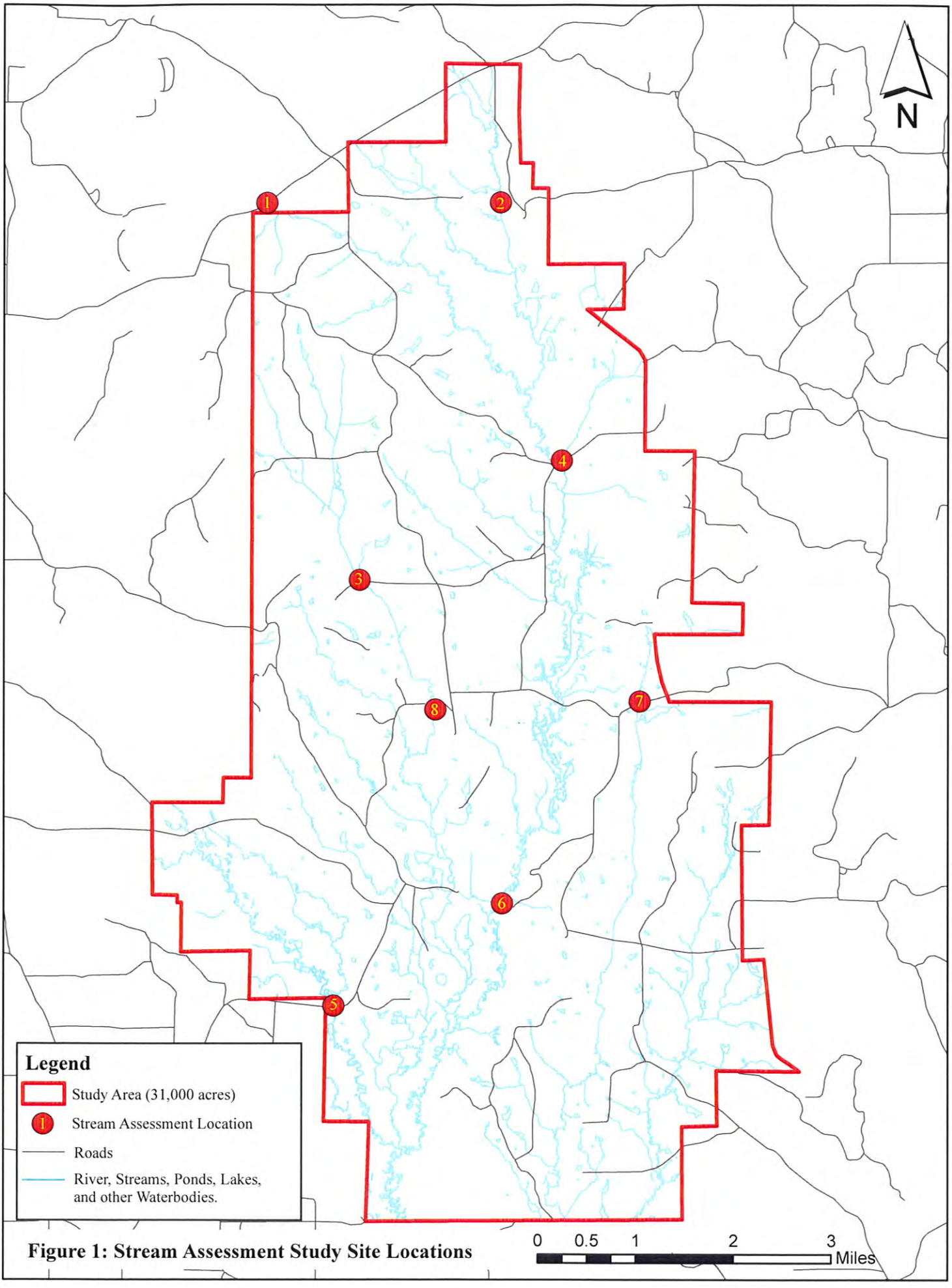
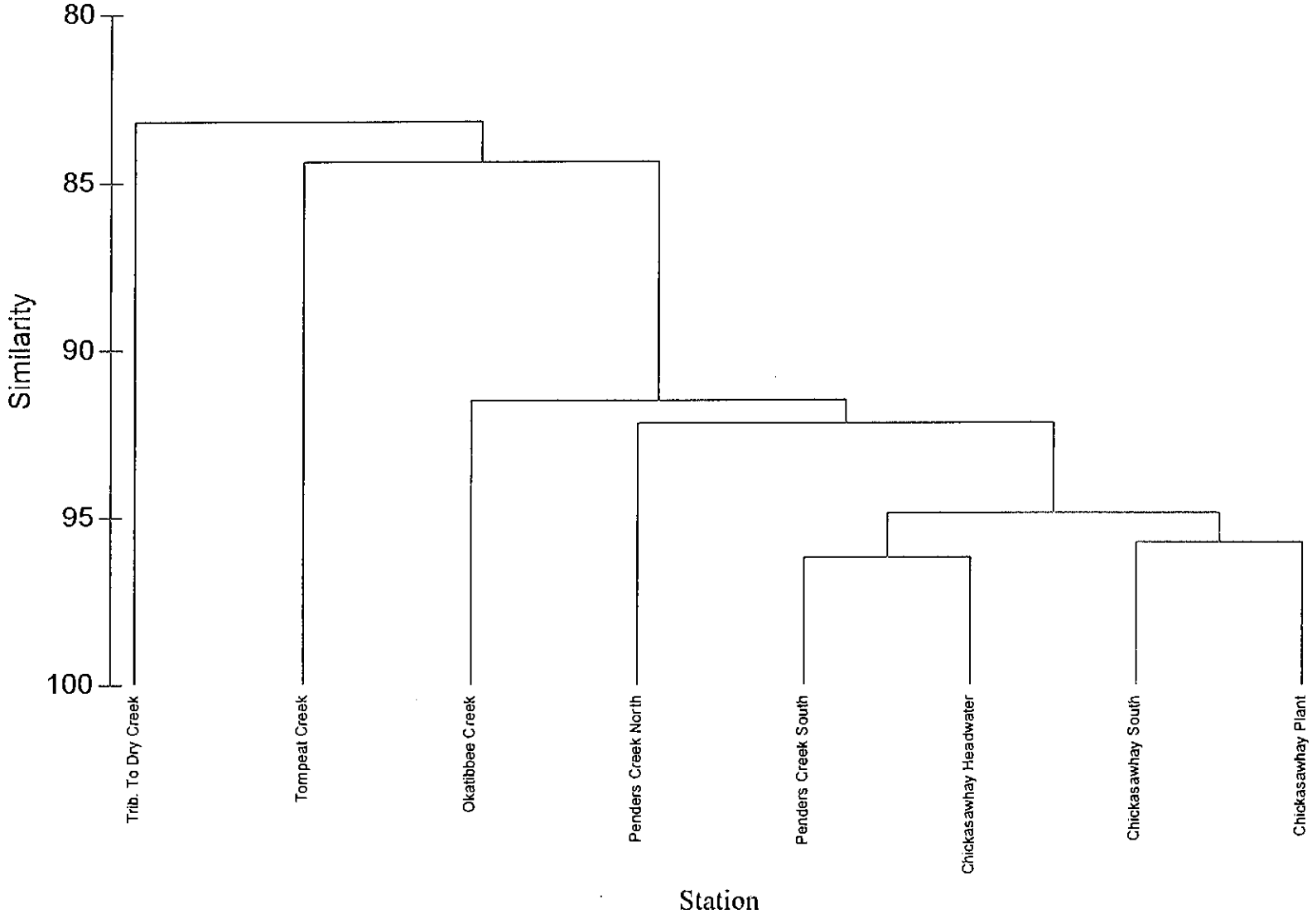


Figure 1: Stream Assessment Study Site Locations

Figure 2. Cluster analysis for the North American Coal Kemper County RBA sampling sites.



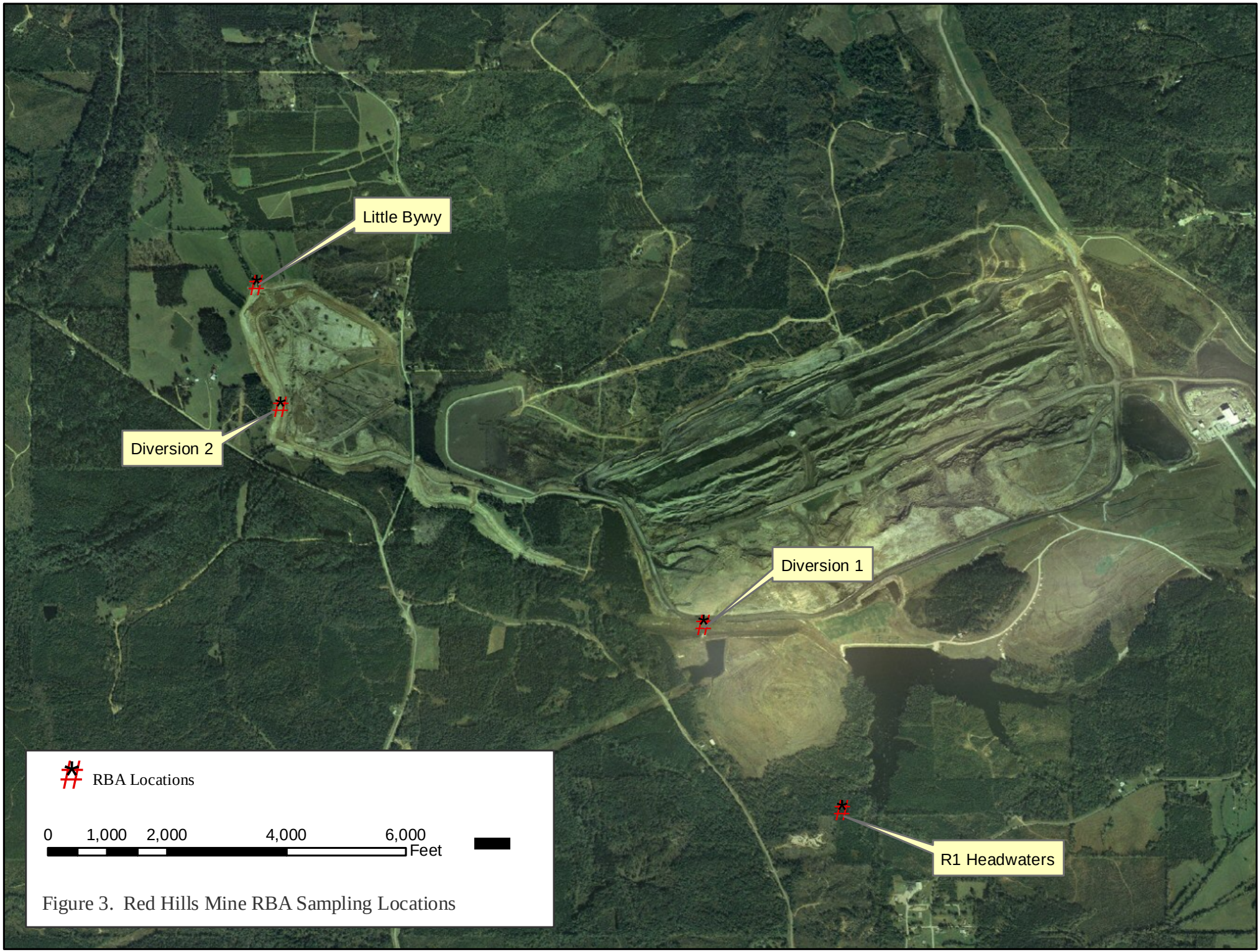


Figure 3. Red Hills Mine RBA Sampling Locations

Figure 4. Cluster analysis for the North American Coal Kemper County and Red Hills Mine RBA sampling sites.

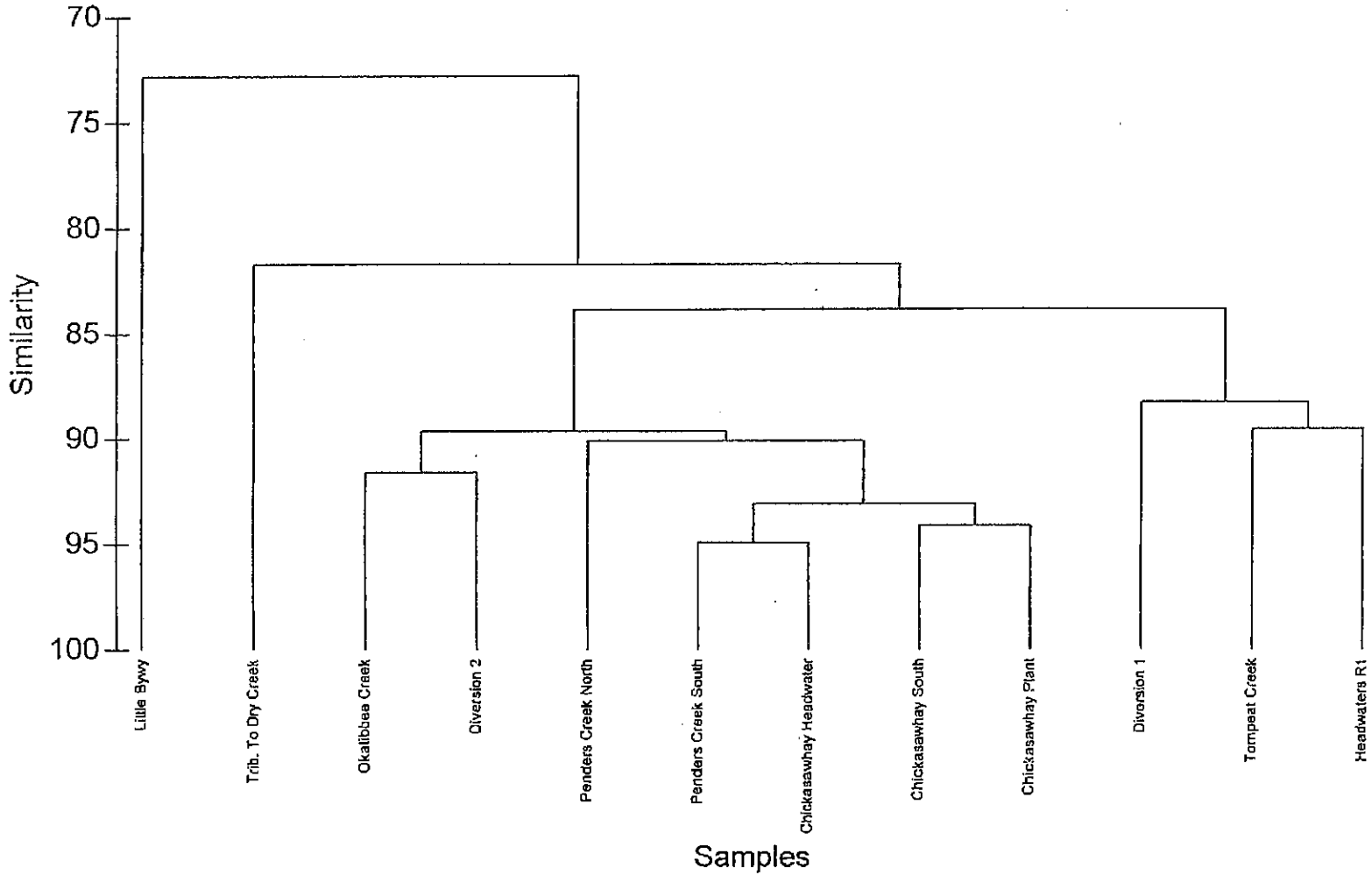


Table 1. Physical/chemical and water quality data for the North American Coal, Kemper County sampling sites.

Station	Station Description	Date Sampled	Station Location		Stream Width (m)	Avg. Stream Depth (m)	Water Temp (°C)	Conductivity µmhos/cm	pH	DO mg/l	DO %Saturation	*Substrate Type	Habitat Assessment Score
			Latitude	Longitude									
CHH	Chickasawhay Headwaters	3-Jun	32°41'43"N	88°49'32"W	2	0.2	24.9	22	7.08	7.78	93.9	sand	98
CHP	Chickasawhay Plant	4-Jun	32°39'24"N	88°46'28"W	5	0.5	23.9	42	7.17	5.9	69.8	sandy silt	112
CHS	Chickasawhay South	3-Jun	32°35'28"N	88°47'06"W	5	0.5	24.4	47	7.3	5.67	68	sand	115
PCN	Penders Creek North	3-Jun	32°38'30"N	88°48'35"W	5	0.75	22.7	37	7.82	7.04	81.9	sand	94
PCS	Penders Creek South	3-Jun	32°37'07"N	88°47'48"W	2.5	0.25	22.6	50	7.38	4.05	45.6	sand	56
TPC	Tompeat Creek	4-Jun	32°37'16"N	88°45'39"W	1	0.2	24.1	49	6.71	1.37	16.4	silt/clay	64
DCT	Dry Creek Tributary	4-Jun	32°41'43"N	88°47'06"W	3	0.2	23.4	68	7.01	4.02	47	sand	66
OKC	Okatibbee Creek	4-Jun	32°34'33"N	88°41'51"W	10	3	25.8	46	7.23	6.71	82.3	sand	100

*Pebble Count Summary

Table 2. Habitat assessment scores for the North American Coal, Kemper County sampling sites, June, 2008.

Habitat Parameter	Max Score	Chickasawhay South	Chickasawhay Plant Site	Okatibbee Creek	Chickasawhay Headwaters	Penders Creek North	Dry Creek Tributary	Tompeat Creek	Penders Creek South
Bottom Substrate/ Available Cover	20	5	4	6	3	7	6	3	3
Pool Substrate Characterization	20	9	6	7	3	4	7	1	7
Pool Variability	20	6	6	7	1	6	7	2	6
Channel Alteration	20	14	16	15	5	14	6	3	5
Sediment Deposition	20	11	11	11	16	14	6	3	11
Channel Sinuosity	20	10	16	9	12	0	0	0	0
Channel Flow Status	20	18	18	18	18	18	16	16	16
Bank Vegetative Protection (Left Bank)	10	6	6	2	5	3	2	9	2
Bank Vegetative Protection (Right Bank)	10	6	6	2	5	3	2	9	2
Bank Stability (Left Bank)	10	5	5	3	5	4	2	7	2
Bank Stability (Right Bank)	10	5	5	3	5	4	2	7	2
Riparian Vegetation Zone Width (Left Bank)	10	10	3	10	10	7	10	2	0
Riparian Vegetation Zone Width (Right Bank)	10	10	10	7	10	10	0	2	0
Total	200	115	112	100	98	94	66	64	56

Table 3. Biological metrics data for the North American Coal, Kemper County sampling sites.

Site Description	No. of Taxa	% Dominant Taxon	No. Chironomidae Taxa	% Chironomidae	% Tanytarsini	% Filterer	% Clingers	No. EPT Taxa	% EPT Taxa	EPT/Chiro	H'
Penders Creek South	32	19	20	83	26	27	27	3	9	0.05	2.80
Penders Creek North	42	43	18	79	15	14	2	5	12	0.05	2.42
Chickasawhay South	45	11	21	70	27	30	8	4	9	0.13	3.31
Chickasawhay Headwater	38	23	18	80	23	27	16	5	13	0.07	2.78
Chickasawhay Plant	41	15	21	66	18	26	24	5	12	0.24	3.13
Tompeat Creek	31	31	12	36	2	2	8	2	6	0.03	2.52
Okatibbee Creek	32	47	16	76	55	60	13	8	25	0.23	2.20
Trib. To Dry Creek	34	24	18	57	29	40	3	0	0	0	2.67

Table 4. Fish data summary for the North American Coal Kemper County sampling sites, June, 2008.

Station	Taxa	Common Name	SL	TL	Weight
Penders Creek South	*Gambusia affinis*	Western mosquito fish	20	26	0.0816
	Gambusia affinis	Western mosquito fish	22	29	0.1391
	Gambusia affinis	Western mosquito fish	32	40	0.3933
Penders Creek North	*Lepomis macrochirus*	Bluegill	Identified and released in the field		
	Lepomis macrochirus	Bluegill	Identified and released in the field		
	Lepomis macrochirus	Bluegill	Identified and released in the field		
	Lepomis macrochirus	Bluegill	Identified and released in the field		
	Lepomis macrochirus	Bluegill	Identified and released in the field		
Okatibbee Creek	*Cyprinella venusta*	Blacktail shiner	51	65	1.8434
	Cyprinella venusta	Blacktail shiner	74	90	4.4854
	Cyprinella venusta	Blacktail shiner	37	50	0.6375
	Cyprinella venusta	Blacktail shiner	49	60	1.3866
	Fundulus olivaceus	Blackspotted top minnow	46	62	1.5153
	Notropis longirostris	Longnose shiner	40	50	0.6965
	Notropis texanus	Weed shiner	56	67	2.5952
	Notropis texanus	Weed shiner	43	53	0.736
	Notropis texanus	Weed shiner	40	49	0.5949
	Notropis texanus	Weed shiner	45	55	1.1079
	Notropis texanus	Weed shiner	42	49	0.6028
Dry Creek Tributary	*Notropis texanus*	Weed Shiner	51	62	1.5243
Chickasawhay South	*Micropterus punctulatus*	Spotted Bass	39	48	1.1443
	Micropterus punctulatus	Spotted Bass	45	55	1.445
	Micropterus punctulatus	Spotted Bass	43	53	1.4616
	Micropterus punctulatus	Spotted Bass	50	61	2.1077
	Lepomis macrochirus	Bluegill	34	43	1.0542
	Lepomis macrochirus	Bluegill	27	32	0.4459
	Lepomis macrochirus	Bluegill	21	27	0.2147
	Cyprinella venusta	Blacktail Shiner	37	47	0.6528
	Cyprinella venusta	Blacktail Shiner	60	72	2.4385
	Cyprinella venusta	Blacktail Shiner	47	57	1.3816
	Cyprinella venusta	Blacktail Shiner	53	66	1.9035
	Cyprinella venusta	Blacktail Shiner	55	68	2.2459
	Cyprinella venusta	Blacktail Shiner	32	47	0.6235
	Cyprinella venusta	Blacktail Shiner	39	48	0.7683
	Notropis texanus	Weed Shiner	49	61	1.6309
	Notropis texanus	Weed Shiner	43	53	0.95
	Notropis texanus	Weed Shiner	42	51	0.65901
	Notropis texanus	Weed Shiner	36	44	0.5171
	Notropis texanus	Weed Shiner	41	50	0.6074
	Notropis texanus	Weed Shiner	53	66	1.5201
	Notropis texanus	Weed Shiner	77	95	5.092
	Notropis texanus	Weed Shiner	42	53	0.6951
	Notropis texanus	Weed Shiner	42	50	0.6953
	Notropis texanus	Weed Shiner	46	55	0.8252
	Notropis texanus	Weed Shiner	41	52	0.7572
	Notropis texanus	Weed Shiner	40	52	0.7314
	Notropis texanus	Weed Shiner	55	71	1.9721
	Notropis winchelli	Clear Chub	47	58	1.2257

Table 4. Continued

Chickasawhay Plant	*Lepomis macrochirus*	Bluegill	33	45	1.166
	Lepomis macrochirus	Bluegill	39	46	1.305
	Cyprinella venusta	Blacktail Shiner	65	83	3.57
	Cyprinella venusta	Blacktail Shiner	72	90	4.9084
	Cyprinella venusta	Blacktail Shiner	50	61	1.443
	Cyprinella venusta	Blacktail Shiner	43	52	1.0019
	Cyprinella venusta	Blacktail Shiner	48	60	1.3595
	Cyprinella venusta	Blacktail Shiner	40	51	0.7535
	Notropis texanus	Weed Shiner	40	51	0.746
	Notropis texanus	Weed Shiner	37	47	0.59
	Notropis texanus	Weed Shiner	35	44	0.5337
	Notropis texanus	Weed Shiner	37	45	0.5338
	Notropis texanus	Weed Shiner	56	71	2.2774
	Notropis texanus	Weed Shiner	37	45	0.554
	Notropis texanus	Weed Shiner	40	52	0.8174
	Notropis texanus	Weed Shiner	50	60	1.5675
	Notropis texanus	Weed Shiner	44	55	0.8072
	Notropis texanus	Weed Shiner	40	50	0.695
	Notropis texanus	Weed Shiner	47	59	1.1594
	Notropis texanus	Weed Shiner	43	52	0.895
	Notropis texanus	Weed Shiner	35	45	0.5041
	Notropis texanus	Weed Shiner	39	49	0.7124
	Notropis texanus	Weed Shiner	35	45	0.5445
	Notropis texanus	Weed Shiner	34	44	0.4179
Chickasawhay Headwaters	*Cyprinella venusta*	Blacktail Shiner	100	120	12.045
Tompeat Creek	*Lepomis macrochirus*	Bluegill	Identified and released in the field		
	Lepomis macrochirus	Bluegill	Identified and released in the field		
	Micropterus punctulatus	Spotted Bass	Identified and released in the field		

Table 5. Physical/chemical and water quality data for the North American Coal, Red Hills Mine sampling sites.

Station Description	Date Sampled	Station Location		Stream Width (m)	Avg. Stream Depth (m)	Water Temp (°C)	Conductivity µmhos/cm	pH	DO mg/l	DO %Saturation	*Substrate Type
		Latitude	Longitude								
R1 Headwaters	23-Oct	33.36409°	89.24241°	1	0.1	17.00	37	9.92	7.17	74.2	sand
Diversion I	24-Oct	33.37256°	89.24873°	3	0.75	14.86	57	7.82	2.75	26.7	silt
Diversion 2	24-Oct	33.38257°	89.26816°	5	1.0	16.04	58	7.27	8.28	83.9	silty sand
Little Bywy	24-Oct	33.38815°	89.26925°	4	0.75	15.23	61	7.46	8.73	86.6	silty sand

*Pebble Count Summary

Table 6. Habitat assessment scores for the North American Coal, Red Hills Mine sampling sites, October, 2008.

Habitat Parameter	Max Score	R1 Headwaters	Diversion 1	Diversion 2	Little Bywy
Bottom Substrate/ Available Cover	20	5	5	7	7
Pool Substrate Characterization	20	7	13	7	7
Pool Variability	20	5	11	11	13
Channel Alteration	20	18	6	6	16
Sediment Deposition	20	6	11	14	11
Channel Sinuosity	20	19	6	6	18
Channel Flow Status	20	11	10	15	16
Bank Vegetative Protection (Left Bank)	10	6	9	5	7
Bank Vegetative Protection (Right Bank)	10	6	9	5	7
Bank Stability (Left Bank)	10	5	9	9	8
Bank Stability (Right Bank)	10	5	9	9	8
Riparian Vegetation Zone Width (Left Bank)	10	10	5	2	5
Riparian Vegetation Zone Width (Right Bank)	10	10	10	2	5
Total	200	113	113	98	128

Table 7. Biological metrics data for the North American Coal, Red Hills Mine sampling sites (October, 2008).

Site Description	No. of Taxa	% Dominant Taxon	No. Chironomidae Taxa	% Chironomidae	% Tanytarsini	% Filterer	% Clingers	No. EPT Taxa	% EPT Taxa	EPT/Chiro	H'
R1 Headwaters	24	25.2	11	50	<1	5	15	2	8	0.25	2.49
Diversion 1	20	27	7	68	3	3	6	1	5	0.007	2.05
Diversion 2	35	20	14	47	27	27	1	6	17	0.24	2.79
Little Bywy	51	28	13	15	<1	<1	2	6	12	2.42	3.06

Biological metrics data for the North American Coal, Kemper County sampling sites (June, 2008).

Site Description	No. of Taxa	% Dominant Taxon	No. Chironomidae Taxa	% Chironomidae	% Tanytarsini	% Filterer	% Clingers	No. EPT Taxa	% EPT Taxa	EPT/Chiro	H'
Penders Creek South	32	19	20	83	26	27	27	3	9	0.05	2.80
Penders Creek North	42	43	18	79	15	14	2	5	12	0.05	2.42
Chickasawhay South	45	11	21	70	27	30	8	4	9	0.13	3.31
Chickasawhay Headwater	38	23	18	80	23	27	16	5	13	0.07	2.78
Chickasawhay Plant	41	15	21	66	18	26	24	5	12	0.24	3.13
Tompeat Creek	31	31	12	36	2	2	8	2	6	0.03	2.52
Okatibbee Creek	32	47	16	76	55	60	13	8	25	0.23	2.20
Dry Creek Tributary	34	24	18	57	29	40	3	0	0	0	2.67

Table 8. Multi-metric bioassessment scores for the Red Hills Mine and Kemper County sampling sites.

Station	Bioassessment Score
Red Hills	
R1 Headwaters	13
Diversion 1	13
Diversion 2	25
Little Bywy	23
Kemper County	
Penders Creek South	21
Penders Creek North	25
Chickasawhay South	25
Chickasawhay Headwaters	25
Chickasawhay Plant	25
Tompeat Creek	17
Okatibbee Creek	27
Dry Creek Tributary	17

Table 9. Fish data summary for the North American Coal Red Hills Mine sampling sites, October, 2008

Station	Taxa	Common Name	SL(mm)	TL(mm)	Weight(g)
R1 Headwaters	No Fish Collected				
Diversion 1	*Lepomis cyanellus*	Green Sunfish	70.1	87.2	10.2103
	Lepomis macrochirus	Bluegill	53.4	66.8	4.7637
	Lepomis macrochirus	Bluegill	47.7	58.7	2.6130
	Lepomis macrochirus	Bluegill	36.3	48.2	1.3262
	Gambusia affinis	Western Mosquitofish	23.4	29.1	0.2435
	Gambusia affinis	Western Mosquitofish	21.0	25.3	0.1358
	Fundulus olivaceus	Blackspotted Topminnow	46.5	55.7	1.3069
Diversion 2	*Lepomis humilis*	Orangespotted Sunfish	56.6	70.0	5.9227
	Lepomis humilis	Orangespotted Sunfish	45.2	56.0	3.0583
	Lepomis humilis	Orangespotted Sunfish	40.1	50.0	2.2385
	Lepomis megalotis	Longear Sunfish	90.8	109.1	28.8230
	Lepomis macrochirus	Bluegill	73.5	98.8	14.1703
	Lepomis macrochirus	Bluegill	61.3	79.8	7.5383
	Lepomis macrochirus	Bluegill	61.4	77.1	7.3434
	Lepomis macrochirus	Bluegill	66.3	83.5	9.0242
	Lepomis macrochirus	Bluegill	60.5	75.3	6.4975
	Lepomis macrochirus	Bluegill	48.8	63.7	2.9960
	Lepomis macrochirus	Bluegill	49.6	65.5	3.3556
	Lepomis macrochirus	Bluegill	58.0	73.5	6.5410
	Lepomis macrochirus	Bluegill	46.9	58.5	3.0704
	Lepomis macrochirus	Bluegill	57.6	73.0	6.1933
	Lepomis macrochirus	Bluegill	40.9	51.0	1.9590
	Lepomis macrochirus	Bluegill	29.5	37.4	0.7717
	Lepomis macrochirus	Bluegill	28.0	35.5	0.6695
	Lepomis macrochirus	Bluegill	45.5	59.1	2.8547
	Lepomis macrochirus	Bluegill	33.5	41.7	1.2020
	Lepomis macrochirus	Bluegill	44.0	58.2	2.7099
	Lepomis macrochirus	Bluegill	46.9	59.4	2.9031
	Lepomis macrochirus	Bluegill	55.0	72.7	5.4218
	Lepomis macrochirus	Bluegill	57.5	74.3	6.2599
	Lepomis macrochirus	Bluegill	55.4	70.5	5.2579
	Lepomis macrochirus	Bluegill	48.1	62.9	3.8568
	Lepomis macrochirus	Bluegill	55.1	69.2	5.0936
	Lepomis macrochirus	Bluegill	39.7	53.1	2.3158
	Lepomis macrochirus	Bluegill	54.0	69.8	5.1648
	Lepomis macrochirus	Bluegill	47.8	61.1	3.2555
	Lepomis macrochirus	Bluegill	43.8	56.0	2.5205
	Lepomis macrochirus	Bluegill	31.3	39.5	1.0501
	Lepomis macrochirus	Bluegill	29.1	35.6	0.7481
	Lepomis macrochirus	Bluegill	26.9	32.5	0.6244
	Lepomis macrochirus	Bluegill	38.6	48.1	1.9569
	Lepomis macrochirus	Bluegill	28.8	36.0	0.7592

Table 9. Continued

Station	Taxa	Common Name	SL(mm)	TL(mm)	Weight(g)
Diversion 2 (continued)	*Lepomis macrochirus*	Bluegill	26.4	32.6	0.5135
	Lepomis macrochirus	Bluegill	23.6	30.5	0.3942
	Lepomis macrochirus	Bluegill	46.9	58.4	2.8202
	Lepomis macrochirus	Bluegill	43.0	55.5	2.1567
	Lepomis macrochirus	Bluegill	49.2	61.5	2.9261
	Lepomis macrochirus	Bluegill	28.8	36.0	0.8203
	Lepomis macrochirus	Bluegill	26.2	32.9	0.5215
	Lepomis macrochirus	Bluegill	31.2	39.7	1.0542
	Lepomis macrochirus	Bluegill	36.4	46.5	1.4673
	Lepomis macrochirus	Bluegill	28.9	36.1	0.6853
	Lepomis macrochirus	Bluegill	27.3	34.4	0.6501
	Lepomis macrochirus	Bluegill	39.6	49.2	1.9582
	Notropis texanus	Weed Shiner	32.5	39.5	0.5687
	Notropis texanus	Weed Shiner	35.4	40.1	0.6536
	Notropis texanus	Weed Shiner	31.5	39.0	0.4990
	Notropis texanus	Weed Shiner	36.9	44.2	0.7176
	Notropis texanus	Weed Shiner	44.3	53.2	1.5416
	Notropis texanus	Weed Shiner	37.9	46.8	0.9242
	Notropis texanus	Weed Shiner	43.9	52.2	1.5195
	Fundulus olivaceus	Blackspotted Topminnow	45.1	53.2	1.3287
	Fundulus olivaceus	Blackspotted Topminnow	40.6	49.6	1.0655
	Fundulus olivaceus	Blackspotted Topminnow	36.8	44.1	0.8009
	Erimyzon oblongus	Creek Chubsucker	60.5	72.9	4.4587
Little Bywy	*Lepomis cyanellus*	Green Sunfish	40.0	50.2	1.6155
	Lepomis macrochirus	Bluegill	101.0	131.8	37.9508
	Lepomis macrochirus	Bluegill	55.8	71.6	5.0952

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