BEFORE THE ALABAMA SURFACE MINING COMMISSION

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A Petition To Designate Lands Adjacent	)
To The Mulberry Fork	)
Of the Black Warrior River	)
As Unsuitable For Coal Mining	)
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PETITION

Petitioner Black Warrior Riverkeeper (Riverkeeper), in accordance with Ala. Admin. Code r. 880-X-7A-.05, petitions the Alabama Surface Mining Commission (ASMC) to designate as lands unsuitable for surface coal mining operations the area encompassed by the proposed Shepherd Bend and Reed Minerals No. 5 mines that have not yet been issued an ASMC permit, an area encompassing approximately 2,241 acres.[1] These two mines represent an imminent threat to the source drinking water provided by the Mulberry Fork of the Black Warrior River and the ASMC should designate the areas as lands unsuitable for mining under Ala. Admin. Code r. 880-X-7A-.05. In so doing, we also urge the ASMC to take up the larger issue of what other areas along the Mulberry Fork designated "Public Water Supply" should be protected by a lands unsuitable designation, as the identical facts which support the designation of Shepherd Bend and Reed No. 5 also support the designation of other lands that drain to the Mulberry Fork. Beyond the imminent threats of Shepherd Bend and Reed No. 5 mines, we propose that the ASMC also designate a larger area of the Mulberry Fork drainage that constitutes "Public Water Supply" as lands unsuitable for mining under Ala. Admin. Code r. 880-X-7A-.05.

[1] This figure is calculated based upon the 1773 acres proposed for Shepherd Bend Mine (less the 38 acres that have been permitted previously) added to the 506 acres proposed for Reed No. 5 Mine.

I. INTRODUCTION

The proposed Shepherd Bend and Reed No. 5 mines are located on the Mulberry Fork of the Black Warrior River. This portion of the Mulberry Fork is also the site of a primary drinking water intake for the Birmingham Water Works Board (BWWB). Water discharged from the proposed Shepherd Bend Mine would enter the Mulberry Fork upstream, and across from, a BWWB surface water intake that serves approximately 200,000 people in the Birmingham area. *Birmingham Water Works Board July 6, 2010 ASMC Comment Letter for Shepherd Bend Mine* (Exhibit 1, incorporated here by reference in its entirety) at p. 1. Water discharged from the proposed Reed No. 5 Mine will enter the Mulberry Fork upstream from the same surface water intake. *Birmingham Water Works Board August 9, 2011 ASMC Comment Letter for Reed No. 5 Mine* (Exhibit 2, incorporated here by reference in its entirety) at p. 1. The Mulberry Fork of the Black Warrior River is designated "Public Water Supply" from the junction of the Locust and Mulberry Forks past Burnt Cane Creek (9 miles below Cordova) all the way to Frog Ague Creek. *See* Ala. Admin. Code r. 335-6-11-.02.

On October 19, 2010 the ASMC issued Permit P-3945 to Shepherd Bend LLC. However, the only land potentially covered by the terms of that permit is the proposed mine's first increment of 286 acres. ASMC Permit P-3945 (Exhibit 3, incorporated here by reference in its entirety) at p. 1. The permit area is further limited by permit condition #3, which states that until sufficient bond is posted for that entire first increment, the permit only covers the first 38 acres for which Shepherd Bend LLC has posted bond. *Id*. at p. 2. According to an e-mail received from ASMC Director Dr. Randall Johnson on August 31, 2012, to date Shepherd Bend has not posted a performance bond beyond the proposed mine's initial 38 acres. Under the express terms of the permit, then, only these first 38 acres are actually covered by P-3945.

The bulk of the land and mineral rights for the proposed Shepherd Bend Mine are held by the University of Alabama. As recently as September 4, 2012, Dr. Guy Bailey, University of Alabama President, stated the university has not been approached about leasing the land for mining and has no current plans to offer it for lease. CBS 42 September 4, 2012 Interview. No mining has occurred at Shepherd Bend.[2]

The Reed No. 5 Mine permit application (P-3957) is pending and the public comment period ends on September 10, 2012. A significant part of the mineral rights for Reed No. 5 Mine are owned by the City of Cordova's Industrial Development Board.

According to the ASMC comments filed by the BWWB for the proposed Shepherd Bend Mine,

> [t]he proximity of the proposed mining operation to such a major municipal water supply is unprecedented to our knowledge, and represents an incompatible use. This operation could result in discharge of mining related pollutants directly to the intake. The NPDES permit and this [ASMC] permit application do not appear to have adequately considered the drinking water use, and are wholly inadequate to protect the Board and its customers from many pollutants commonly associated with mining activities.

Birmingham Water Works Board July 6, 2010 ASMC Comment Letter for Shepherd Bend Mine (Exhibit 1) at p. 1. Similarly, as stated in the BWWB's ASMC comments for the proposed Reed No. 5 Mine, "[o]ur Mulberry Intake will be used to provide drinking water to the Birmingham Metropolitan Area for many years in the future and this mine would negatively impact the drinking water supply. Given what is at stake, we feel that this mining permit should not be issued."

[2] Both the ASMC and NPDES permits issued to Shepherd Bend LLC for the mine are subject of current litigation. The issuance of NPDES Permit No. 0079162 for Shepherd Bend Mine is being challenged in *Black Warrior Riverkeeper v. Alabama Department of Environmental Management and Shepherd Bend LLC*, (Ala. Civ. App. No. 2110520). The issuance of ASMC permit P-3945 is being challenged in *The Water Works Board of the City of Birmingham v. the Alabama Surface Mining Commission and Shepherd Bend LLC* (ASMC Division of Hearings and Appeals).

Birmingham Water Works Board August 9, 2011 ASMC Comment Letter for Reed No. 5 Mine. (Exhibit 2) at p. 1. The BWWB's NPDES permit comment letter for Reed No. 5 elaborates:

> [t]he proximity of the proposed mining operation to such a major municipal water supply intake poses a potential hazard to drinking water users. The proposed permit appears to have been developed primarily from federal guidelines for coal mining operations. These guidelines were developed for use in permitting typical mining operations across the entire nation, not for the circumstances where a surface mining operation would be conjoined with a major municipal water supply intake. A review of these guidelines and their supporting documents reveals that protection of major public water supplies was not explicitly considered in their development. The permit limits and monitoring requirements are wholly inadequate to protect the Board and its customers from many pollutants commonly associated with mining activities.

Birmingham Water Works Board December 16, 2010 ADEM Comment Letter for Reed No. 5 Mine. (Exhibit 4, incorporated by reference in its entirety) at p. 1 (hereinafter *ADEM Comment Letter*).

The receiving waters for both proposed mines are considered source drinking water by the State's Water Use Classifications (*see generally* Ala. Admin. Code r.335-6-10) as well as the BWWB. State law also includes an anti-degradation policy, which is designed to maintain water quality to fully protect existing uses. *See* Ala. Admin. Code r. 335-6-10-.04. The BWWB's public comments for the Reed No. 5 NPDES permit incorporate a Shepherd Bend December 2010 PowerPoint presentation (Appendix D) which suggests that the Board deems the areas covered by both Shepherd Bend and Reed No. 5 mines to be "renewable resource lands in which the operations could result in a substantial loss or reduction of long range productivity of water supply. . . ." *ADEM Comment Letter* (Exhibit 4) at p. 35. Moreover, the BWWB also states that much of the Reed No. 5 Mine "falls within the Source Water Protection Area for the Mulberry Intake, located just downstream. This area defines the 'critical, or special, area in the immediate vicinity of a surface water plant intake that is closely scrutinized for contaminant sources.'" *Birmingham Water Works Board August 9, 2011 ASMC Comment Letter for Reed No. 5 Mine.* (Exhibit 2) at p. 2. We assert that all of the area along the section of the Mulberry Fork designated "Public Water Supply" should be considered part of the Source Water Protection Area.

In addition to the possible contamination of surface water flowing to the Mulberry Fork intake, the pollution of groundwater in the area of the proposed mines is also a major concern.

> The groundwater underlying the proposed Reed Minerals No. 5 mine is in direct hydraulic communication with surface water in the Mulberry Fork, which is designated for public water supply. Due to the nature of groundwater flow at this site, contaminants introduced to groundwater from mining operations will discharge to the Mulberry Fork. Further, the groundwater directly underlying the site is likely designated as an "Underground Source of Drinking Water" (USDW) by ADEM Admin. Code r. 335 Division 6 Regulations, defined as "an aquifer or portion thereof 1) which currently supplies drinking water for human consumption, or 2) in which the ground water contains fewer than 10,000 mg/L of total dissolved solids.

Id. at p. 3. We believe this to also be the case at Shepherd Bend Mine. Whether by direct discharge to surface water or through infiltration into groundwater, surface coal mining in the areas of the proposed Shepherd Bend and Reed No. 5 mines (or elsewhere in the drainage) will substantially harm the source drinking water provided by the Mulberry Fork.

Independently, but also in view of the substantial concerns expressed by the BWWB, numerous individual residents and drinking water customers have expressed opposition to the location of surface coal mining operations in close proximity to source drinking water. On behalf of their many residents served by the Mulberry Fork drinking water intake, the Birmingham City Council has passed unanimous resolutions opposing Shepherd Bend and Reed No. 5 mines. *See* Exhibits 5 and 6. The following organizations, groups and businesses have also expressed opposition to Shepherd Mine because of the impact it will have on source drinking water and drinking water treatment: Alabama Environmental Council, Alabama Rivers Alliance, Avondale Brewing Company, Birmingham Audubon Society, Cahaba Brewing Company, Cahaba Riverkeeper, Cahaba River Society, Coalition of Alabama Students for the Environment, Choctawhatchee Riverkeeper, Citizens Opposed to Strip Mining on the Black Warrior River, Coosa Riverkeeper, enAct, Episcopal Diocese of Alabama's Task Force for the Stewardship of Creation, GASP, Glen Iris Neighborhood Association, Greater Birmingham Ministries, Green Initiative at UAB, Good People Brewing Company, Hurricane Creekkeeper, League of Women Voters of Alabama, Metro-Birmingham NAACP, Mobile Baykeeper, Montevallo Environmental Club, Occupy Birmingham, Patriots for Conservation, Restoring Eden at Samford, Southern Environmental Law Center, Tennessee Riverkeeper, UA ECo, UA NAACP, UA Student Government Association, UAB Student Government Association, Waterkeeper Alliance, and Wild South.

With respect to Reed No. 5 Mine, the following organizations, groups and businesses have expressed their opposition: Alabama Environmental Council, Alabama Rivers Alliance, Beth Maynor Young Conservation Photography, Birmingham Audubon Society, Birmingham City Council, Blue Horizon Enterprises, Coalition of Alabama Students for the Environment, Citizens Opposed to Strip Mining on the Black Warrior River, Coosa Riverkeeper, Friends of the Locust Fork River, Good People Brewing Company, Green Initiative at UAB, League of Women Voters: Birmingham Chapter, Montevallo Environmental Club, Occupy Birmingham, Patriots for Conservation, Public Health Student Association at UAB, Restoring Eden at Samford, Ruffner Mountain Nature Center, Sierra Club: Alabama Chapter, UA ECo, UAB Student Government Association, Tennessee Riverkeeper and Wild South.

In addition to the specific concerns raised about the effect of coal mines which discharge to the Mulberry Fork and their demonstrated effect on source drinking water, this Petition also raises two other related and critical issues. The first is, despite the extensive coal mining that has occurred in the area both currently and historically, there has never been a comprehensive study of the cumulative impacts of mining on source drinking water in the Mulberry Fork, nor any meaningful consideration of how the operations of two (or even more) additional mines will further contribute to these impacts. Just as importantly, there have never been any scientific studies of how concentrated coal mining along the Mulberry Fork may affect the health of those who live nearby or who rely on this intake for their drinking water. It is past time for these kinds of studies to be conducted and incorporated in decisions about where and under what circumstances coal mining should occur along the Mulberry Fork when the integrity of source drinking water is at stake.

The second related issue concerns the fact that, even if these mines are permitted with the best of regulatory intentions, permit exemptions exist which suspend supposedly protective permit limits in their entirety during certain rain events. Unfortunately, there is no consideration or plan provided in the existing regulatory framework of how (when unregulated discharges or a catastrophic event occurs) source drinking water and public heath will be preserved and protected.

II. <u>BACKGROUND</u>

Congress passed the Surface Mining Control and Reclamation Act of 1977 (SMCRA) (30 U.S.C. § 1201 et seq.) to "establish a nationwide program to protect society and the environment from the adverse effects of surface coal mining operations." 30 U.S.C. § 1202(a). SMCRA further provides that the Secretary of the Interior or the relevant state authority, depending on which entity is responsible for the enforcement of SMCRA in the particular region, has discretion "[u]pon petition pursuant to subsection (c) of this section, [to] designate an area as unsuitable for all or certain surface coal mining," *id.* § 1272(a)(2), where surface mining

- is incompatible with existing state or local land-use plans;
- affects fragile or historic lands on which such operations could cause significant damage to important historical, cultural, scientific and aesthetic values and natural systems;
- affects renewable resource lands (such as forest lands and farmland); or
- affects natural hazard lands such as lands prone to earthquakes.

30 U.S.C. § 1272(a)(3)(A)-(D). On May 20, 1982, the ASMC achieved primacy under SMCRA and assumed responsibility for the regulation of coal mining operations in Alabama, including the process for delegating lands unsuitable for mining.

The ASMC process for designating lands unsuitable for mining is codified at Ala. Admin. Code r. 880-X-7A-.01 through 880-X-7D-.11. The ASMC *must* designate lands unsuitable for mining if “reclamation is not technologically and economically feasible under the Act.” Ala. Admin. Code r. 880-X-7C-.04(1). The ASMC *may* (but is not required to) designate an area if it meets certain other requirements. Ala. Admin. Code r. 880-X-7C-.04(2).

Specifically, areas that "affect renewable resource lands in which such operations could result in a substantial loss or reduction of long-range productivity of water supply" are eligible. *See* Ala. Admin. Code r. 880-X-7C-.04(2)(c). ASMC regulations do not define “renewable resource lands” but regulations developed under SMCRA do. They are “geographic areas which contribute significantly to the long-range productivity of water supply or of food or fiber products, such lands to include aquifers and aquifer recharge areas.” 30 C.F. R. § 762.5. Courts have looked at protection of drinking water as a valid reason to consider the lands unsuitable designation. *See, e.g., Pleasant City v. Ohio DNR*, 617 N.E.2d 1103 (Ohio 1993); *Appolo Fuels, Inc. v. US,* 381 F. 3d 1338 (D.C. Cir. 2004).

The only areas potentially excluded from the lands unsuitable for mining petition process are lands covered by a permit or lands where, *prior to the passage of SMCRA*, significant legal or financial commitments had been made or actual mining was occurring. *See* Ala. Admin. Code r. 880-X-7C-.05(b). There are no time limits specified for when a petition must be filed. However, "[a]ny petitions received after *the close of the public comment period* on a permit application relating to the same permit area shall not prevent the State Regulatory Authority from issuing a decision on that permit application." Ala. Admin. Code r. 880-X-7D-.06(1)(g) (emphasis added). Moreover, the ASMC "may return any petition received thereafter to the petitioner with a statement why the State Regulatory Authority cannot consider the petition." *Id.* That suggests that the converse is also true: as long as a permit has not been issued that covers the lands at issue *or* the public comment period is open, a petition to designate lands unsuitable for mining may be timely filed.

A petition to designate lands unsuitable for surface coal mining operations may be filed as a matter of right by "[a]ny person having an interest which is or may be adversely affected . . . ." Ala. Admin. Code r. 880-X-7D-.05(1). This is the identical language that allows citizens to file public comments or request an informal conference on pending permit applications (which Riverkeeper has used extensively in the past). *See* Ala. Admin. Code r. 880-X-8K-.05.2.(b) and 880-X-8K-.05.3. A petitioner is required only to provide

> (a) The location and size of the area covered by the petition;
> (b) Allegations of facts and supporting evidence which would tend to establish that the area is unsuitable for all or certain types of surface coal mining operations;
> (c) A description of how mining of the area has affected or may adversely affect people, land, air, water or other resources;

(d) The petitioner's name, address, and telephone number; and
(e) Identification of the petitioner's interest which is or may be adversely affected.

Ala. Admin. Code r. 880-X-7D-.05(1).

III. LOCATION AND SIZE OF THE PETITION AREA

As stated previously, the Petition area includes those portions of the proposed Shepherd Bend and Reed No. 5 mines that are not covered by an ASMC permit, an area encompassing approximately 2,241 acres. The location and size of each mine is depicted in the attached permit maps. *See* Exhibit 7 (Shepherd Bend Mine Permit Map) and Exhibit 8 (Reed No. 5 Mine Permit Map). But as stated previously and for the identical reasons, Petitioner believes that the ASMC should also consider other lands that similarly drain to the Mulberry Fork public water supply for the designation. (Exhibit 9) We have compiled a map as a minimum starting point to encompass the area that should be considered for a lands unsuitable designation. However, we encourage the ASMC in evaluating our Petition to consult with the BWWB and other stakeholders to ensure that any such designation is properly inclusive of *all* lands that have the potential to affect the source water quality of the Mulberry Fork, even if they are not included on Petitioner's Exhibit 9. [3]

IV. ALLEGATIONS OF FACT AND SUPPORTING EVIDENCE OF ADVERSE EFFECTS ON DRINKING WATER AND HUMAN HEALTH

As proposed, Shepherd Bend and Reed No. 5 mines join a cluster of three other large coal mines on the Mulberry Fork that are reclaimed or currently in reclamation: Horse Creek Mine,

[3] There are many existing, well-respected resources available to help in considering the protection of source drinking water. For example, the Trust for Public Land is one such organization that has been at the forefront of developing plans for local communities that preserve land to ensure clean drinking water. The Trust has compiled Protecting the Source, a handbook for source water protection, and also offers many other resources in collaboration with national and state partners .

Red Star Mine and Quinton Mine. Horse Creek Mine is just across the Mulberry Fork from the Reed No. 5 site, situated on the river's edge and north of Horse Creek. Red Star Mine is across the Mulberry Fork from Shepherd Bend, on the river's edge just upstream and on the same side as the BWWB's Mulberry Fork intake. Shepherd Bend Mine is approximately 3 miles from Reed No. 5 at their closest points; the BWWB's Mulberry Fork intake is about 5.4 miles downstream of the southernmost portion of Reed Mine No. 5. Quinton Mine is to the east of the Mulberry Fork intake, southeast of Burnt Cane Creek, which enters the Mulberry Fork just downstream of the Mulberry Fork intake. Despite the number of coal mines currently and historically on, or near, the Mulberry Fork, there are no peer-reviewed studies available which assess the cumulative impacts of these mines on source drinking water quality or public health.[4] In addition to current mining, pre-SMCRA mine sites contribute many contaminants of concern to source water: acid mine drainage associated with these sites showed elevated concentrations of arsenic, iron, copper, zinc and selenium. Goldhaber, et al., Dispersion of Arsenic from Arsenic-enriched Coal and Gold Ore in the Southern Appalachians (1999).

EPA observed in late 2010 that "[d]espite the amount of data Alabama has collected for Clean Water Act § 303(d) listing purposes, there is a scarcity of information available specifically pertaining to in-stream water quality in coal mining areas" and that "much remains to be done in assessing waters in areas of active coal mining in Alabama." *See EPA October 1, 2010 Comment Letter* (Exhibit 10) at p. 2. Coal mining activities rank as the second largest source of impairment for stream miles in our state. *Id.* (*citing* Table 2-7 of ADEM's 2010 Integrated Water Quality Monitoring and Assessment 305(b) Report*).* Most coal mines

[4] We understand that both ADEM (impacts of surface coal mining near wadeable streams in the coal-mining regions of Alabama) and EPA (surface mining impacts on drinking water in the Black Warrior basin) are engaged in studies that may represent a start to the process of assessing the impacts of surface mining on source water quality.

discharge to rivers and streams yet remarkably "77% of Alabama's rivers and streams have not been assessed for water quality purposes." *Id*.

EPA conducted a recent study that found nine out of every ten streams downstream from surface mining operations were impaired based on a genus-level assessment of aquatic life. *Downstream Effects of Mountaintop Coal Mining,* Downstream Effects of Mountaintop Coal Mining. Given the data available that conclusively ties coal mining to stream impairment, Alabama regulatory agencies can no longer turn a blind eye to this connection and must address the important question of how to protect source drinking water from the contamination caused by surface mining.

Shepherd Bend and Reed No. 5 mines will both discharge immediately upstream of the BWWB's Mulberry Fork drinking water intake. According to evidence developed during the ADEM and ASMC permit comment process, both Shepherd Bend and Reed No. 5 mines have a high potential for "adverse impacts" to the Birmingham drinking water supply. *See Birmingham Water Works Board July 6, 2010 ASMC Comment Letter for Shepherd Bend Mine* (Exhibit 1) at p. 1; *Birmingham Water Works Board August 9, 2011 ASMC Comment Letter for Reed No. 5 Mine.* (Exhibit 2) at p. 1. As a result, many citizens, including Riverkeeper, have asked the ASMC not to permit these mines because (as the BWWB observes) surface mining operations and drinking water withdrawals are such incompatible uses.

We are taking that request one step further and asking the ASMC to protect source drinking water and to demonstrate that, based on competent, scientifically sound data, that either safe, affordable drinking water and coal mining can coexist in close proximity (which we do not believe) or designate the lands covered by the proposed Shepherd Bend and Reed No. 5 mines, as well as the Mulberry Fork "Public Water Supply" drainage area, as unsuitable for mining.

Individually, according to currently available science, mining in these areas will significantly degrade source water quality as it exists today. Cumulatively, given the documented history of previous mining in the area, the permitting of these two (or any other) mines will push the source water quality of the Mulberry Fork into the red zone where the best case scenario is only that treatment costs will rise, which is an unacceptable outcome. The worst case scenario is that a catastrophic pond or treatment failure, or even a substantial rain event, will contaminate source water and shut down an intake that serves 200,000 people.[5]

The Safe Drinking Water Act (SDWA) was established to protect the quality of drinking water in the U.S. *See* 42 U.S.C. § 300f et seq. (1974). The law, amended in 1986 and 1996, includes many provisions to protect drinking water and its sources. Originally, the SDWA focused more on treatment as the primary means to keep drinking water safe. Significantly, however, the 1996 amendments recognize and this Petition makes the case that source water and watershed protection must be an essential component of safe drinking water.[6]

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[5] The harm addressed by this Petition is not theoretical and could lead to the shutdown of the Mulberry Fork intake. For example, in late 2006 the BWWB began to note elevated levels of dangerous disinfection byproducts in Mulberry Fork source drinking water. As a result, on November 1, 2006 the Mulberry Fork drinking water intake had to shut down completely. In November 2007, sampling on the Mulberry Fork detected elevated levels of industrial bromide waste, which was the cause of the increase in the disinfection byproducts at the Western Filter Plant, located some 100 miles downstream from its source. On May 21, 2007 (during drought conditions) the BWWB was finally able to turn the intake back on, after obtaining a court order that limited the loading of bromide by the responsible industrial party. Because of the drought, the BWWB could not meet the area's drinking water needs without the restoration of the Mulberry Fork intake.

[6] Enforcement of an NPDES or ASMC permit, even if it were prompt and rigorous, does not adequately protect source drinking water, which is why Riverkeeper has filed the Petition. Enforcement, typically after-the-fact remedies like fines and engineering fixes, may seek to correct the problem for the future but in no way can reverse the immediate harm to source water. An illustrative and analogous example of this fact is the July 15, 2011 coal slurry spill at North River Underground Mine No. 1 located in Fayette and Tuscaloosa Counties, Alabama. Although not a surface mining operation, this spill dumped 600,000 to 1 million gallons of coal slurry containing elevated levels of suspended solids, arsenic and lead into tributaries of the North River upstream of Tuscaloosa's drinking water. This spill was far enough from the drinking water intake such that it did not cause direct harm; however, if a catastrophic event like this occurred at a surface mine in close proximity to the Mulberry Fork intake (even a much smaller magnitude spill), no amount of fines or fixes could protect the source drinking water, at least for the short term.

The SDWA authorizes EPA to establish minimum standards to protect tap water and requires all owners or operators of public water systems to comply with these standards. Under this delegation of authority, EPA has established both primary (i.e., at the tap) and secondary (i.e., at the source) drinking water standards. *See* 40 C.F.R. Parts 141 and 143. The SDWA contains secondary maximum contaminant levels (MCLs) for total iron of 0.3 mg/L and total manganese of 0.050 mg/L. 40 C.F.R § 143.3. Currently, the levels allowed by the proposed NPDES permits for both Shepherd Bend and Reed No. 5 mines are 10 times the MCL for iron and 40 times the MCL for manganese. By comparison, the BWWB's 2007 daily average raw water concentrations for iron and manganese at the Mulberry Fork's Western Filtration Plant were 0.057 mg/L and 0.079, respectively. *See ADEM Comment Letter* (Exhibit 4) at p. 2. Thus, it is well documented that surface coal mining at Shepherd Bend and Reed No. 5 (or any other) mines will cause significant degradation of current source water quality.

1. Contaminants Known to Be Present in Petition Area and Documented Effects

Iron and manganese are known to cause serious aesthetic and treatment problems for drinking water. Secondary limits established for iron and manganese are currently based on these aesthetic concerns only. In higher concentrations, iron and manganese cause the following documented problems:

- *Staining:* Iron and manganese stain laundry and water use fixtures.
- *Taste:* Iron and manganese cause a metallic or vinyl type taste in the water. They can combine with tea, coffee and alcohol to create an inky dark appearance and a harsh offensive taste. Vegetables cooked in water with high iron can turn dark and look unappetizing.
- *Appearance:* Iron and manganese will often appear as an oily, "crusty" sheen to the water's surface.
- *Sulfur Taste:* The same conditions that liberate iron and manganese underground can liberate hydrogen sulfide from the soil or rock.
- *Clogging:* Iron and manganese support the growth of iron and manganese bacteria, which can clog strainers, pumps, and valves.

See New Hampshire Department of Environmental Services Fact Sheet on Iron and Manganese. At present, EPA has not set health standards for either iron or manganese in drinking water; however, a health-based standard for manganese is possible in the future because manganese may affect neurological and muscle function in humans. *Id.* *See also* National Institute of Environmental Health Sciences "Manganese and Brain Damage," (Manganese known to cause neurological effects following inhalation exposure, particularly in occupational settings, and there have been epidemiological studies that report adverse neurological effects following extended exposure to very high levels in drinking water, although the validity of these results may also be influenced by other factors).

The BWWB states unequivocally that any increase in iron and manganese levels (as well as sediment) will lead to greater demands on treatment operations as well as increased treatment costs. *See ADEM Comment Letter* (Exhibit 4) at p. 2. "Costly operational changes to the treatment plant may be required if iron and manganese precipitation and subsequent reduction occurs in the raw water storage tanks or the sedimentation basins." *Id.* Higher particle loading from total suspended solids, iron and manganese will require "additional operations and maintenance" at the water treatment plant as well as reduce the plant's "overall treatment flow rating." *Id.* These costs will be paid by consumers, not the mines which create or contribute to the problem.

Total Suspended Solids (TSS) and total dissolved solids (TDS) are pollutant categories that are of utmost importance when considering permits for coal mines along "Public Water Supply" river segments. ADEM's Surface Water Quality Screening Assessment of the Cahaba and Black Warrior River Basins (2002) ADEM's Surface Water Quality Screening Assessment of the Cahaba and Black Warrior River Basins (2002) demonstrates that this particular segment of the Mulberry Fork is seriously at risk. A review of the water quality assessment demonstrates major impairment from mining and sedimentation to the area of the Mulberry Fork designated "Public Water Supply." For instance, Appendix D of the document lists the impairment potential due to mining of the sub-watershed as "High." Appendix I of the document shows that this sub-watershed carries the highest sediment load in terms of tons/per acre/per year in the entire Mulberry Fork watershed, and that the largest contributor of sediment is mined lands. Appendix M indicates that the sub-watershed has higher concentrations of TDS than anywhere else in the Black Warrior River basin.

In addition to iron, manganese and sediment, there are many other contaminants of concern associated with coal that affect source water, drinking water quality and treatment costs. And while aesthetic issues of taste or economic issues of treatment costs are important for drinking water, these additional contaminants represent a potential danger to human health. The BWWB points to arsenic (described by the USGS as "well above the average for all U.S. coal") , sulfur, salinity, mercury, lead, zinc, copper and cadmium (among others) as elements that are associated with Alabama's coal deposits, specifically those near the Mulberry Fork and the drinking water intake. *Id. See also Coal Mine Drainage and Water Quality Study* and *Surface Water Quality Analysis (*Exhibit 4, Appendices B and C) at pp. 14-30) (Coal samples taken in Mulberry Fork drainage area show relatively high concentrations of aluminum, arsenic, lead and mercury).

It is well established that the Warrior Coal Field has locally elevated concentrations of mercury, as well as elevated levels of arsenic, molybdenum, selenium, copper and thallium. *See* Gold, Dielhaber and Hatch, Modes of Occurrence of Other Trace Elements in Coals from the Warrior Field, Black Warrior Basin, Northwestern Alabama (April 27, 2004) (incorporated here by reference in its entirety) (hereinafter *Trace Elements in Coal).* The presence of these and other toxic elements associated with coal mining in an area where local residents get their drinking water (as well as swim, and fish) make it imperative that the ASMC carefully evaluate these areas for a possible designation as lands unsuitable for mining. We believe that the only way to adequately protect both human health and the environment in these circumstances is to protect source drinking water prophylactically through a lands unsuitable designation.

If, as stated in *Trace Elements in Coal*, iron and manganese are present in concentrations that greatly exceed recommended levels for safe drinking water, it is also reasonable to expect that the other toxic pollutants associated with coal mine drainage may also be present at levels that are potentially dangerous to human health and water quality. Sampling in the area of the two proposed mines performed by the BWWB's engineering firm, Malcolm Pirnie, on two different occasions emphasizes this important point.

> Based on the [acid base accounting] tests, this coal bearing material is expected to generate acidic conditions. As no reported natural neutralization potential exists in these samples, the acidic waters produced are likely runoff dumps during rain events . . . .
>
> Should acidic conditions become pervasive, these coal bearing materials are likely to leach metals into the environment, some at concentrations above current creek levels and various local and federal limits. Based upon the [synthetic leaching tests] the metals of greatest concern are: aluminum, arsenic, iron, manganese and zinc.

Coal Mine Drainage and Water Quality Study (Exhibit 4, Appendix B) at p. 19.

Arsenic, lead and mercury in drinking water all pose significant human health risks. If they increase in source drinking water, the BWWB is going to have to install additional treatment technology. At the public hearing for Shepherd Bend Mine, Darryl R. Jones, the BWWB's Assistant General Manager for Operations and Technical Services, voiced the concern that in a worst case scenario, certain levels of certain pollutants might not even be treatable given existing equipment and that the intake would have to be shut down until proper equipment could be installed. Mr. Jones also voiced the opinion that since 1989, the Mulberry Fork public drinking water was the most difficult source for the BWWB to treat due to multiple threats. For those pollutants that can affect human health, their possible increase and an inability to treat them in the near term with current equipment and processes is alarming.

The non-cancer effects of arsenic "can include thickening and discoloration of the skin, stomach pain, nausea, vomiting; diarrhea; numbness in hands and feet; partial paralysis; and blindness. Arsenic has been linked to cancer of the bladder, lungs, skin, kidney, nasal passages, liver, and prostate." EPA: Arsenic in Drinking Water. Arsenic in drinking water also increases mortality from cardiovascular and kidney disease. *See* Meliker, et al., Arsenic in Drinking Water, etc (2007). Lead in drinking water causes a variety of adverse health effects:

> [i]n babies and children, exposure to lead in drinking water above the action level can result in delays in physical and mental development, along with slight deficits in attention span and learning abilities. In adults, it can cause increases in blood pressure. Adults who drink this water over many years could develop kidney problems or high blood pressure.

EPA: Lead in Drinking Water. Mercury "well in excess of the maximum contaminant level for many years" can cause kidney damage. EPA: Mercury in Drinking Water.

Moreover, copper and selenium (also found in Warrior coal deposits) also pose health risks. In the near term, copper in drinking water can cause gastrointestinal distress; in the long term, it can result in liver or kidney damage. EPA: Drinking Water Contaminants. Selenium can cause hair or fingernail loss, lead to numbness in the fingers or toes, and cause circulatory problems. *Id.*

Recent public health studies focusing on quantity of coal mined in a given area irrespective of mining type (surface or underground) have found a significant mining effect on increased risk of low-birthweight deliveries (Ahern et al.,2010) as well as health effects for adults in coal mining areas of Appalachia. *See, e.g.*, Hendryx, et al., Mortality from heart, respiratory, and kidney disease in coal mining areas of Appalachia (2009); Hendryx, et al., A geographical information system-based analysis of cancer mortality and population exposure to coal mining activities in West Virginia (2010). These studies identify a variety of environmental contributors to the problems studied, including increased ground and surface water pollution from mining.

While these cited studies have focus on central Appalachia, it is reasonable to conclude that some of these same health effects may also be present in southern Appalachia. Although Alabama has been excluded from the defined six-state "Appalachian region" by EPA, EPA Region 4 has recently indicated in another context that some of the same types of mining concerns identified in the defined "Appalachian region" are also at issue in Alabama. *See, e.g., December 17, 2010 EPA Letter to the U.S. Army Corps of Engineers in re: Swann's Crossing Mine (Tuscaloosa County, Alabama); February 23, 2011 EPA Letter to the U.S. Army Corps of Engineers in re: Reese's Branch Mine No. 2 (Walker County, Alabama); February 24, 2011 EPA Letter to the U.S. Army Corps of Engineers in re: Cedar Lake Mining (Blount County, Alabama).*

The northern 37 counties of Alabama have long been considered part of the Appalachian region by the federal Appalachian Region Commission. Moreover, along with Tennessee and Kentucky, the Black Warrior River watershed (and much of Alabama's coal) is contained in Eco-region 68; the state of Alabama actually produces nearly seven times the amount of coal produced by the Appalachian state of Tennessee.[7] Alabama coal mines produced 20.6 million tons of coal in 2008 (1.8% of the U.S. total). Similarly, coal production statistics and reports include Alabama in the Appalachian region. *See, e.g.*, 2008-09 Appalachian Region Coal Production.

Although "mountaintop mining" may be different in scale in Alabama, the process whereby mountains and hills are blown up to expose coal seams; overburden is scraped and shaped into piles or deposited as fill in streams; and surface and groundwater are substantially disturbed to extract coal are essentially the same whether it occurs in central or southern Appalachia.[8] While it is not known whether some of the adverse health effects documented as a result of mining in central Appalachia are also present in Alabama, the conclusions reached in these peer-reviewed studies are extremely concerning. In view of the similarities between surface mining in central and southern Appalachia, and the documented impact that the Shepherd Bend and Reed No. 5 mines would have on source drinking water, it would be reckless to permit these operations without assessing what the human health and drinking water impacts will be. Unless the ASMC can scientifically establish that surface mining can occur in such close proximity to source drinking water with no demonstrable adverse health effects, the lands covered by the proposed Shepherd Bend and Reed No. 5 mines as well as the Mulberry Fork drainage, should be designated as unsuitable for mining.

[7] With 2.7 million tons of coal mined in 2008, Tennessee is one of the lesser coal mining states, making up only 0.2% of U.S. coal production. 2008 Coal Production Statistics for Alabama and Tennessee.

[8] Mountaintop mining creates large-scale impairment of surface water and groundwater. (Palmer et al., 2010; Ghose, 2007; McAuley and Kozar, 2006; Hitt and Hendryx, 2010; U.S. Department of Labor, 2010). Some chemicals associated with the processes (such as mercury, lead, arsenic, selenium, cadmium, chromium, iron and manganese) which are also present in the Warrior Coal Field (and specifically, the Shepherd Bend, Reed No. 5 and Mulberry Fork drainage areas) have been shown in animal and/or human studies to pose adverse developmental or reproductive risks (Agency for Toxic Substances and Disease Registry, 2010).

2. Precipitation Event Exemptions and Possible Catastrophic Failures

The NPDES permits for both Shepherd Bend and Reed No. 5 mines contain manganese and precipitation event exemptions, which have the demonstrated potential to "swallow the rule" of the express permit limitations that are supposedly in place to protect source drinking water at Shepherd Bend and Reed No. 5 mines. The exemption states in pertinent part that

> any discharge or increase in the volume of a discharge which is caused by an applicable 24-hour precipitation event . . . and which occurs during or within 24-hours after such event may be exempt under the discharge limitations.

The fact that the precipitation event exemption is based upon federal guidelines (40 C.F.R. § 434.63) begs the question of whether the exemption is justified or protective of water quality where drinking water is concerned. Much like the recommended NPDES permit limits, these exemptions were crafted with surface coal mining, not source drinking water, in mind. In addition to being exempt from federal effluent guidelines, permit limits based upon the reasonable potential analysis are suspended and become "report only" if the precipitation exemption is invoked. The only parameters that are potentially restricted during precipitation events are pH (a prescribed range of 6.0 s.u. to 9.0 s.u.); iron (7.0 mg/L daily maximum) and settleable solids (.5 mL/L daily maximum). Particularly where source drinking water is concerned, precipitation event exemptions have the demonstrated potential to significantly degrade source water quality.

Dr. Robert Angus, an emeritus biology professor at the University of Alabama at Birmingham, has testified that the past use of these exemptions for iron, manganese and TSS as well as the failure to impose limits for TDS, sulfate, chlorides, aluminum and other heavy metals at all have caused a violation of Alabama's water quality standards. *See* Affidavit of Dr. Robert Angus (Exhibit 11). Dr. Angus also states that precipitation events carry the most potential for harm in the receiving waters from a mine site. The stormwater leaving the site carries heavy metals and other toxic pollutants from mining activities—yet few, if any, limits are imposed if the precipitation exemption is invoked. *Id.* *See also* Affidavit of Warner Golden (Exhibit 12) (The exemption of discharges of iron, manganese and TSS in most precipitation events at Shepherd Bend Mine will cause a violation of water quality standards for the receiving waters because the discharges are not effectively treated or controlled).

The BWWB is similarly concerned about these exemptions and failures:

> [t]he NPDES Permit could allow large slugs of suspended solids to Mulberry Fork. The permit included no limits for total suspended solids in stormwater runoff (only settleable solids), essentially allowing unlimited discharges of fine, non settleable suspended solids such as clays and fine silts. Given the extreme land disturbance associated with surface mining---and high rate of erosion expected---this could allow large slugs of suspended solids in runoff from even small precipitation events. This in turn could have deleterious effects on aquatic life and greatly increase solids removal costs in the water treatment plant.
>
> Of special concern is the potential for catastrophic movement of solids into the stream during large storm events, whether as the result of impoundment failure or precipitation-induced mass wastage of mining materials on high slopes. The permit includes no limits on solids for >10-year storm events, essentially providing no protection from such events . . . . Catastrophic solids loading events could not only affect the water quality at the intake, it could endanger the intake itself by burial, clogging, or other damage.

See ADEM Comment Letter (Exhibit 4) at p. 5. The record establishes that Shepherd Bend and Reed No. 5 mines will significantly increase the loading of solids and contaminants to source drinking water and that the BWWB is concerned about its ability to treat these pollutants. What is clearly missing from the record is how the ASMC will keep this increased loading from occurring or ensure that source drinking water will not decline significantly if these (or additional) mines are permitted in the Mulberry Fork drainage.

For the foreseeable future, coal mining will continue in the Black Warrior River basin. However, this accepted fact begs the question of whether it is sensible, appropriate or protective of the public health to locate coal mines in established source drinking water areas or at water intakes. Given the known link between coal mining, stream impairment and possible adverse public health effects, the ASMC must carefully weigh and scientifically support putting coal mines on top of source drinking water. Just as importantly, the ASMC must evaluate the public health consequences of such a choice. When the ASMC does, the only appropriate outcome is to designate the areas covered by the Shepherd Bend and Reed No. 5 mines (as well as other lands that drain to the Mulberry Fork public water supply) as lands unsuitable for mining.

V. PETIONER'S INTEREST THAT IS ADVERSELY AFFECTED

Petitioner Black Warrior Riverkeeper, Inc. is an Alabama nonprofit membership corporation with over 2,000 members that is dedicated to the preservation, protection and defense of the Black Warrior River and its tributaries. Riverkeeper actively supports effective implementation and enforcement of environmental laws, including SMCRA and the ASMC regulations, on behalf and for the benefit of its members, as well as all who use and enjoy the River.

Many members of Riverkeeper use and value the Mulberry Fork of the Black Warrior River for drinking water, not to mention recreation (including but not limited to canoeing, kayaking, fishing, swimming, wildlife observation, nature and landscape observation and photography, and for aesthetic enjoyment). Their use and enjoyment of the Mulberry Fork for drinking water will be adversely affected by the proposed Shepherd Bend and Reed No. 5 mines, (or any other mines on lands that drain to the Mulberry Fork public water supply). They will use the Mulberry Fork less for drinking water if the water is degraded or not safe to drink. If the

BWWB has to increase treatment or install new treatment technology as a result of the proposed Shepherd Bend and Reed No. 5 mines, these members of Riverkeeper (and the general public) may pay more for their drinking water. If the ASMC protects source drinking water with a "lands unsuitable for mining designation," members of Riverkeeper will rely on and enjoy the Mulberry Fork drinking water more in the future because they can be confident that the water is clean and safe to drink. Moreover, they will not have to pay additional treatment costs.

Members of Riverkeeper are among the 200,000 customers of the BWWB who use and value the Mulberry Fork intake for drinking water now and plan to do so in the future. *See* Standing Affidavits (Exhibit 12). They are representative of Riverkeeper members and the general public who rely on the BWWB's Mulberry Fork intake for clean, safe and affordable drinking water. If the ASMC does not designate the areas covered by the proposed Shepherd Bend and Reed No. 5 mines as well as the Mulberry Fork public water supply drainage as "lands unsuitable for mining," their use and aesthetic enjoyment of the Mulberry Fork for drinking water will suffer and decline. They will use and enjoy the Mulberry Fork intake more in the future (as well as pay less for drinking water) if the ASMC protects these areas as "lands unsuitable for mining."

VI. CONCLUSION

The goal of this Petition is not to stop coal mining, but to protect an important resource: clean, safe and affordable drinking water. The Birmingham region has invested substantially in the Mulberry Fork intake; it currently serves 200,000 of the BWWB's 680,000 customers. The drinking water supplied by the Mulberry Fork of the Black Warrior River represents a unique, site-specific resource with a value clearly superior to that of coal in these circumstances.

Regulatory permit challenges, although critically important to ensure that permits are drafted to be properly protective of water quality, present a somewhat imperfect means to protect drinking water. The emphasis in those proceedings is whether the applicant meets minimal regulatory requirements for a permit, and they fail to effectively consider larger issues like cumulative effects or source drinking water protection. By contrast, the lands unsuitable for mining process is comprehensive and *preventative* in nature; it is specifically designed to protect valuable drinking water sources like the Mulberry Fork. The ASMC must now directly consider the effect coal mining will have on the source water quality of the Mulberry Fork. This segment is extraordinarily valuable to the Birmingham region, and the ASMC must determine whether, as this Petition asserts, surface coal mining in close proximity to the Mulberry Fork intake harms and devalues the river as a drinking water source. As established by the Petition, the only logical and reasonable result is to designate as unsuitable for mining the areas covered by the Shepherd Bend and Reed No. 5 mines, as well as the identified Source Water Protection Area of the Mulberry Fork public water supply.

Respectfully submitted,

BLACK WARRIOR RIVERKEEPER

Eva L. Dillard
ASB-4118-A59E
Attorney for Petitioner
Black Warrior Riverkeeper, Inc.
712 37th Street South
Birmingham, AL 35222-3206
(205) 458-0095 Office
(205) 458-0094 Facsimile
edillard@blackwarriorriver.org

Exhibit List

Exhibit 1	*Birmingham Water Works Board July 6, 2010 ASMC Comment Letter for Shepherd Bend Mine*
Exhibit 2	*Birmingham Water Works Board August 9, 2011 ASMC Comment Letter for Reed No. 5 Mine*
Exhibit 3	ASMC Permit P-3945
Exhibit 4	*Birmingham Water Works Board December 16, 2010 ADEM Comment Letter for Reed No. 5 Mine*
Exhibit 5	Birmingham City Council Resolution Opposing Shepherd Bend Mine
Exhibit 6	Birmingham City Council Resolution Opposing Reed No. 5 Mine
Exhibit 7	Shepherd Bend Mine Permit Map
Exhibit 8	Reed No. 5 Permit Map
Exhibit 9	Minimum Proposed Source Water Protection Area for Mulberry Fork
Exhibit 10	*EPA October 1, 2010 Comment Letter*
Exhibit 11	Affidavit of Dr. Robert Angus
Exhibit 12	Affidavit of Warner Golden, P.E.
Exhibit 13	Standing Affidavits

THE BIRMINGHAM
WATER WORKS BOARD

July 06, 2010

Dr. Randall C. Johnson
Alabama Surface Mining Commission (ASMC)
P.O. Box 2390
Jasper, AL 35502-2390

RE: Shepherd Bend Mine
ASMC Permit Application P3945

Dear Dr. Johnson:

The Water Works Board of the City of Birmingham (Board) would like to provide the following comments regarding the permit application for the Shepherd Bend Mine (ASMC P3945) located in Walker County. Water discharged from this mining operation would enter the Mulberry Fork, upstream and across from one of our surface water intakes, the Mulberry Intake. The Mulberry Intake has been in operation since 1989 and, as one of the Board's water sources, serves approximately 200,000 people in the Birmingham area. The Board submitted comments to the Alabama Department of Environmental Management (ADEM) regarding the Shepherd Bend Mine NPDES permit. We are concerned that this proposed mine has the potential to adversely impact the Birmingham area drinking water.

Our comments and requests for the permit application are summarized below:

- *Part II. Section E.2. - Geology* states that "Chemical analyses conducted to identify acid-forming or toxic-forming zones shall be made on a representative number of samples of the overburden within the permit area." It appears that only Acid Base Accounting (ABA) analyses were run on lithologic samples. ABA does not evaluate potential for "toxic-forming" compounds such as enhanced leaching of metals of exposed overburden materials. Evaluation of toxic-forming compounds should be conducted for each lithologic zone sampled.

- *Part II. Section F - Groundwater Hydrology* indicates that the baseline groundwater quality investigation is not sufficient. In addition to pH, Iron, Manganese, Acidity, Alkalinity, and Sulfate, a number of constituents should be added to the Groundwater Monitoring Parameters in Section V of the Hydrologic Monitoring Plan including: Aluminum, Arsenic, Copper, Mercury, Antimony, Zinc, Chromium, and Lead.

- *Part II. Section H – Probable Hydrologic Consequences Determination.* The proximity of the proposed mining operation to such a major municipal water supply intake is unprecedented to our knowledge, and represents an incompatible use. This operation could result in the discharge of mining related pollutants directly to the intake. The NPDES permit and this permit application do not appear to have adequately considered the drinking water use, and are wholly inadequate to protect the Board and its customers from many pollutants commonly associated with mining activities. The following comments concern the impact of the mining operation on the water supply:

- The proximity of the mining operation to Board's intake poses a potential hazard to drinking water uses. The Board's drinking water intake is within approximately 800 feet of the mining operation outfalls. Because the intake is so close to the proposed outfalls, the mining discharges may not evenly mix with the full stream flow prior to reaching the intake. The proximity and configuration of the proposed operation could result in a bank-entrained plume of mining-related pollutants traveling directly to the intake and into the Board's treatment facilities.

- The iron and manganese limits are not protective of drinking water uses. The NPDES permit limitations include daily average total iron concentrations of 3.0 mg/L (with daily maximum of 6.0 mg/L), daily average total manganese concentrations of 2.0 mg/L (daily maximum of 4.0 mg/L), daily average total suspended solids (TSS) of 35.0 mg/L (with a daily maximum of 70.0 mg/L), and pH ranging from 6.0-9.0 (daily minimum and maximum, respectively). The permit also notes that the manganese limitations are not applicable if pH is 6.0 or higher and total iron is less than 10 mg/L.

  The Safe Drinking Water Act includes secondary maximum contaminant levels (MCLs) for total iron concentrations of 0.3 mg/L and total manganese of 0.050 mg/L. The average concentrations allowed by the NPDES permit are ten times the secondary MCL for iron and forty times the secondary MCL for manganese. By comparison, the daily average raw water concentrations for iron and manganese for the Western Filter Plant in 2007 were 0.057 mg/L and 0.079 mg/L, respectively. Iron and manganese can cause significant aesthetic problems in drinking water, including consumers' perceptions of the quality of the drinking water, staining of clothes and basins, and taste of the water.

  The NPDES permit specifies discharge limits for total iron and manganese concentrations, however, the speciation of the iron and manganese (i.e. whether Fe and Mn are in reduced or oxidized states) will significantly impact the ability of the Board's existing treatment facilities to remove iron and manganese. For example, if Fe^{2+} and Mn^{2+} are primarily present in the discharge waters and enter the plant in the reduced oxidation states rather than as particulate iron and manganese, the current treatment process train will not be able to remove them. Speciation of iron and manganese in the discharges is needed to assess whether additional treatment would be required to oxidize the Fe^{2+} and Mn^{2+} and then remove the precipitates. However, even if the iron and manganese is present in particulate form in the discharge waters, opportunities may exist for the particulate iron and manganese to become reduced either in the riverbed sediments or in the treatment plant. Costly operational changes to the treatment plant may be required if iron and manganese precipitation and subsequent reduction occurs in the raw water storage tanks or in the sedimentation basins.

  The Board's Western Filter Plant may also be impacted by higher particle loading from TSS, iron, and manganese, which would require additional operations and maintenance (e.g. removing solids from the raw water storage tanks, increasing coagulant dosages to remove additional turbidity, more frequent backwashing of filters due to reduced filter run times, and generation of more wastewater) and may reduce the overall treatment flow rating of the plant.

- The permit application does not address the protection of the public water supply from pollution by many other mining-related pollutants, including toxic metals. Of significant concern is the potential presence of other contaminants in the discharge waters that may impact the source water. Coal in this region of Alabama has been associated with other elements that may impact water treatment, including arsenic, (described by the USGS as "well above the average for all U.S. coal"), sulfur, salinity, mercury and others. Drainage from coal mines often has elevated concentrations of not just iron and manganese, but many other metals including lead, zinc, copper, and cadmium. **Appendix A** provides a summary of data collected for the National Coal Resources Data System (NCRDS). Based on our review of data from the NCRDS trace elements can be found in very high concentrations at sites near the Mulberry Fork intake. It is expected that these trace metals will also be found in high concentrations in stormwater runoff from exposed coal. Coal samples taken near the Shepherd Bend Mine site exhibit relatively high concentrations of aluminum, arsenic, lead, and mercury. See the attached Technical Memoranda **Coal Mine Drainage and Water Quality Study** and **Surface Water Quality Analysis** for results of water quality studies conducted at a nearby mining site.

  If the NPDES permit allows discharges of iron and manganese concentrations over 10-40 times higher than maximum contaminant levels, it is reasonable to presume that other pollutants associated with coal mine drainage could also greatly exceed levels necessary to protect aquatic life and drinking water. These elements, which are not currently included in the discharge permit, could significantly impact the treatment process needs of the water supply and drastically increase costs of treatment and potentially impact public health. For example, arsenic removal would require additional processes, and demand and require increased chemical dosages. Further, the presence of ammonia would significantly complicate the disinfection strategy employed at the Western Filter Plant. Additional discharge limitations on the range of elements found in the coal that could impact the Board drinking water source should be established. Further, total dissolved solids (TDS) may be high in the coal beds and should be limited to avoid exceeding the 500 mg/L TDS secondary MCL; if high TDS levels are observed at the Western Filter Plant intake, the only (and very costly) option for reducing TDS is reverse osmosis. To better evaluate the probable impacts of these discharges on operations at the Board's Western Filter Plant, additional analysis is needed beyond what is included in the NPDES permit. The impact of the flow rates at the various outfalls should be evaluated on a seasonal basis relative to river flows to estimate the anticipated concentrations of iron, manganese, and TSS at Mulberry Fork Intake. Further study is also required to determine what other elements/compounds may occur in the discharges and additional costs of treatment associated with those discharges.

- The maximum pH limit is not protective of designated uses. The NPDES permit includes a provision that would allow a maximum daily pH of 10.5 standard units. This is well outside the range of water quality criteria deemed protective of aquatic life uses. Additionally, this pH level would exacerbate the toxicity of other constituents. The solubility of many toxic metals (for which the permit includes no limits) would increase. At this pH, even extremely low concentrations of ammonia could be toxic to aquatic life.

- The permit application does not adequately address controls on metals in stormwater runoff from mining operations. The NPDES metals limits on stormwater runoff are even less protective than for the non-precipitation-related discharges. No limits are included for any metals except iron for small precipitation events, and these iron limits are over 20 times the MCL. Larger storm events have no metals limits at all. Of special note, runoff of acid or ferruginous drainage from coal refuse disposal piles include no metals limits at all, even for l-year, 24-hour storm events.

- The NPDES Permit could allow large slugs of suspended solids to Mulberry Fork: The permit includes no limits for total suspended solids in stormwater runoff (only settleable solids), essentially allowing unlimited discharges of fine, non-settleable suspended solids such as clays and fine silts. Given the extreme land disturbance associated with surface mining- and high rate of erosion expected - this could allow large slugs of suspended solids in runoff from even small precipitation events. This in turn could have deleterious effects on aquatic life and greatly increase solids removals costs in the water treatment plant.

  Of special concern is the potential for catastrophic movement of solids into the stream during large storm events, either as the result of impoundment failure or precipitation-induced mass wastage of mining materials on high slopes. The permit includes no limits on solids for >l0-year storm events, essentially providing no protection from such events. Similarly, the permit includes no hard requirement for the permittee to develop a BMP plan to contain solids, and no such plan was available to the reviewers. Catastrophic solids loading events could not only affect the water quality at the intake, it could endanger the intake itself by burial, clogging, or other damage.

- The NPDES permit provides little protection from post-mining impacts. According to section I.A.2 of the permit, permit limits would cease to apply upon revegetation of the site and Phase II bond release. This provides no long-term protection of the drinking water intake from potential post-mining drainage problems such as failure of vegetation, acid mine seepage, or other inadequacies of post-mining reclamation.

- Since a spill from the fuel storage area at the Shepherd Bend Mine could shut down the Mulberry Fork intake, the Board contends that it is critical to have an adequate Spill Prevention, Control, and Countermeasure (SPCC) plan for this facility. The SPCC plan for the Shepherd Bend Mine does not provide adequate detail as required by 40 CFR 112.The following issues were noted with the proposed plan:
  - 40 CFR 112.4 – Facility maps and diagrams were not provided and failure analysis was not performed.
  - 40 CFR 112.7 – Countermeasures for discharge discovery, response, and cleanup were not provided. A prediction of potential discharge's direction, rate of flow, and potential quantity of material that could be discharged was not provided. An oil spill contingency plan following 40 CFR 109 was not provided. A written commitment of manpower, equipment, and materials was not provided. Inspection procedures were not clearly defined in the plan. Personnel, training, and discharge prevention procedures were not provided.
  - 40 CFR 112.8/112.12 – Facility drainage was not provided, and procedures for inspection and discharge of rainwater from containment areas were not provided.

- *Sedimentation basin designs do not meet standard design criteria and are inadequate for public water supply protection*: Based on the permit application materials, the proposed sedimentation basins are inadequate to prevent very large sediment discharges to Mulberry Fork. Relevant performance standards include those of federal regulations (30 CFR Ch. VII Part 816) and the equivalent regulations of the Alabama Surface Mining Commission Administrative Code (Chapter 880-X-10C). These regulations require the following of siltation structures:

  > Additional contributions of suspended solids sediment to streamflow or runoff outside the permit area shall be prevented to the extent possible using the best technology currently available.

  The federal and state mining regulations have few quantitative design criteria for sedimentation basins that are directly related to the removal of suspended solids; rather, most of their design criteria are related to prevention of impoundment failure during very large storm events. For these reasons, it is appropriate to consider other standard design criteria for sedimentation basins, when evaluating whether or not the ponds prevent "additional contributions of suspended solids to streamflow...using the best technology currently available". For the purposes of this review, standard design criteria for sedimentation basins are taken from the *Alabama Handbook for Erosion Control, Sediment Control and Stormwater Management on Construction Sites and Urban Areas*, published by the Alabama Soil and Water Conservation Commission (SWCC).

  A comparison of the proposed pond designs to the Alabama SWCC criteria (see table below) demonstrates that they fall far short of standard design criteria with respect to multiple factors such as dewatering time, sediment storage volume, and baffling. Such basins still might remove a proportion of the highly settleable solids (e.g., sand & larger silt), and the ponds appear to have been primarily designed with SEDCAD to meet effluent limits for settleable solids. However, such basins would be wholly inadequate for preventing additional contributions of suspended solids as required by state and federal regulations. By failing standard design criteria, the ponds cannot be said to represent the best technology available.

Comparison of Proposed Sedimentation Basin Designs to Alabama SWCC Design Criteria

[shaded cells indicate that proposed design does not meet design criteria]

Basin	Dewatering Time[1] (hours)		Length-to-Width Ratio		Sediment Storage Capacity (ac-ft)		Number of Baffles	
	Criterion	Design	Criterion	Design	Criterion	Design	Criterion	Design
005	48-240	~17	2:1	~3:1	8.3	1.9	3	1
006		~14		~2:1	2.8	3.3		1
007		~14		~1:2	4.5	4.0		1
008		~16		~4:1	12.0	2.6		1

[1]Interpreted from SEDCAD results as total dewatering time when water elevation is at the invert of the emergency spillway

This conclusion is borne out by the SEDCAD results presented. SEDCAD results demonstrate extremely high effluent TSS concentrations for the storm events: including peak concentrations >30,000 mg/L and average concentrations (calculated from total sediment load and water volumes provided) of >20,000 mg/L. It is clear that, even operating as designed, the basins will be discharging plumes of extremely turbid water just upstream of a public water supply intake, and thus violating federal and state regulations.

- The permit application made reference to the possible use of chemical treatment or flocculation bricks to control TSS. However, the pond design information includes no such elements. Based on the effluent TSS concentrations discussed above, it is highly recommended to implement chemical treatment measures and to include them in the facility design, along with plans/measures to determine appropriate dosing rates. Such measures require careful planning and should not be left as afterthought only to be hurriedly implemented in the event that major sedimentation problems are discovered.

- Sedimentation control structures are the primary control for surface waters leaving the property. These generally control the sediments, when well-designed, but may not reduce dissolved or ionic constituents that may be elevated due to mining activities. Constituents not controlled may include metals, explosive residue, sulfate from sulfide oxidation, etc. In addition, many of the trace contaminants in **Appendix A** are not likely to be mitigated by settling ponds.

- *Attachment III-A-5 – Disposal of Debris, Acid-Forming and Toxic Forming Material and Materials Constituting a Fire Hazard* only addresses acid forming materials (refers to neutralization). It also indicates that materials will be placed into a burial pit, but does not expand on the design of the pit. The pit design should ensure that the materials do not contact groundwater, over the short-term and long-term, even during wet periods.

- *Attachment III-D - Hydrologic Monitoring Plan* indicates that the groundwater monitoring program is not sufficient. The applicant is requesting a waiver to monitor only one groundwater well at the site. The applicant specifically states, "No groundwater is being used in the area for a source of potable water and data shows a general lack of supply; therefore, a waiver for the remaining monitoring wells is requested as they are removed by mining."

  The groundwater underlying the proposed Shepherd Bend mine is in direct hydraulic communication with surface water in the Mulberry Fork, which is designated for public water supply. Due to the nature of groundwater flow at this site (see Attachment 2-3), contaminants introduced to groundwater from mining operations will discharge to the Mulberry Fork. Further, the groundwater directly underlying the site is designated as an "Underground Source of Drinking Water" (USDW) by ADEM Admin. Code r. 335 Division 6 Regulations.

  Therefore, the permit and waiver for groundwater monitoring should be denied. At a minimum, The Hydrologic Monitoring Plan (Attachment III-D) should be revised to include groundwater monitoring of all wells installed at the site and replacement of all wells mined through. The Hydrologic Monitoring Plan should be revised to include a groundwater monitoring program that includes procedures to continually monitor groundwater quality in all wells versus baseline or background conditions. Additionally, the owner and ASMC's responses and corrective actions for significant contaminant increases in groundwater over baseline or background conditions should be included in the application and Attachment III-D Hydrologic Monitoring Plan.

Our Mulberry Intake will be used to provide drinking water to the Birmingham Metropolitan Area for many years in the future and this mine would negatively impact the drinking water supply. Given what is at stake, we feel that this mining permit should not be issued. If the permit is issued, we feel that all of the areas of concern noted above must be addressed in order for us to continue to provide the regions residents with safe drinking water at a reasonable price.

Please email me at djones@bwwsb.com or call 205-244-4404 if you have any questions or comments.

Very Truly Yours,

Darryl R. Jones

Darryl R. Jones, P.E.
Assistant General Manager
Operations and Technical Services

cc: Mac Underwood, BWWB
Patrick Flannelly, Malcolm Pirnie, Inc.

Appendix A

Trace Elements in Samples Collected from Coal Fields in the Vicinity of the BWWB Public Water Supply Intake

Trace Elements in Samples Collected from Coal Fields in the Vicinity of the BWWB Public Water Supply Intake

Introduction

A review was completed to determine concentrations of specific trace elements in coal fields in the vicinity of the BWWB public water supply intake located on the Mulberry Fork of the Black Warrior River in Walker County, Alabama (Figure 1). Trace element concentrations are provide in the *U.S. Geological Survey Open File Report 97-134,* which contains a database of analytical data, sample locations, descriptive information, analytical methods and sampling techniques, database perspective, and bibliographic references for selected coal field samples in Walker County, Alabama. All sample locations were mapped to determine the concentration of trace elements within the vicinity of the BWWB public water supply intake and local watershed. The attached table (Table 1) represents the concentrations of trace elements in samples collected from coal fields near the BWWB public water supply intake. All concentrations are provided in parts per million or milligrams per kilogram.

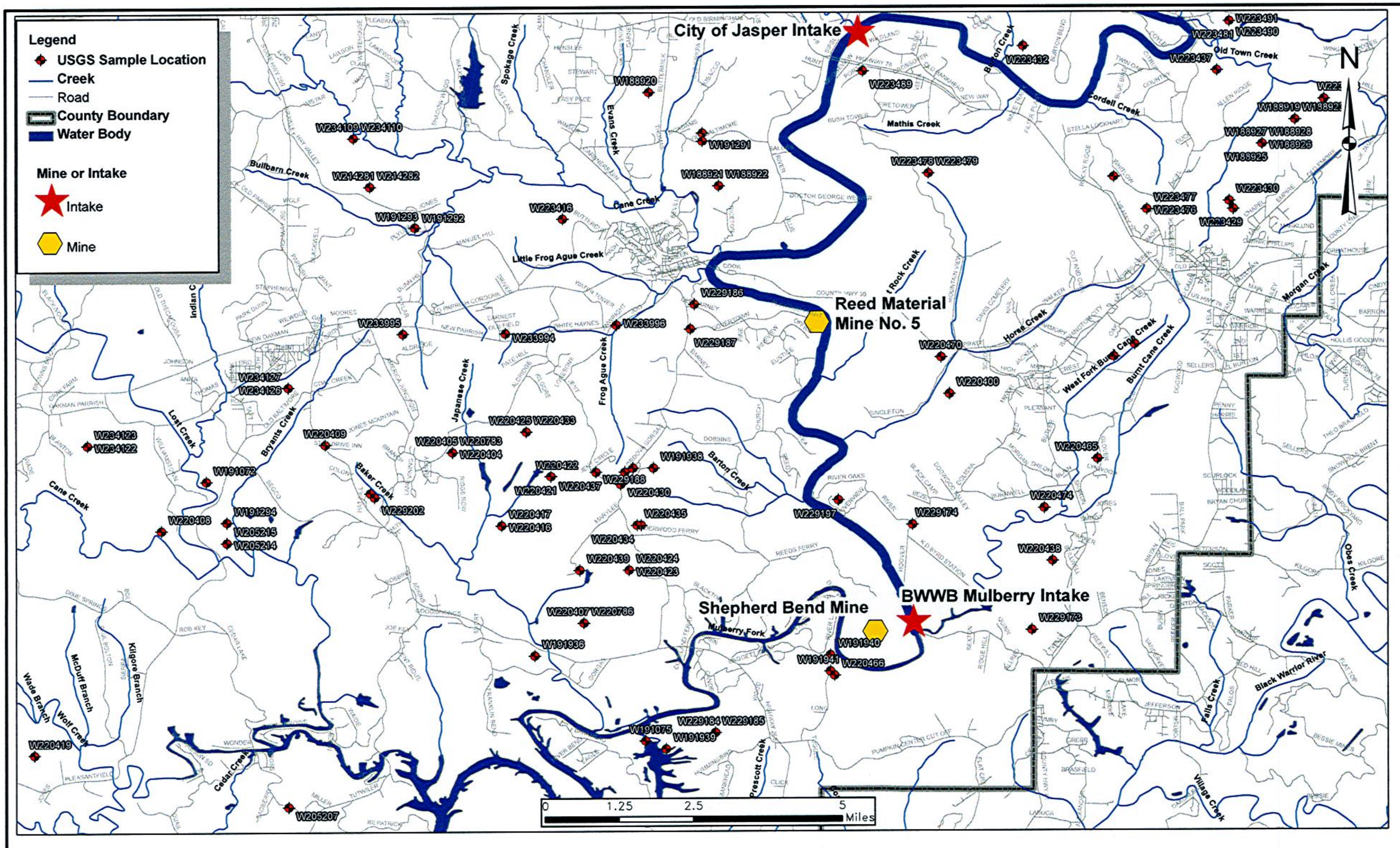
USGS Database Background

During the energy crisis of the mid-1970s the U.S. Geological Survey (USGS), in cooperation with State Geological Surveys, initiated a project to create a comprehensive national coal information database. This database, known as the National Coal Resources Data System (NCRDS), was to contain information on the quantity and quality of domestic coal resources. A major objective was to locate, measure, and characterize all of the Nation's coal resources, without regard to bed thickness, depth, location, or quality. An initial goal of the project was to obtain and characterize at least one sample per coal bed from every geographic quadrangle (approximately 50 sq. miles) underlain by coal. During the nearly 30 years since its inception, the NCRDS's Coal Quality database has developed into the largest publicly available database of coal fields. The data are used primarily by state Geological Surveys, university researchers, and other federal and state agencies.

The EPA utilizes the USGS Coal Quality database for Clean Water Act and Clean Air Act evaluations. The 1990 Amendments to the Clean Air Act (U.S. Statutes, 1990) cite more than a dozen elements as potential hazardous air pollutants and EPA uses the USGS Coal Quality database to conduct studies of the toxic air emissions from coal burning utilities. The EPA also uses the Coal Quality database for evaluations of coal bed methane (CBM) wastewater and water quality and runoff from coal mining sites.

Conclusion

Review of the database indicates that trace elements are present at significant concentrations in coal fields located near the BWWB intake (Table 1). Further, concentrations of these trace elements would be expected in stormwater runoff from mine tailings, abandoned mines, and coal piles.



USGS SAMPLE LOCATIONS OF TRACE ELEMENTS IN ALABAMA COAL FIELDS
NEAR THE BWWB PUBLIC WATER SUPPLY INTAKE

December 10, 2008

FIGURE 1

Table 1. Total Trace Element Concentrations in Samples Collected from Coal Fields Near the BWWB Public Water Supply Intake
(All concentrations in mg/Kg or parts per million)

USGS Sample No.	Aluminum	Iron	Sulfur	Arsenic	Bromine	Chromium	Mercury	Manganese	Molybdenum	Lead	Antimony	Selenium	Strontium	Zinc
W191072	35,000	8,200	1,200	11	2	31	0.14	13	3.2	9.1	0.61	5.2	470	6.4
W191074	8,000	8,000	1,100	18	1	9.1	0.22	12	2.3	1.1	0.31	3	110	4
W191075	27,000	16,000	1,100	13	4	23	0.31	11	4	6.4	1.3	6	160	10
W191292	24,000	7,400	990	10	4	20	0.22	20	1.6	5.8	0.53	1	69	8.4
W191293	23,000	5,800	760	7.1	4	19	0.28	13	1.9	5.1	0.39	1.5	120	8.3
W191294	27,000	9,400	1,200	8.1	2	32	0.11	11	5.6	11	1.8	6.8	360	5
W191936	34,000	8,400	920	20	1	25	0.22	13	2.9	7.5	0.74	4.5	250	8.7
W191937	40,000	16,000	1,100	40	2	35	0.39	18	5.1	16	3	6.3	460	11
W191938	12,000	9,600	510	20	2	10	0.23	7.7	4	3.6	3.1	2	62	9.5
W191939	14,000	13,000	970	7.8	1	12	0.21	7	2.7	3.7	0.67	2.7	200	5.1
W191940	21,000	10,000	990	5.6	1	20	0.02	16	2.9	4.4	0.56	4.9	140	7
W191941	26,000	12,000	660	18	1	25	0.24	14	13	11	2	6	180	7.6
W205206	12,000	5,600	1,300	39	2.1	14	0.09	14	8.6	5.7	0.9	2.7	110	9.4
W205207	12,000	11,000	1,600	21	2.3	16	0.2	17	4.8	7	2	2.1	110	9.8
W205214	14,000	4,300	710	8	2.1	16	0.02	17	2.7	6.9	4	1	90	19
W205215	15,000	7,400	1,200	15	2.5	17	0.2	9.9	1.8	6.2	0.6	1.8	630	5.5
W220400	19,000	7,200	930	3.3	4.7	20	0.24	240	0.17	3.8	2.2	5.3	160	31
W220404	14,000	13,000	870	22	1	19	0.21	9.6	2.2	3.8	1.5	3.4	330	3.6
W220405	9,500	5,900	630	29	1.7	16	0.25	4.9	3.9	3.5	4.3	2	76	10
W220407	12,000	3,000	510	3.6	1.1	14	0.05	13	4.9	3.7	1.7	2.1	240	15
W220408	20,000	8,000	850	48	1.8	25	0.23	10	3	5.5	0.77	3.2	740	4.8
W220409	27,000	9,600	750	140	2	30	0.24	11	2.4	4.9	1.9	4.9	400	4.2
W220416	16,000	3,800	560	11	1	18	0.22	6.3	1.6	5.6	0.44	3.4	88	13
W220417	9,400	4,800	640	5.8	1.7	18	0.25	6	3	2.7	5.8	2.7	170	3.7
W220421	17,000	8,900	870	32	1.3	20	0.19	14	1.7	4.3	1.1	3.7	380	3.7
W220422	12,000	3,900	340	4.7	1.3	15	0.08	8.2	1.3	4.3	4.3	2	46	7.8
W220423	15,000	30,000	1,200	140	0.92	42	0.53	13	5.3	2.8	3.7	4.5	150	7.3

Table 1. Total Trace Element Concentrations in Samples Collected from Coal Fields Near the BWWB Public Water Supply Intake
(All concentrations in mg/Kg or parts per million)

USGS Sample No.	Aluminum	Iron	Sulfur	Arsenic	Bromine	Chromium	Mercury	Manganese	Molybdenum	Lead	Antimony	Selenium	Strontium	Zinc
W220424	9,400	11,000	240	100	1.1	12	0.39	14	1.4	4.1	5.5	2.2	48	28
W220425	18,000	12,000	820	76	1.3	18	0.21	8.9	1.8	3.8	0.72	4.8	310	3.7
W220430	12,000	2,900	420	11	1.5	15	0.08	7.2	2	4.3	6.9	1.6	67	6.3
W220432	30,000	18,000	1,500	12	1	31	0.2	26	1.5	6.2	0.34	4.7	540	6.8
W220433	11,000	3,200	420	15	1.2	14	0.12	15	4.9	3.9	3.6	2.6	61	7.3
W220434	17,000	12,000	950	15	1.3	20	0.4	12	2.6	5.4	1.3	4.3	530	4.3
W220435	8,400	9,600	560	130	1.4	13	0.19	5.8	2.8	3.1	5.3	2.2	38	7.7
W220436	23,000	9,500	1,100	20	1.7	27	0.3	14	2.4	5.6	1.5	4.4	520	4.5
W220437	10,000	4,600	720	15	1.4	16	0.17	7.4	4.6	3.6	3.3	2	120	5.4
W220438	16,000	2,900	300	13	1.6	15	0.34	11	0.37	4.1	1.4	0.7	95	6.3
W220439	9,000	2,500	360	7	2.7	13	0.08	3.9	2.1	3.3	5.5	4.1	50	6.6
W220464	3,000	11,000	690	19	1.8	6.2	0.43	7.6	0	0.3	2.2	2.1	27	8.4
W220465	13,000	13,000	390	28	5.4	15	0.34	5.9	1.6	2.7	1.1	8.4	32	8.1
W220466	16,000	7,500	640	29	0.95	20	0.25	10	2.9	3.3	1.3	3	150	4.8
W220470	22,000	4,200	620	4	6.8	21	0.05	7.8	0.91	3.6	0.6	1.6	88	8.4
W220471	4,300	17,000	310	170	1.7	8.4	0.19	6.7	12	1	5.8	1.8	17	9
W220472	5,200	4,600	290	15	2.8	8.8	0.24	3	3.3	1.3	3.2	1	14	9.4
W220473	12,000	33,000	1,100	130	1.6	14	0.2	110	11	0.89	2	1.8	31	15
W220474	22,000	6,600	3,000	26	8.7	28	0.05	11	0.48	3.2	3.9	1.3	30	17
W220783	27,000	8,700	680	19	1.2	31	0.38	7.3	6.7	5.6	2.1	7.5	280	4.7
W220786	12,000	18,000	870	86	0.78	13	0.4	11	4.7	0.84	1.4	2.7	140	5.5
W223416	18,000	16,000	530	600	5.8	19	0.41	7.8	0.43	4.3	3.4	1.4	62	4.9
W223429	9,000	14,000	400	150	2.3	20	0.35	17	5.7	4.9	4.3	2.5	25	20
W223476	22,000	3,500	320	6.9	2.2	19	0.2	7.9	1.1	3.8	0.36	1.4	160	4.9
W223477	16,000	9,200	400	61	2.2	15	0.25	13	5.8	3.1	3.5	1.5	22	26
W229173	17,000	5,800	680	4.9	4.8	15	0.05	25	1.8	5.6	1.3	1.3	140	11
W229174	16,000	9,800	240	110	3.5	15	0.13	17	0.68	3.8	1.7	1.3	92	26

Table 1. Total Trace Element Concentrations in Samples Collected from Coal Fields Near the BWWB Public Water Supply Intake
(All concentrations in mg/Kg or parts per million)

USGS Sample No.	Aluminum	Iron	Sulfur	Arsenic	Bromine	Chromium	Mercury	Manganese	Molybdenum	Lead	Antimony	Selenium	Strontium	Zinc
W229184	15,000	10,000	580	26	2.1	15	0.22	11	2.5	6.8	1.5	2.2	120	7.4
W229185	17,000	49,000	570	170	2.2	18	0.52	7.7	0	13	14	3.4	77	26
W229186	29,000	14,000	980	69	3	24	0.18	20	1.1	12	0.98	2.3	250	14
W229187	9,800	22,000	550	150	1.9	16	0.52	12	0	4.9	2.5	1.8	63	6.2
W229188	5,300	1,600	260	1.1	2.4	4.9	0.06	2.7	0.9	2.2	3.8	0.52	23	3.7
W229197	14,000	30,000	670	320	2.2	14	0.44	15	1.4	5.2	1.8	1.4	52	9.1
W229202	9,200	3,600	4,100	2.4	4.1	13	0.06	15	0.75	7.3	4.5	1.2	36	21
W229203	41,000	14,000	700	44	4	43	0.29	13	5.9	19	2.6	9.4	840	7.9
W229204	11,000	2,300	450	6.9	2.8	14	0.05	4.7	4.2	5.4	4.2	1.9	48	10
W233994	4,100	36,000	860	120	1.7	6.2	0.12	29	0	3.4	10	1.7	45	9.4
W233995	45,000	23,000	1,100	110	2.3	72	0.06	30	3.4	31	6.5	9	250	88
W233996	22,000	24,000	680	150	3	21	0.04	18	1.5	7.8	2.1	1.6	140	15
W234124	18,000	10,000	1,000	98	3.4	18	0.09	18	4	7.6	0.53	4.3	380	9.7
W234125	10,000	8,400	780	15	2.4	16	0.09	7.1	7.2	5.7	3.6	2.9	79	7.3
W234126	31,000	17,000	1,100	32	2	34	0.15	34	7.1	15	3.1	10	860	23
W234127	11,000	6,200	770	15	1.8	14	0.04	4.7	8.7	5.9	5	1.9	73	28

1. Executive Summary

The Birmingham Water Works Board (Board) utilizes the Mulberry Fork as a primary water source for the Western Filter Plant (WFP). A coal mine has recently been proposed adjacent to the Board's Mulberry intake with outfalls being located approximately 800 feet upstream. The Board has raised concern regarding the impact of this mine on the raw water quality and subsequent treatment at WFP. Therefore, a sampling and analysis plan was developed to determine the possible increase in concentrations of metals and organics due to mine runoff. The mine to be evaluated is approximately 1.5 miles upstream of the Board's Mulberry intake on the east bank of Mulberry Fork.

The Board has conducted Acid Base Accounting (ABA) tests on five coal bearing samples collected from the Black Warrior River watershed in July 2009. Based on test results, this coal bearing material is expected to generate acidic conditions. As no reported natural neutralization potential exists in these samples, the acidic waters produced are likely runoff dumps during rain events. Therefore, operational processes should be considered to reduce the potential of acidic runoff. The operational processes may either be directed toward the control and treatment of the runoff or the implementation of controls to reduce the oxidation of sulfides in these materials on the dumps and waste dumps.

Should acidic conditions become pervasive, these coal bearing materials are likely to leach metals into the environment, some at concentrations above current Mulberry Fork levels and various local and federal limits. Based on the synthetic leaching tests (SPLP) the metals of greatest concern are: aluminum, arsenic, iron, manganese, and zinc.

Only one of the five samples was reported to leach BETX. Both benzene and toluene were leached at concentrations above the EPA drinking water standards for this sample.

Total organic carbon concentrations reported within the leachate from the SPLP tests ranged from 2.7 to 4.5 weight %. The impact of this additional amount of organic carbon to Mulberry Fork watershed is unknown at this time.

2. Study Background

The Board utilizes the Mulberry Fork as a primary water source for the Western Filter Plant. A coal mine has recently been proposed adjacent to the Board's Mulberry intake with outfalls being located approximately 800 feet upstream. The Board has raised concern regarding the impact of this mine on the raw water quality and subsequent treatment at WFP. Therefore, a sampling and analysis plan (SAP) was developed to determine possible increases in concentrations of metals and organics due to mine runoff (*Sampling and Analysis Plan for the Shepherd Bend Coal Mine Waste Rock & Coal Rejects; Coal Mine Drainage and Water Quality Study dated October 2008*). The mine to be evaluated is approximately 1.5 miles upstream of the BWWB's Mulberry intake on the east bank of Mulberry Fork.

3. Material Sampling

Five (5) samples of coal bearing materials were collected in accordance with the SAP authorized by the Board. These samples were collected within the Black Warrior River watershed near an active coal mine that uses the nearby site for processing the coal bearing materials. Each of the five samples were split and placed into two Ziploc bags and sent to the two ALS laboratories for analysis.

4. Sample Analysis

Two splits from each of the five (5) samples were analyzed by two ALS laboratories: ALS Environmental Division located in Houston Texas; and, ALS Minerals Division located in Reno Nevada. The samples were analyzed in accordance with the SAP authorized by the Board. ALS Houston performed the metal/organic leaching tests and ALS Reno performed the acid base accounting (ABA) tests.

Synthetic Precipitation and Leaching Potential (SPLP) anlyses (EPA Method 1312) were performed at the ALS Houston facility. The SPLP metals extraction / leachate were performed using a 1:1 ratio of sample to extraction fluid. Normally EPA Method 1312 calls for a 1:20 extraction / leachate ratio. The use of the 1:1 ratio was done to lower the methods detection limits for leached metals and organics and to increase the likelihood of observing potential impacts that might occur from the leaching of the coal bearing materials. The dissolved organic carbon (DOC) analyses were performed on the 7 day distilled water leachate from the five samples. All reported sample results passed laboratory QA/QC procedures and requirements and are considered a fair representation of the likely leachate chemistry from a rain event. Metals analyzed included: aluminum, antimony, arsenic, cadmium, chromium, copper, iron, lead, lithium, manganese, mercury, molybdenum, nickel, selenium, silver, strontium, titanium, and zinc. Organics and non-metals analyzed included: BETX (Benzene, Ethyl Benzene, Toluene, and Xylenes), Bromide, dissolved organic carbon, and total organic carbon.

Acid Base Accounting (ABA) tests were performed at the ALS Reno facility. The ABA tests were performed using industry standard methods based on Sobek (*Sobek, A., Schuller, Freeman, W.J. and Smith, R. (1978), Field and Laboratory Methods Applicable to Overburdens* *and Minesoil, EPA report no. EPA-600/2-78-054 p.47-50*). The results are reported in tons of calcium carbonate required to neutralize the acid for every 1000 tons of ore that may be oxidized. The pH reported is a paste pH thus reflecting the pH of small amounts of water that are in contact with this material, such as after a rain event. Additionally, the laboratory quantified the total sulfur in each sample and the amount of sulfur that was present in the form of sulfide sulfur. Sulfide sulfur is the form that may be oxidized and form sulfuric acid, initiating the condition referred to as acid mine drainage. The lowering of the pH under these types of conditions may also increase the leaching of the metals contained within the coal bearing materials, simulated by the SPLP tests described above.

5. Sample Results

5.1 Synthetic Precipitation and Leaching Potential (SPLP) – EPA Method 1312.

Metal concentrations above the method detection limits (MDL) in the SPLP leachate were observed for: aluminum, antimony, arsenic, chromium, iron, lithium, manganese, mercury, nickel, strontium, titanium, and zinc (see Table 1). Metal concentrations associated with four (4) or five (5) of the samples were reported above the MDL including: **aluminum** (average value 0.85 mg/L), **lithium** (average value 0.01 mg/L), **strontium** (average value 0.03 mg/L), and **zinc** (average value 0.07 mg/L).

- Metal concentrations in SPLP leachate that exceeded current average Mulberry Fork concentrations for one or more samples included: aluminum, iron, manganese, nickel, titanium, and zinc.
- Metal concentrations in SPLP leachate that exceeded anti-degradation limits for one or more samples included: arsenic and zinc.
- Metal concentrations in SPLP leachate that exceeded suggested mine permit limits for one or more samples included: arsenic and mercury.
- Metal concentrations in SPLP leachate that exceeded EPA Primary (or Secondary) Drinking Water Standards for one or more samples included: aluminum, antimony, arsenic (secondary), iron (secondary), manganese (secondary), and mercury.

Organics and non-metal concentrations (see Table 2) above the method detection limits in the SPLP leachate were observed for: benzene and toluene only in one of the five samples (sample number 4).

- Organics and non-metal in SPLP leachate that exceeded EPA Primary (or Secondary) Drinking Water Standards for one or more samples included: benzene and toluene.

Dissolved organic carbon from the distilled water leach was reported in two of the five samples while total organic carbon concentration ranged from 2.7 to 4.5 weight percent for the five SPLP leachate samples.

5.2 Acid Base Accounting (ABA)

Maximum potential acidity (MPA) ranged from 7.8 to 84.4 tons $CaCO_3$/1000 tons of ore. Based on industry best practices (*Managing Sulphidic Mine Wastes and Acid Drainage, Environment Australia, 1997; Best Practice Environmental Management in Mining*) and government guidelines (*EPA/DOE Mine Waste Technology Program, various annual reports*). Materials having MPA values less than 10 are generally considered to be non-acid producing material. Materials having MPA values from 10 to 20 are considered to be non-definitive for acid generation. Materials with an MPA greater than 20 are considered likely to produce acidic conditions if no natural conditions or operational procedures are available to counter-act the acid generation and/or oxidation of sulfide sulfur (most prevalently pyrite).

The neutralization potential of a material may arise from many sources which may include: contained carbonates, silicates, and other minerals that consume acid when in contact with acidic conditions. The neutralization potential of the material is determined through titration of the material with an acid. For the five samples, the neutralization potential was reported between 0 and 2 tons $CaCO_3$/1000 tons of ore. These values are very low and represent material that has little buffering capacity towards acidic conditions.

If the neutralization potential of a material is greater than the potential to generate acid and the kinetics of these reactions is adequate, then the material on balance would not be considered to be acid generating. The net neutralization potential (NNP) represents this overall acidic reaction of the materials. For the five samples these are all negative numbers indicating that there is a propensity to generate acid with no buffering capacity to mediate the resultant acidic waters.

The paste pH results show that oxidization of sulfides within the coal bearing material sampled is not currently occurring (pH >7). However, the potential for sulfide oxidation is present based on ABA results, with the exception of Sample #2 where the paste pH suggests that oxidation is occurring and that sufficient sulfides are present to lower the pH of water in contact with this material to acidic conditions (pH = 4.1). It is not unusual for samples with high pyrite contents to show this type of analysis pattern.

The total sulfur and sulfide sulfur results support the MPA and paste pH results described above. Sulfide sulfur is found in all five samples and comprises most all of the sulfur found in the samples. These reported results indicate that sulfide sulfur is present in the coal bearing materials sampled and analyzed, and this sulfide sulfur may be oxidized to generate acidic conditions.

6. Summary Findings

Five samples of coal bearing material were sampled and sent to ALS analytical laboratories located in Houston and Reno for leaching and acid generation testing. All samples were under standard chain-of-custody procedures throughout the collection and transfer to the analytical facilities.

Based on the ABA tests, this coal bearing material is expected to generate acidic conditions. As no reported natural neutralization potential exists in these samples, the acidic waters produced are likely runoff dumps during rain events. Therefore, operational processes should be considered to reduce the potential of acidic runoff. The operational processes may either be directed toward the control and treatment of the runoff or the implementation of controls to reduce the oxidation of sulfides in these materials on the dumps and waste dumps.

Should acidic conditions become pervasive, these coal bearing materials are likely to leach metals into the environment, some at concentrations above current creek levels and various local and federal limits. Based on the SPLP tests the metals of greatest concern are: aluminum, arsenic, iron, manganese, and zinc.

Only one of the five samples was reported to leach BETX. Both benzene and toluene were leached at concentrations above the EPA drinking water standards for this sample.

Total organic carbon concentrations reported within the leachate from the SPLP tests ranged from 2.7 to 4.5 weight %. The impact of this additional amount of organic carbon to Mulberry Fork watershed is unknown at this time and not part of this study.

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Table 1. Leachable Metal Concentrations.

Results of Synthetic Precipitation and Leaching Procedure (SPLP) [USEPA Method 1312]

(All concentrations are reported in mg/L)

	Aluminum	Antimony	Arsenic	Cadmium	Chromium	Copper	Iron	Lead	Lithium
Sample 1	**3.400**	<0.005	<0.005	<0.00060	<0.00060	<0.005	**0.822**	<0.00040	**0.0255**
Sample 2	**0.104**	<0.005	**0.00922**	<0.00060	<0.00060	<0.005	**18.6**	<0.00040	**0.0064**
Sample 3	**0.308**	**0.00793**	<0.005	<0.00060	<0.00060	<0.005	<0.036	<0.00040	**0.0292**
Sample 4	**0.163**	<0.005	**0.00672**	<0.00060	<0.00060	<0.005	<0.036	<0.00040	<0.0050
Sample 5	**0.149**	<0.005	<0.005	<0.00060	**0.00705**	<0.005	<0.036	<0.00040	**0.0063**
Average Value in Mulberry Fork [1]	0.060	0.01	0.01	0.015	0.05	0.05	0.11	0.01	—
Antidegradation Limit [2]	NS	0.0104	0.009	NS	0.0505	0.0516	NS	0.0092	NS
Suggested Mine Permit Limit [3]		<0.1	<0.01		0.2	0.4		<0.01	
EPA Primary Drinking Water Standards [4]	0.05 to 0.2 [5]	0.006	0.01 0.0 [6]	0.005	0.1	1.3	0.3 [5]	0.015 0.0 [6]	NS

	Manganese	Mercury	Molybdenum	Nickel	Selenium	Silver	Strontium	Titanium	Zinc
Sample 1	**0.0141**	<0.000042	<0.005	<0.005	<0.005	<0.005	**0.03030**	**0.0246**	**0.095**
Sample 2	**0.0614**	**0.000262**	<0.005	**0.0536**	<0.005	<0.005	**0.08970**	<0.005	**0.198**
Sample 3	<0.005	<0.000042	<0.005	**0.0050**	<0.005	<0.005	**0.00691**	<0.005	**0.019**
Sample 4	<0.005	<0.000042	<0.005	<0.005	<0.005	<0.005	**0.00746**	<0.005	**0.011**
Sample 5	<0.005	<0.000042	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	**0.022**
Average Value in Mulberry Fork [1]	0.06	0.0003	—	0.05	—	0.05	—	0.01	0.05
Antidegradation Limit [2]	NS	0.0003	NS	NS	NS	NS	NS	NS	0.0537
Suggested Mine Permit Limit [3]		<0.0003							0.8
EPA Primary Drinking Water Standards [4]	0.05 [5]	0.002	NS	NS	0.05	0.10 [5]	NS	NS	5 [5]

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Table 1. Leachable Metal Concentrations.

Results of Synthetic Precipitation and Leaching Procedure (SPLP) [USEPA Method 1312]

(All concentrations are reported in mg/L)

1) Average Value in Mulberry Fork from "Shepheard Bend Mine: Potential Impacts on the Mulberry and Drinking Water Concerns" presented by Patty Barron, P.E. and Patrick Flannelly, P.E. October 2008

2) Antidegradation Limit from "Shepheard Bend Mine: Potential Impacts on the Mulberry and Drinking Water Concerns" presented by Patty Barron, P.E. and Patrick Flannelly, P.E. October 2008

3) Suggested Mine Permit Limit from "Shepheard Bend Mine: Potential Impacts on the Mulberry and Drinking Water Concerns" presented by Patty Barron, P.E. and Patrick Flannelly, P.E. October 2008

4) EPA Primary Drinking Water Standards - Natioinal Primary Dinking Water Regulations

5) EPA Secondary Drinking Water Standards - Natioinal Secondary Dinking Water Regulations

6) EPA Primary Drinking Water Standards - Public Health Goal

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Table 2. Leachable Concentrations (Miscellaneous Constituents)
Results of Synthetic Precipitation and Leaching Procedure (SPLP) [USEPA Method 1312]
(SPLP concentrations are reported in ug/Kg)

	Benzene	Bromide	EthylBenzene	DOC	TOC	Toluene	Xylenes
Sample 1	<25	<0.30	<25	11.0	32,200	<25	<25
Sample 2	<25	<0.30	<25	2.67	42,500	<25	<25
Sample 3	<25	<0.30	<25	<1	45,400	<25	<25
Sample 4	37	<0.30	<25	<1	27,100	31	<25
Sample 5	<25	<0.30	<25	<1	36,900	<25	<25
Average Value in Mulberry Fork (mg/L) [1]	0.060						
Antidegradation Limit (mg/L) [2]	NS	NS	NS	NS	NS	NS	NS
Suggested Mine Permit Limit (mg/L) [3]		<0.05					
EPA Primary Drinking Water Standards (mg/L) [4]	0.005 0.0 [6]	NS	0.7	NS	NS	1	10

DOC = Dissovled Organic Carbon; TOC = Total Organic Carbon

1) Average Value in Mulberry Fork from "Shepheard Bend Mine: Potential Impacts on the Mulberry and Drinking Water Concerns" presented by Patty Barron, P.E. and Patrick Flannelly, P.E. October 2008

2) Antidegradation Limit from "Shepheard Bend Mine: Potential Impacts on the Mulberry and Drinking Water Concerns" presented by Patty Barron, P.E. and Patrick Flannelly, P.E. October 2008

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5) EPA Secondary Drinking Water Standards - Natioinal Secondary Dinking Water Regulations

6) EPA Primary Drinking Water Standards - Public Health Goal

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Table 3. Acid Generation Potential and Sulfide Sulfur Leachability
Results of Synthetic Acid Base Accounting Procedure (ABA) [Industry Standard Method]

	Maximum Potential Acidity (MPA)	Neutralization Potential (NP)	Net Neutralization Potential (NNP)	NP:MPA Ratio	pH	Total Sulfur (%)	Sulfide Sulfur (%)
Sample 1	7.8	2	-6	0.26	7.1	0.25	0.25
Sample 2	84.4	0	-84	0.00	4.1	2.70	2.66
Sample 3	8.4	1	-7	0.12	7.4	0.27	0.26
Sample 4	10.9	0	-11	0.00	7.9	0.35	0.35
Sample 5	14.1	1	-13	0.07	7.1	0.45	0.45
Average Value in Mulberry Fork (mg/L) [1]	*0.060*						*21*
Antidegradation Limit (mg/L) [2]	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*
Suggested Mine Permit Limit [3]							
EPA Primary Drinking Water Standards [4]	*NS*	*NS*	*NS*	*NS*	*6.5 - 8.5*	*NS*	*NS*

MPA / NP / NNP reporting units = tCaCO3/1000t ore

1) Average Value in Mulberry Fork from "Shepheard Bend Mine: Potential Impacts on the Mulberry and Drinking Water Concerns" presented by Patty Barron, P.E. and Patrick Flannelly, P.E. October 2008

2) Antidegradation Limit from "Shepheard Bend Mine: Potential Impacts on the Mulberry and Drinking Water Concerns" presented by Patty Barron, P.E. and Patrick Flannelly, P.E. October 2008

3) Suggested Mine Permit Limit from "Shepheard Bend Mine: Potential Impacts on the Mulberry and Drinking Water Concerns" presented by Patty Barron, P.E. and Patrick Flannelly, P.E. October 2008

4) EPA Primary Drinking Water Standards - Natioinal Primary Dinking Water Regulations

5) EPA Secondary Drinking Water Standards - Natioinal Secondary Dinking Water Regulations

6) EPA Primary Drinking Water Standards - Public Health Goal

1. Summary

The Birmingham Water Works Board (Board) utilizes the Mulberry Fork as a primary water source for the Western Filter Plant (WFP). A surface water sampling plan was developed to aid in determining the potential impacts of a proposed mine near the current Mulberry intake. Since, there is an existing coal mine currently in operation upstream of the Mulberry intake, it was utilized as the focal point for our sampling locations. The mine that was evaluated is approximately 1.5 miles upstream of the Board's Mulberry intake on the east bank of Mulberry Fork. Four locations were sampled during a wet weather event and a dry weather event in July and August of 2009. Below is a list of the locations that were sampled.

- Site 1 – Mulberry Intake
- Site 2 – 800 feet downstream of mine outfall
- Site 3 - Mine Outfall
- Site 4 – 800 feet upstream of mine outfall

The sampling results confirmed the potential for several metals to be discharged from the mine outfall at elevated levels as compared to the typical water quality in this reach of the Mulberry Fork. Four of the metals found were consistent with the ones listed as potential concerns in the Coal Mine Drainage and Water Quality Study memo (Malcolm Pirnie, September 2009) with the addition of one parameter. The potential metals of concern are aluminum, iron, manganese, zinc, and strontium. All of these metals are regulated except for strontium. It is important to note that though these metals returned elevated results at the outfall location, the results at the downstream location were not greater than the typical concentrations seen from 2007-2008.

Total organic carbon (TOC) concentrations were elevated at all locations during the wet weather sampling event. The concentration discharged from the outfall was greater than that of the other three locations, however the elevated concentration at the intake can not be solely attributed to the mine outfall. During the dry weather sampling event, results from all locations were comparable to each other as well as the 2007-2008 average for concentrations of TOC.

None of the constituents sampled at the mine outfall location were beyond the limits of the current permit. However, it is important to note that aluminum, zinc, strontium, and TOC are not monitoring requirements according to the current permit but were being discharged at elevated levels.

The following section provides summary tables of the data collected during the sampling events on the Mulberry Fork.

2. Water Quality Data

Laboratory analysis was performed at the Board's Envirolab and the Alabama Power Laboratory as noted in the tables. Table 2.1 and 2.2 shows the data that was collected during the wet and dry weather events in July and August of 2009.

Table 2.1
Wet Weather Event Water Quality

Parameter	Sample Location				
	Site 1 - Mulberry Intake	Site 2 - Downstream of Outfall	Site 3 - Outfall of Mine	Site 4 - Upstream of Outfall	MCL[1]
	Samples Collected 7/22/2009 - Wet Weather Event				
Aluminum (mg/L)	<0.05	<0.05	0.206	<0.05	0.2
Antimony (mg/L) Method 200.8	<0.005	<0.005	<0.005	<0.005	0.006
Antinomy (mg/L) Method 200.9	<0.005	<0.005	<0.005	<0.005	0.006
Arsenic (mg/L)	<0.005	<0.005	<0.005	<0.005	0.01
Benzene (mg/L)	<0.0005	<0.0005	<0.0005	<0.0005	0.005
Bromide (mg/L)	<0.1	<0.1	<0.1	<0.1	-
Chromium (mg/L)	<0.005	<0.005	<0.005	<0.005	0.1
Chromium-Hexa (Diss) (mg/L)	<0.01	<0.01	<0.01	<0.01	-
Copper (mg/L)	<0.01	<0.01	<0.01	<0.01	1
Dissolved Organic Carbon (DOC) (mg/L)	2.94	2.75	3.43	2.78	4
Ethlylbenzene (mg/L)	<0.0005	<0.0005	<0.0005	<0.0005	0.7
Iron (mg/L)	0.109	0.11	0.667	0.128	0.3
Lead (mg/L)	<0.005	<0.005	<0.005	<0.005	0.015
Lithium (mg/L)*	0.007	0.005	0.013	ND	-
m,p,-Xylene (mg/L)	<0.001	<0.001	<0.001	<0.001	0.01
Manganese (mg/L)	<0.01	0.059	0.188	0.09	0.1
Mercury (mg/L)	<0.001	<0.001	<0.001	<0.001	0.002
Molybdenum (mg/L)*	<0.01	<0.01	<0.01	<0.01	-
o-Xylene (mg/L)	<0.0005	<0.0005	<0.0005	<0.0005	0.01
Selenium (mg/L) EPA 200.9	<0.005	<0.005	<0.005	<0.005	0.05
Strontium (mg/L)*	0.058	0.055	0.401	0.047	-
Sulfate (mg/L)	25.1	22.1	22.4	22.7	250
Toluene (mg/L)	<0.0005	<0.0005	<0.0005	<0.0005	1
Total Dissolved Solids (TDS) (mg/L)	78	83	83	88	-
Total Organic Carbon (TOC) (mg/L)	3.61	3.59	4.09	3.33	4
Zinc (mg/L)	<0.01	<0.01	<0.01	<0.01	5
Soluble Aluminum (mg/L)	0.0643	0.0635	0.0811	0.0648	-
Soluble Antimony (mg/L)	<0.005	<0.005	<0.005	<0.005	-
Soluble Arsenic (mg/L)	<0.005	<0.005	<0.005	<0.005	-
Soluble Copper (mg/L)	0.025	<0.01	<0.01	<0.01	-
Soluble Lead (mg/L)	<0.005	<0.005	<0.005	<0.005	-
Soluble Lithium (mg/L)*	0.005	0.004	0.009	<0.003	-
Soluble Mercury (mg/L)	N/A	<0.001	<0.001	<0.001	-
Soluable Molybdenum (mg/L)*	<0.01	<0.01	<0.01	<0.01	-
Soluble Strontium (mg/L)*	0.043	0.039	0.307	0.036	-
Soluble Zinc (mg/L)	0.028	0.0162	0.0126	0.0469	-

*Samples analyzed at AL Power Lab

[1]MCL - for drinking water

Higher than other locations but not regulated

Greater than MCL

Table 2.2
Dry Weather Event Water Quality

Parameter	Site 1 - Mulberry Intake	Site 2 - Downstream of Outfall	Site 3 - Outfall of Mine[2]	Site 4 - Upstream of Outfall	MCL[1]
	Sample Location				
	Samples Collected 8/18/2009 - Dry Weather Event				MCL
Aluminum (mg/L)	<0.05	<0.05	0.106	<0.05	0.2
Antimony (mg/L) Method 200.9	<0.005	<0.005	<0.005	<0.005	0.006
Antinomy (mg/L) Method 200.8	<0.005	<0.005	<0.005	<0.005	0.006
Arsenic (mg/L)	<0.005	<0.005	<0.005	<0.005	0.01
Benzene (mg/L)	<0.0005	<0.0005	<0.0005	<0.0005	0.005
Bromide (mg/L)	<0.10	<0.10	<0.10	<0.10	-
Chromium (mg/L)	<0.005	<0.005	<0.005	<0.005	0.1
Chromiumm (VI) (mg/L)	<0.00001	<0.00001	0.01	<0.00001	-
Chromium-Hexa (Diss) (mg/L)	<0.01	<0.01	<0.01	<0.01	-
Copper (mg/L)	<0.005	<0.01	<0.01	0.0156	1
Dissolved Organic Carbon (DOC) (mg/L)	2.76	2.81	2.71	2.66	4
Ethlylbenzene (mg/L)	<0.0005	<0.0005	<0.0005	<0.0005	0.7
Iron (mg/L)	0.0764	0.083	0.396	0.0776	0.3
Lead (mg/L)	<0.005	<0.005	<0.005	<0.005	0.015
Lithium (mg/L) *	<0.003	<0.003	<0.003	<0.003	-
Lithium (mg/L)	<0.003	<0.003	<0.003	<0.003	-
m,p,-Xylene (mg/L)	<0.001	<0.001	<0.001	<0.001	0.01
Manganese (mg/L)	0.0241	N/A	0.242	0.0592	0.1
Mercury (mg/L)	<0.001	<0.001	<0.001	<0.001	0.002
Molybdenum (mg/L) *	<0.01	<0.01	<0.01	<0.01	-
Molybdenum (mg/L)	<0.01	<0.01	<0.01	<0.01	-
o-Xylene (mg/L)	<0.0005	<0.0005	<0.0005	<0.0005	0.01
Selenium (mg/L) EPA 200.9	<0.005	<0.005	<0.005	<0.005	0.05
Strontium (mg/L) *	0.051	0.033	0.036	0.033	-
Strontium (mg/L)	0.051	0.033	0.036	0.033	-
Sulfate (mg/L)	29.1	15	15.8	18.7	250
Sulfide (mg/L)	0.06	0.06	<0.01	0.02	
Sulfide (mg/L) *	0.06	0.06	<0.01	0.02	
Sulfide - Dissolved (mg/L)	<0.01	0.02	<0.01	<0.01	
Sulfide - Dissolved (mg/L) *	<0.01	0.02	<0.01	<0.01	
Toluene (mg/L)	<0.0005	<0.0005	<0.0005	<0.0005	1
Total Dissolved Solids (TDS) (mg/L)	28	23	20	60	-
Total Organic Carbon (TOC) (mg/L)	3	2.75	2.99	2.93	4
Zinc (mg/L)	<0.01	<0.01	<0.005	<0.01	5
Soluble Aluminum (mg/L)	<0.05	<0.05	<0.05	<0.05	
Soluble Antimony (mg/L) EPA 200.8	<0.005	<0.005	<0.005	<0.005	-
Soluble Antimony (mg/L) EPA 200.0	<0.005	<0.005	<0.005	<0.005	-
Soluble Arsenic (mg/L)	<0.005	<0.005	<0.005	<0.005	-
Soluble Copper (mg/L)	<0.01	<0.01	<0.01	<0.01	-
Soluable Iron (mg/L)	<0.05	<0.05	<0.05	<0.05	-
Soluble Lead (mg/L)	<0.005	<0.005	<0.005	<0.005	-
Soluable Molybdenum (mg/L)	<0.01	<0.01	<0.01	<0.01	-
Soluble Strontium (mg/L) *	0.047	0.032	0.033	0.032	-
Soluble Strontium (mg/L)	<0.05	<0.05	<0.05	<0.05	-
Soluble Zinc (mg/L)	0.0345	<0.01	0.212	0.0629	-

*Samples analyzed at AL Power Lab

[1]MCL - for drinking water

[2] Sampled in mid-river due to lack of discharge from mine outfall

Higher than other locations but not regulated

Greater than MCL

Table 2.3 shows the average water quality seen at the Mulberry intake from monthly samples collected during 2007 and 2008.

Table 2.3
Mulberry Intake Water Quality

Mulberry Fork Characteristics				
Parameter	**AVG**	**Max**	**Min**	**Units**
Metals*				
Aluminum	0.065	0.270	<0.05	mg/L
Antimony	<0.005	<0.005	<0.005	mg/L
Arsenic	<0.005	<0.005	<0.005	mg/L
Chromium	<0.005	0.06	<0.005	mg/L
Copper	0.024	0.402	<0.01	mg/L
Iron	0.10	1.01	<0.05	mg/L
Lead	<0.005	0.007	<0.005	mg/L
Manganese	0.040	0.148	<0.01	mg/L
Zinc	0.064	0.230	<0.01	mg/L
Mercury	<0.001	<0.001	<0.001	mg/L
IC*				
Bromide	<0.25	<0.25	<0.25	mg/L
Chloride	5.11	23.30	2.08	mg/L
Fluoride	0.06	0.24	<0.05	mg/L
Nitrate as N	0.72	5.89	<0.06	mg/L
Nitrite as N	<0.08	0.36	<0.08	mg/L
Orthophosphate	<0.17	<0.17	<0.17	mg/L
Sulfate	26.2	82.7	8.3	mg/L
Conductivity	167	370	86	ms/cm
Fecal Coliform	F11	F65	0	cfu/100mL
Hardness	77	126	34	mg/L
TDS	132	280	60	mg/L
TOC	3.1	5.7	1.0	mg/L
TSS	5.0	15	1.2	mg/L

*Data from Envirolab Nov 2007 - 2008 Project 77

3. Summary Findings

While concentrations of the parameters of concern were not seen downstream at elevated levels they are still cause for potential concern if a mine outfall were to be within a close proximity of the Mulberry Intake as proposed for the Shepherd Bend Mine. Also, it is apparent from the data that there are additional contaminants that need to be considered as monitoring requirements for current and future coal mine permits. The following parameters which were seen at elevated levels in the outfall discharge consist of aluminum, iron, manganese, zinc, strontium, and TOC.

EXHIBIT 2

THE BIRMINGHAM
WATER WORKS BOARD

August 9, 2011

Promo
Chester Marks
Ø

Dr. Randall C. Johnson
Alabama Surface Mining Commission (ASMC)
P.O. Box 2390
Jasper, AL 35502-2390

AUG 2011
RECEIVED
SURFACE MINING
COMMISSION

RE: Reed Minerals No. 5 Mine
ASMC Permit Application P3957

Dear Dr. Johnson:

The Water Works Board of the City of Birmingham (Board) would like to provide the following comments regarding the permit application for the Reed Minerals No. 5 Mine (ASMC P3957) located in Walker County. Water discharged from this mining operation would enter the Mulberry Fork, upstream from one of our surface water intakes, the Mulberry Intake. The Mulberry Intake has been in operation since 1989 and, as one of the Board's water sources, serves approximately 200,000 people in the Birmingham area. The Board submitted comments to the Alabama Department of Environmental Management (ADEM) regarding the Reed Minerals No. 5 Mine NPDES permit. We are concerned that this proposed mine has the potential to adversely impact the Birmingham area drinking water.

Our comments and requests for the permit application are summarized below:

- *Part II. Section E.2. - Geology* states that "Chemical analyses conducted to identify acid-forming or toxic-forming zones shall be made on a representative number of samples of the overburden within the permit area." It appears that only Acid Base Accounting (ABA) analyses were run on lithologic samples. ABA does not evaluate potential for "toxic-forming" compounds such as enhanced leaching of metals of exposed overburden materials. Evaluation of toxic-forming compounds should be conducted for each lithologic zone sampled.

- *Part II Section F - Groundwater Hydrology* indicates that the baseline groundwater quality investigation is not sufficient. In addition to pH, Iron, Manganese, Acidity, Alkalinity, and Sulfate, a number of constituents should be added to the Groundwater Monitoring Parameters in Section V of the Hydrologic Monitoring Plan including: Aluminum, Arsenic, Copper, Mercury, Antimony, Zinc, Chromium, and Lead.

3600 First Avenue North, P. 0. Box 830110, Birmingham, Alabama 35283-0110 Phone 205-244-4000 Website: www.bwwsb.com

- *Part II Section G — Surface Water Hydrology* incorrectly identifies the use classification of the Mulberry Fork as Fish and Wildlife only. The Mulberry Fork is classified for Public Water Supply from its junction with the Sipsey Fork, upstream of the proposed mine, to its junction with the Locust Fork, downstream of the proposed mine. In fact, much of the proposed mine area falls within the Source Water Protection Area for the Mulberry Intake, located just downstream. This area defines the "critical, or special, area in the immediate vicinity of a surface water plant intake that is closely scrutinized for contaminant sources."

- *Part II. Section H — Probable Hydrologic Consequences Determination.* The proximity of the proposed mining operation to such a major municipal water supply intake represents an incompatible use. This operation could result in the discharge of mining related pollutants directly to the intake. The NPDES permit and this permit application do not appear to have adequately considered the drinking water use, and are wholly inadequate to protect the Board and its customers from many pollutants commonly associated with mining activities. The attached comments provided to ADEM concern the impact of the mining operation on the water supply.

- No design information has been provided on the sedimentation ponds. These structures are the primary means of maintaining effluent water quality and should be carefully designed with respect to volume, dimensions, sediment storage, baffling, and structural integrity. These ponds, and other treatment systems, should be designed to the best available technology to prevent the additional contribution of settleable and suspended solids to the public water supply. Proposed sediment basin sizing in the applicant's NPDES permit filing does not meet ADEM's design guidance for sediment storage. We request that the ASMC, when reviewing the basin designs, increase the capacity of these structures.

- *Attachment II-I and III-A-3* The permit application makes reference to the possible use of chemical treatment to control pH, metals, TSS. It is highly recommended to implement chemical treatment measures and to include them in the facility design, along with plans/measures to determine appropriate dosing rates. Such measures require careful planning and should not be left as afterthought only to be hurriedly implemented in the event that major problems are discovered.

- Sedimentation control structures are the primary control for surface waters leaving the property. These generally control the sediments, when well-designed, but may not reduce dissolved or ionic constituents that may be elevated due to mining activities. Constituents not controlled may include metals, explosive residue, sulfate from sulfide oxidation, etc. In addition, many trace contaminants in are not likely to be mitigated by settling ponds.

- *Attachment III-D - Hydrologic Monitoring Plan* should be revised to include sampling and reporting of all parameters, even when precipitation event exemptions will be applied for with ADEM. Further, the monitoring plan should be expanded to include the following parameters, sampled monthly at groundwater monitoring wells, the outfalls, and receiving stream: k

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Total Suspended Solids	Acidity	Copper (total)
Total Dissolved Solids or Specific Conductance	Alkalinity	Chromium (total)
	Aluminum (total)	Nickel (total)
pH	Arsenic (total)	Iron (total)
Temperature	Cadmium (total)	Manganese (total)
Rainfall	Lead (total)	Mercury (total)
Sulfate	Selenium (total)	Zinc (total)
Antimony	Ethyl benzene	Pyritic Sulfur
Bromide	Xylene	Strontium
Benzene	Lithium	Turbidity
Toluene	Molybdenum	Total Organic Carbon

The groundwater underlying the proposed Reed Minerals No. 5 mine is in direct hydraulic communication with surface water in the Mulberry Fork, which is designated for public water supply. Due to the nature of groundwater flow at this site, contaminants introduced to groundwater from mining operations will discharge to the Mulberry Fork. Further, the groundwater directly underlying the site is likely designated as an "Underground Source of Drinking Water" (USDW) by ADEM Admin. Code r. 335 Division 6 Regulations, defined as "an aquifer or portion thereof 1) which currently supplies drinking water for human consumption, or 2) in which the ground water contains fewer than 10,000 mg/L of total dissolved solids." Baseline ground water sampling and well surveys (municipal and private) should be completed to determine if these criteria are met.

Our Mulberry Intake will be used to provide drinking water to the Birmingham Metropolitan Area for many years in the future and this mine would negatively impact the drinking water supply. Given what is at stake, we feel that this mining permit should not be issued. If the permit is issued, we feel that all of the areas of concern noted above must be addressed in order for us to continue to provide the regions residents with safe drinking water at a reasonable price.

Please email me at djones@bwwsb.com or call 205-244-4404 if you have any questions or comments.

Very Truly Yours,

Darryl R. Jones, P. .
Assistant General Manager
Operations and Technical Services

cc: Mac Underwood, BWWB
Patrick Flannelly, Malcolm Pirnie, Inc.

3600 First Avenue North, P. 0. Box 830110, Birmingham, Alabama 35283-0110 Phone 205-244-4000 Website: www.bwwsb.com

EXHIBIT 3

STATE OF ALABAMA
SURFACE MINING COMMISSION

Page 1 of 6

Permit Number:P- 3945-64-15-S

License Number:L- 786

PERMIT TO ENGAGE IN SURFACE COAL MINING OPERATIONS

Pursuant to **The Alabama Surface Mining Control and Reclamation Act of 1981**, as amended, **ALA. Code** Section 9-16-70 et. seq. (1975) a permit to engage in Surface Coal Mining Operations in the State of Alabama is hereby granted to:

SHEPHERD BEND LLC
PO BOX 2322
JASPER AL 35502
(SHEPHERD BEND MINE)

Such operations are restricted to * 286 acres as defined on the permit map and located in: **(See Condition #3)**

SE/NE, NE/SE, SE/SE SEC. 34, SW/SW, NW/SW, NE/SW, SE/SW, NW/SE, SW/SE SEC. 35, TOWNSHIP 15 SOUTH, RANGE 6 WEST, NW/NW, NE/NW, SE/NW, NW/NE, NE/NE, SW/NE, SE/NE SEC. 2 TOWNSHIP 16 SOUTH; RANGE 6 WEST; WALKER COUNTY, ALABAMA

This permit is subject to suspension or revocation upon violation of any of the following conditions:

1. The permittee shall conduct Surface Coal Mining and Reclamation Operations in accordance with the plans, provisions and schedules in the permit application.

2. The permittee shall conduct operations in a manner to prevent damage or harm to the environment and public health and safety and shall notify ASMC and the public in accordance with ASMC Rule 880-X-8K-.16 of any condition which threatens the environment or public health and safety.

3. Surface coal mining operations are restricted to those areas for which sufficient bond has been posted with ASMC. On the date of issuance of this permit, bond was posted only for increment #1 consisting of 38 acres as defined on the permit map.

4. No mining disturbance is to occur on any part of the permit on which legal "right of entry" has not been obtained. When such rights are "pending" the applicant shall submit acceptable evidence, to the Director, that such rights have been obtained according to ASMC Regulation 880-X-8D-.07.

5. No disturbance is to occur on any properties on which land use comments from legal owners of record are "pending" prior to the applicant providing acceptable comments.

6. No disturbance is to occur in the 300' setback area to any occupied dwelling prior to the applicant providing acceptable evidence to ASMC of its having secured a waiver of each subject area signed by the owner of the dwelling.

7. No mining disturbance shall occur within the l00' setback of any public road or the relocation of any public road prior to the applicant providing acceptable evidence, to the Director, of its having secured approval for a waiver from the appropriate jurisdictional authority and specific written waiver from ASMC.

8. The permittee shall notify the ASMC and seek consultation with the US Fish and Wildlife Service if:
    a. The permit is modified in any way that causes an effect on species or Critical Habitat listed under the Endangered Species Act of 1973.
    b. New information reveals the operation may affect Federally protected species or designated Critical Habitat in a manner or extent not previously considered or
    c. A new species is listed or Critical Habitat is designated under the Endangered Species Act that may be affected by the operation.

9. The permittee shall contact the ASMC and consult with the Alabama Historic Preservation Officer if the permit is modified or if previously unknown archaeological or historic resources are discovered on the permit area. Upon discovery of previously unknown artifacts or archaeological features the permittee shall cease operations until the Alabama Historic Preservation Officer approves resumption of operations.

10. This permit is to allow for surface mining solely for the 286 acres contained within Section 2, Township 16 South, Range 6 West and Section 34 and 35, Township 15 South, Range 6 West.

11. Every load of coal will be tarped and loads of coal and heavy equipment will not be transported from the mine between the hours of 6:45 to 8:00 a.m. or 3:00 to 4:00 p.m., Monday through Friday, which is the time that school buses will be in the area.

12. Applicable weight limits on the trucks hauling coal from the property will be strictly enforced by Shepherd Bend.

13. Shepherd Bend will gate the access road to the property. The gate will be locked when employees are not on site.

14. If no speed limits are posted on public roads, the limit for paved roads is 45 MPH and on unpaved roads is 35 MPH.

15. Supplemental Surface Water Monitoring: In addition to the requirements of the Hydrologic Monitoring Plan, the Permittee shall perform instream and outfall chemical monitoring for the following parameters:
<u>Parameters:</u>

Total Suspended Solids (TSS) (mg/L)
Total Dissolved Solids (TDS) or
Specific Conductance (μS/cm)
pH (s.u.)
Temperature (°C)
Sulfate (mg/L)
Acidity (mg/L)
Alkalinity (mg/L)
Aluminum – Total recoverable (μg/L)
Arsenic – Total recoverable (μg/L)
Cadmium – Total recoverable (μg/L)
Lead – Total recoverable (μg/L)
Copper – Total recoverable (μg/L)
Chromium – Total recoverable (μg/L)
Nickel - Total recoverable (μg/L)
Iron - Total recoverable (μg/L)
Manganese - Total recoverable (μg/L)
Mercury - Total recoverable (μg/L)
Selenium - Total recoverable (μg/L)
Zinc – Total recoverable (μg/L)
Rainfall- inches (for the 24 hour period prior to the sample collection)

<u>Sampling Locations:</u>

Sediment basin outfalls once they are constructed and certified, downstream site 432-005A, and upstream site 432-007

In-stream samples shall be collected as follows: if the depth of the receiving stream is less than ten feet, samples shall be collected mid-depth at the deepest point of the channel; if the depth of the receiving stream is equal to or greater than ten feet, samples shall be collected at a depth of five feet at the deepest point of the channel.

Sampling Frequency:

Supplemental sediment basin discharge and in-stream grab samples shall be collected and analyzed once per month for a minimum of 12 months. If after 12 months a parameter has shown no increase in concentration, monitoring of that parameter may be reduced to once per quarter (with the exception of iron, manganese, sulfates, conductivity, acidity, alkalinity, suspended solids, pH and flow). The samples shall be collected during low or base flow conditions (not during or within 24 hours after a precipitation event).

When an increment is eligible for a Phase I bond release, and supplemental data has shown no increase in a parameter for the drainage basin, supplemental monitoring of the basin may cease.

Supplemental upstream and downstream samples shall be collected and analyzed once per month. If all sediment basins have shown a year of no increase in concentration, the in-stream sampling may be reduced to once per quarter (with the exception of iron, manganese, sulfates, conductivity, acidity, alkalinity, suspended solids, pH and flow).

At the time when all increments have received a Phase I bond release (excluding the incidental increment), supplemental monitoring in-stream may be reduced to once per year.

Test Procedures:

For the purpose of reporting and compliance, permittees shall use one of the following procedures:

a. For parameters with an EPA established Minimum Level (ML), report the measured value if the analytical result is at or above the ML and report less than the ML for values below the ML. Test procedures for the analysis of pollutants shall conform to 40 CFR Part 136, guidelines published pursuant to Section 304(h) of the FWPCA, 33 U.S.C. Section 1314(h), and Standard Operating Procedures. If more than one method for analysis of a substance is approved for use, a method having a minimum level lower than the applicable water quality standard shall be used. If the minimum level of all methods is higher than the applicable water quality standard, the method having the lowest minimum level shall be used and a report of less than the minimum level shall be reported and will constitute compliance, however should EPA approve a method with a lower minimum level during the term of this Permit the Permittee shall use the newly approved method.

b. For pollutant parameters without an established ML, an interim ML may be utilized. The interim ML shall be calculated as 3.18 times the Method Detection Level (MDL) calculated pursuant to 40 CFR Part 136, Appendix B. The measured value should be reported if the analytical result is at or above the ML and less than the ML if the analytical result is below the ML.

c. For parameters without an EPA established ML or interim ML, a report of less than the detection limit shall constitute compliance if the detection limit of all analytical methods is higher than the applicable water quality standard using the most sensitive EPA approved method.

d. The applicable water quality standard for a parameter shall correspond to the designated use classification for the receiving stream. If more than one use classification is designated, the lowest standard for a parameter will apply.

Reporting:

Supplemental surface water monitoring reports shall be submitted quarterly to the ASMC with the discharge monitoring reports (DMR’s). The supplemental data shall be submitted electronically via cd-rom, email or any other acceptable electronic form.

Remedial Action:

Should monitoring indicate that any of the chemicals monitored have caused or contributed to a violation of Alabama's narrative or numeric water quality standards, the permittee shall: immediately notify the ASMC and ADEM; conduct an analysis of the reasons for the increasing trends and potential violations, and identify the corrective measures the permittee intends to take to reduce the discharge of the appropriate parameters. The permittee shall implement those measures following written approval by the ASMC and ADEM.

16. On the date of issuance of this permit, the NPDES permit issued by the Alabama Department of Environmental Management was under appeal to the Environmental Management Commission. Should that permit be suspended, revoked or ruled null and void, Shepherd Bend, LLC shall immediately cease all mining activity on this site.

17. The permittee shall contact the ASMC and consult with the US Army Corps of Engineers if the permit is modified in any way that would affect wetlands or waters of the United States that is not authorized under Nationwide 21 Permit SAM2008-00457-HWL.

18. US Army Corps of Engineers (USACE) Nationwide 21 Permit SAM2008-00457-HWL expires March 18, 2012. The permittee shall not conduct activities authorized under that permit after its expiration unless it is re-issued, extended or replaced with a new authorization by the USACE.

EFFECTIVE DATE:	OCTOBER 19, 2010
ISSUE DATE:	OCTOBER 19, 2010
EXPIRATION DATE:	OCTOBER 18, 2015

Randall C. Johnson, Director

/ns
cc: I & E, Permit File

The Alabama Surface Mining Commission acting by and through its Director, hereby finds, on the basis of information set forth in the application or from information otherwise available, that --

1. The permit application is complete and accurate and the applicant has complied with all requirements of the Act and the regulatory program.

2. The applicant has demonstrated that reclamation as required by the Act and the regulatory program can be accomplished under the reclamation plan contained in the permit application.

3. The proposed permit area is:

   (a) Not within an area under study or administrative proceedings under a petition, filed pursuant to Chapter 880-X-7 to have an area designated as unsuitable for surface coal mining operations;

   (b) Not within an area designated as unsuitable for mining pursuant to Chapter 880-X-7 or subject to the prohibitions or limitations of Section 880-X-7B.-06 and Section 880-X-7B-.07 of this chapter; or

4. For mining operations where the private mineral estate to be mined has been severed from the private surface estate, the applicant has submitted to the Regulatory Authority the documentation required under Section 880-X-8D.07 and Section 880-X-8G-.07 of this chapter.

5. The Regulatory Authority has made an assessment of the probable cumulative impacts of all anticipated coal mining on the hydrologic balance in the cumulative impact area and has determined that the proposed operation has been designed to prevent material damage to the hydrologic balance outside the permit area.

6. The applicant has demonstrated that any existing structure will comply with Section 880-X-2B-.01, and the applicable performance standards of Chapter 3 or 10.

7. The applicant has paid all reclamation fees from previous and existing operations as required by 30 C.F.R., Subchapter R.

8. The applicant has satisfied the applicable requirements of Subchapter 880-X-8J.

9. The applicant has, if applicable, satisfied the requirements for approval of a long-term, intensive agricultural, postmining land use, in accordance with the requirements of 880-X-l0C-.58(4) and 880-X-10D-.52(4).

10. The operation will not affect the continued existence of endangered or threatened species, or result in destruction or adverse modification of their critical habitats, as determined under the Endangered Species Act of 1973 (16 U.S.C. 1531 et seq.).

11. The Regulatory Authority has taken into account the effect of the proposed permitting action on properties listed or eligible for listing on the National Register of Historic Places. This finding is supported in part by inclusion of appropriate permit conditions or changes in the operation plan protecting historic resources, or a documented decision that the Regulatory Authority has determined that no additional protection measures are necessary.

12. For a proposed remining operation where the applicant intends to reclaim in accordance with the requirements of Section 880-X-l0C-.56 or 880-X-10D.-49, the site of the operation is a previously mined area as defined in Section 880-X-2A-.06.

13. Surface coal mining and reclamation operations will not adversely affect a cemetery.

14. After application approval but prior to issue of permit, ASMC reconsidered its approval, based on the compliance review required by Section 880-X-8K-.10(2)(a) in light of any new information submitted under 880-X-8D-.05(8).

15. The applicant has submitted the performance bond or other equivalent guarantee required under Chapter 880-X-9 of the ASMC Rules prior to the issuance of the permit.

16. For mining operations where a waiver is granted from the 100' setback from a public road according to 880-X-7B-.07, the interests of the public and affected landowners have been protected.

17. The Regulatory Authority has taken into account the effect of the proposed permitting action on properties listed or eligible for listing on the National Register of Historic Places. A site survey performed by P.E. Lamoreaux & Associates dated November 27, 2007, found no sites potentially eligible for listing on the National Register of Historic Places located on this proposed mine site.

One cemetery was located within the area studied but not within the permit area. The State Historic Preservation Officer concurred with these findings by letter dated January 11, 2008. This finding is supported in part by inclusion of appropriate permit conditions or changes in the operation plan protecting historic resources, or a documented decision that the Regulatory Authority has determined that no additional protection measures are necessary. Concerns for unknown resources, which might be discovered during mining have been made conditions of the permit.

18. The US Fish and Wildlife Service (FWS) provided comments dated December 4, 2007 on the proposed operation. The FWS identified several species of concern and requested that a site survey be performed. A survey was performed by Yokely Environmental Consulting Service, which found none of those species. The FWS reviewed this survey and found no likely impacts to federally listed species. By letter dated March 13, 2008 the FWS determined that no further Endangered Species Act consultation was necessary. The US Army Corps of Engineers authorized the activities under this permit under Nationwide 21 permit number SAM-2008-457-HWI dated September 10, 2008. The Corps suspended this permit on December 8, 2008; re-instated it on July 9, 2010; and extended it until 2012 by letter dated September 16, 2010. The ADCNR provided comments dated November 16, 2007. Concerns and recommendations of the ADCNR have been addressed in the permit. The ASMC finds that the proposed operation will not jeopardize the continued existence of endangered or threatened species or critical habitat thereof.

19. The proposed permit area is:

    a. Not within an area under study or administrative proceedings under a petition, filed pursuant to Chapter 880-X-7 to have an area designated as unsuitable for surface coal mining operations.
    b. Not within an area designated as unsuitable for mining pursuant to Chapter 880-X-7 or subject to the prohibitions or limitations of Section 880-X-7B-.06 and Section 880-X-7B.-07 of this chapter.

20. **<u>FINDINGS IN RESPONSE TO PUBLIC COMMENTS</u>**

An Informal public conference was held on August 19, 2010 in Sumiton, Alabama at Bevill State Community College. Those who attended the conference presented oral and written comments. The public also submitted written comments throughout the public comment period. Information submitted by the public has been considered in reviewing this permit application and will be addressed in these findings.

In review of an application for a permit or revision, the ASMC distributes various parts of the permit application to the review staff. The review staff includes persons trained in various disciplines such as Biology, Geology, Hydrology, Engineering, Blasting and Subsidence. In addition, input is solicited from external sources including the US Fish and Wildlife Service, US Army Corps of Engineers, Mine Safety and Health Administration, Alabama Historical Commission, Alabama Department of Environmental Management, Alabama Department of Conservation and Natural Resources, and various local and county governments in the locality of the mining operation.

Transcripts of informal conferences and written comments are distributed to the review staff who consider the comments during the review process.

Description of the Proposed Mining Operation

The proposed Shepherd Bend Mine is located in Walker County Alabama. The mine area is located within the Mulberry Fork River drainage system. The mining operation involves the removal of coal by area surface mining methods using mobile equipment. The total mine area under this permit is 286 acres.

ASMC regulations require a reclamation bond to be posted for each mining operation to cover the cost of reclamation should the operator default on its obligations under the permit. The operator has chosen to initiate mining on Increment I as identified on the permit map and operation plan. Increment I is composed of a total of 38 acres. Thirty-four acres are mining acres and 2 acres for sediment control pond and 2 acres is access/haulage road. The incidental acre includes a haul road and temporary basin #006. The highwall elimination portion of the bond is calculated using a worse case scenario; therefore the longest cut illustrated on the cut layout map is used for this particular amount. The maximum amount of exposed highwall was measured to be 2,200’ in length with an average height of 140’. Said numbers are entered into the highwall elimination equation, which result in the number of cubic yards of material that would eliminate the highwall. This number was calculated to be 598,888 cubic yards. The bond rate used for drilling and shooting a highwall is $1.00 per cubic yard, resulting in a total highwall elimination cost of $598,888.

Revegetation costs are based on a flat per acre rate, which is $800 per acre, this includes seed, fertilizer, mulch, etc. Grading costs are also based on a flat rate of $1,500 per-acre. This includes all earth moving applications. Topsoil replacement rates are used when topsoil will be returned to the surface prior to revegetation; this is a flat rate of $500 per acre. Haul roads are calculated on a per acre basis as well, $1,000 per acre is held for haul road reclamation, this includes the grading and revegetation of the road. Temporary water impoundments are bonded on a per structure basis, $20,000 per structure is held for temporary impoundments, this will be used to make any needed repairs to spillways, culverts, dams, etc.. Coal stockpiles are bonded on a flat per acre rate, which is $2,000 per acre.

Unit costs for each variable associated with reclamation are constantly monitored to ensure current rates are mirrored in bonding. The final step in bonding is to apply a contractor profit and overhead margin of 15 percent to the subtotal of each bond.

The total bond required for increment I is $825,801. Bonds for other increments will be calculated and posted as mining progresses.

Many oral and written comments were received opposing the mining operation for a number of reasons. These comments were against mining in general, expressed concerns over noise, dust, reduction in property values, and aesthetic impacts to name a few.

Walker County does not have zoning ordinances. The Alabama Surface Mining Commission is not empowered with the authority to determine what a landowner or lease holder may do with his or her property. To the extent that impacts from mining operations are regulated by our agency, we will enforce those regulations.

Several persons pointed out that during the public comment period the application contained deficiencies or was incomplete and should not have been placed on public notice.

Prior to formal submission of a permit application, the ASMC performs an administrative completeness review to determine if the applicant has answered every part of the application. The application does not have to be technically complete at this point. Alabama Administrative Code 880-X-8K-.02(a) states one of the major objectives of the public notice and participation requirements of the regulations is to *"Provide for public participation in the review of applications and the issuance, or denial of permits;"* Alabama Administrative Code 880-X-8K-.05 (1) (a) Filing and Public Notice.; Provides that *"Upon submission of an administratively complete application, an applicant for a permit, significant revision of a permit under Section 880-X-8M-.06, or renewal of a permit under Section 880-X-8M-.07, shall place an advertisement in a local newspaper of general circulation in the locality of the proposed surface coal mining and reclamation operation at least once a week* *for four consecutive weeks. A copy of the advertisement as it will appear in the newspaper shall be submitted with the permit application to the Regulatory Authority."* The regulations do not contemplate that the ASMC has reviewed the application and made a final determination on technical and legal compliance prior to the beginning of the public notice and participation process. The regulations, in fact, provide for the public to play a role in the in the actual review process. Concerns and deficiencies identified by the public play an important role in the technical review of the application. The review process is complicated and involves the exchange of ideas, deficiencies, corrections, additions and changes to parts of the application between the applicant and the ASMC aided by input from the public and other state, local and federal agencies. Other state and federal agencies with authorization jurisdiction on a proposed mining operation must be made aware of the submission of an application through the public notice process so that the review by these agencies can be coordinated with that of the ASMC. It is often not possible for those agencies to finalize their authorization process until the ASMC is near completion of it is technical review. Hence, some authorizations, such as those under the Clean Water Act may not be completed until the technical review and public notice process for the ASMC permit has been completed. These authorizations must be approved before the ASMC issues a permit. Throughout the review process for a permit application, changes and updates to a permit application are submitted to ASMC and included in the public review file at the ASMC office in Jasper, AL. These changes are also posted on the ASMC website for public access.

Several persons questioned the validity of the National Pollutant Discharge Elimination System (NPDES) permit issued by the Alabama Department of Environmental Management for this operation. They noted a challenge of this permit is pending before the Alabama Environmental Management Commission. Some questioned the Memorandum of Understanding (MOU) between ASMC and ADEM which places responsibility for review of Pollution Abatement Plans (PAP) required under ADEM regulations for NPDES permits to ASMC and state that ASMC has no jurisdiction over Clean Water Act requirements.

The NPDES permit issued by ADEM is under review by an Administrative Hearing Officer with that department. NPDES permit AL0079162 was issued by ADEM 7/21/2008. The permit is valid unless or until it is suspended or revoked by ADEM, the hearing officer, or a court of competent jurisdiction.

ASMC and ADEM regulations both require submission of plans to minimize or prevent violation of the Clean Water Act and NPDES permit effluent limits. The two agencies have had in place a working MOU since 1980 which defers review of Pollution Abatement Plans (PAPs) to ASMC in order to avoid duplication and to facilitate coordination between our agencies. Alabama Administrative Code 880X-

10C-.13(5) requires that "*Discharges of water from areas disturbed by mining activities shall be made in compliance with all applicable State and Federal water quality effluent limitation guidelines for coal mining.*" ASMC requires pollution control and abatement facilities to meet all applicable standards imposed by the NPDES permit. ASMC also requires all discharges from the mine site to be tested and reported to ASMC. ASMC performs monthly inspections of all mine sites and collects water samples from discharging facilities. These samples are analyzed for the parameters set in the NPDES permit. Any violations of effluent limits result in enforcement action against the permittee. These enforcement actions require corrective action, result in penalties in most cases, and can result in revocation of the ASMC permit.

The portion of the ASMC permit application that corresponds to a PAP is the Part III. The PAP for this application proposes to use Best Management Practices (BMP's) which include ponds, silt fences, hay bales, rock dams, diversions and sumps.

Best Management includes a wide range of measures and practices used to minimize pollution of surface water, air, land or ground water. These measures and practices are more particularly described in the "Alabama Handbook for Erosion Control, Sediment Control and Stormwater Management on construction Sites and Urban Areas."

Some BMP's are simple and can be implemented easily while others are more elaborate and require extensive planning. Numerous BMP's are included in the usual reclamation process of grading, contouring and revegetation. Various BMP's are used in construction, use, maintenance and removal of roads to minimize erosion, provide stability, minimize off-site siltation, minimize water pollution and provide dust control. BMP's are used to provide sediment control and minimize off-site siltation from small disturbed areas. Large scale BMP's, such as sedimentation ponds, are used to treat surface water runoff from large disturbed areas.

The Shepherd Bend Mine permit, Part III-B-2(a), requires areas disturbed by construction of impoundment to be seeded, fertilized and mulched to ensure that erosion is minimized. Also, hay bales or riprap may be placed at the toe of the dam to aid in the control of erosion.

Road plans and Part III-B-5 specifications will use BMP's, such as hay bale check dams, silt fencing and rock filter check dams to minimize erosion.

Also, BMP's to be used to minimize off-site impacts include, but are not limited to: (1) installation of culverts, (2) vegetation and stabilization of roadway slopes, (3) surfacing of roadway with durable non-toxic, non-acid forming material, (4) construction and stabilization of roadway ditches, (5) dust control by periodic applications of water, chemical binders and/or other dust suppressants; and (6) sediment control by use of silt fence, rock check dams, hay bale berms, etc. in strategic locations to minimize off-site siltation.

The BMPs used to control and treat surface runoff from large disturbed areas are sedimentation ponds. Sedimentation ponds are the best available technology to treat surface water runoff from large surface disturbances to minimize adverse impacts to the environment.

The specifics of the BMP plan for sedimentation ponds are included in Part III-B-2(a) of the permit application. Site specific detail design plans have been submitted, revised and approved in Part III-B-2(a) for sedimentation ponds 005, 006, 007 and 008.

An NPDES permit was issued by the Alabama Department of Environmental Management for Shepherd Bend Mine on July 21, 2008 with an effective date of August 1, 2008. ADEM made a determination during issuance of this NPDES permit that proposed control practices and effluent limitation requirements established for discharge from the Shepherd Bend Mine would be protective of water quality. It is the responsibility of the ASMC reviewing engineer to ensure that appropriate BMP's are proposed for various disturbance and that sedimentation ponds are designed to meet the more stringent applicable State or Federal effluent limitations and comply with either applicable regulatory requirements.

Provided that the operator complies with the surface water drainage control plan approved in the permit application, the proposed BMP,s should be adequate to protect streams in the area and not result in a violation of water quality standards.

A person expressed concern of incremental wear and tear on roads and bridges from coal mining and haulage equipment.

Heavy equipment and coal haulage vehicles damage roads. Heavy trucks also damage interstate highways. Coal severance tax revenue from this operation will be collected by the Alabama Department of Revenue. A portion of that severance tax will be returned to Walker County to help maintain roads and bridges.

Several persons expressed concern regarding adverse impact on air quality and its effect on public health.

These concerns are primarily related to common dust caused by the mining operation and coal dust resulting from handling and transportation of coal.

The Mine Safety and Health Administration (MSHA) regulates dust, including coal dust, associated with the mining operation as it relates to protection of the mine workings.

The engineering plan in the permit application, see Part III-B-5, includes provisions for control of dust from haul roads, primary roads and routes of travel in the mine area by periodic application of water, chemical binders, and/or other dust suppressants. Provided that these measures are implemented, this should result in effective dust control for transportation facilities. The ASMC does not regulate dust from vehicles on public roads.

Several persons expressed concerns regarding the drainage control plan and design of sedimentation ponds. The concerns expressed include: (A) The sufficiency of the SedCad design program to prevent water quality violations; (B) Storm events greater than a 10-year/24-hour; (C) Chemical treatment; (D) Pond Safety Factors; (E) Sediment Storage Volumes.

The general plan in Part III-B-2(a) of the permit application is intended to provide an overall drainage control plan for the entire permit area. The emphasis in this plan is to determine the location and number of sedimentation ponds required to provide effective control of surface drainage from the disturbed area. The general plan identifies any sedimentation pond proposed to remain as a permanent impoundment.

The reviewer ensures that point sources are approved under the NPDES permit to correspond to the sedimentation pond location approved in the general plan. Information required in this plan is general in nature and not intended to be detailed similar to that included in the detailed design plans. The general plan approved in Part III-B-2(a) of the permit application provides the minimum information required in rule 880-X-8F-.11 (1)(a).

With regard to the SedCad analysis, storm events, TSS and SS, and pond safety factor, the Alabama Surface Mining Law and Regulations address the following:

Rule 880-X-10C-.17(3)(a)3(iii) requires the ponds to contain or treat the 10-year/24-hour event for sedimentation control. The NPDES permit as approved on July 21, 2008 requires the TSS discharge to be a daily maximum of 70 mg/l for normal discharges. The NPDES permit allows Precipitation Event Discharge Limitations caused by an applicable 24-hour event to be based on settleable solids of 0.5 ml/l. The use of the SedCad design is the best available technology to predict the adequacy of the sedimentation ponds to meet the 0.5 ml/l settleable solids during the storm event.

TSS amounts for forest areas that have had timber cut indicate TSS greater than 70 mg/l without pond control. The use of sedimentation ponds will aid in the control of runoff at all phases of mining.

Sediment storage volumes are not used to determine the settleable solids requirements in the design of the pond. This volume is a “rule of thumb” amount as set by 0.1 Ac-ft. times the disturbed acres. However, a smaller amount can be approved if the volume varies only slightly.

In the case of pond 005, the sediment storage volume is 8.07 acre-feet instead of 10.0 acre-feet. This equals to 0.09 acre-feet per disturbed acre instead of 0.10 acre-feet.

In regard to ponds 005 and 008, the design plans have been reviewed and the sediment storage volumes increased to 8.07 acre-feet and 9.6 acre-feet, respectfully.

Pertaining to the safety factor requirements, rule 880-X-10C-.20(1)(d)2 requires the pond to be designed for a minimum static safety factor of 1.3 at normal pool. The pond detailed design plan as submitted for ponds 005, 006 and 008 exceed this requirement with pond 005 having a safety factor of 1.985. Pond 007 did not require a stability analysis since the pond is incised. (all volume below normal ground elevation).

The use of chemical treatment is discussed in Part III-A-7.

The effluent limitation requirements for all surface water discharges are established by ADEM during issuance of the NPDES permit to be protective of water quality. The NPDES permitting process establishes the location of point sources for discharge of drainage from the mine area. The ASMC has the authority and responsibility to ensure that sedimentation ponds and/or other treatment facilities are located, designed, constructed and maintained to cause discharges to comply with applicable effluent limitations to protect water quality. The ASMC ensures that sedimentation ponds and/or other treatment facilities are proposed at the location of the corresponding point sources approved by ADEM in the NPDES permit.

ADEM has the lead role in protection of water quality in the state by establishing appropriate effluent limitations while the ASMC plays an important role in water quality by ensuring treatment facilities are designed, constructed and maintained to comply with approved NPDES effluent limitation. The ASMC’s regular monitoring of water quality in the field and the agency’s review of hydrologic monitoring data submitted plays a significant role in protection of water quality.

The Memorandum of Understanding between ADEM and the ASMC was updated and executed on April 13, 2009. This agreement outlines numerous areas of cooperation between ADEM and the ASMC to reduce duplicative efforts and to ensure compliance with the clean water act and the Alabama Surface Mining Control and Reclamation Act of 1981. There is no need to give the task of reviewing pollution abatement plans back to ADEM because it would result in duplication of efforts.

One person expressed concerns pertaining the disposal of debris, acid-forming and toxic-forming materials and minerals constituting a fire hazard.

Part III-A-5, attachment III-A-5 provides that any acid or toxic forming material are to be buried within the mine pit. This burial area can vary in location depending on acid or toxic forming materials are encountered.

If such material is found, the provision is to ensure that the material is buried ten feet above the maximum water table and covered with a minimum of four feet of material. The attachment III-A-5 has been revised to add material constituting a fire hazard.

Several persons pointed out that all of the property proposed to be mined was not under control of the permit applicant through lease or ownership. Several noted that the application stated that leases were "pending" where this was not the case.

When initially submitted to ASMC, much of the area proposed to be mined was not under lease to, or ownership of, the applicant. During the review period, the applicant obtained right to mine, both mineral and surface lands in Increment I, through deed or lease. Documentation of this has been submitted to ASMC. The remaining uncontrolled property (mineral rights owned by Allendale Land Company) was deeded to Shepherd Bend LLC on 8/17/2010. There are various parcels of land in future mining increments that the applicant does not have right-to-mine authorization for. Alabama Administrative Code 880-X-8D-.07 (1) requires that: *"Each application shall contain a description of the documents upon which the applicant bases his or her legal right to enter and begin surface mining activities in the permit area and whether that right is the subject of pending litigation. The description shall identify those documents by type and date of execution, identify the specific lands to which the document pertains, and explain the legal rights claimed by the applicant."* The ASMC interprets the words "enter and begin surface mining activities" to mean the mining increments initially under bond and on which activities will occur. As of the date of this decision, all mineral and surface lands in Increment I are either under lease to, or ownership of, Shepherd Bend LLC. As a standard practice the ASMC places a condition on every permit prohibiting the mining of property for which right-to-mine has not been obtained. ASMC does not allow the bonding or authorize the disturbance of mining increments which contain property on which the permittee has no right-to-mine.

The use of the term “pending” to describe the status of right-to-mine on a parcel does not mean that negotiations are on-going between a landowner and a mining company. The ASMC recognizes that this simply means that the applicant does not currently have the right-to-mine. Once a permit is issued by ASMC, the permittee is required to submit a copy of any lease or deed acquired after the fact. Any landowner has the right to request that his or her property be removed from a proposed permit area prior to issuance of a permit. The ASMC honors those requests. None of the property owners identified in the application have so requested.

Several persons cited provisions of the Alabama Administrative Code 880-X-7C-.04 which identifies criteria for designating lands as unsuitable for mining. These persons stated that the area proposed to be mined meets some of those criteria and should not be mined.

The criteria identified under this regulation apply to the formal process of designating lands as unsuitable for mining in 880-X-7D. This process must be initiated by petition to the ASMC by a person who has an interest, which is or may be adversely affected. No such petition has been submitted to ASMC for properties in this permit application. 880-X-7B-.06 identifies areas on which mining is prohibited under the Alabama Code. The lands contained in this permit application do not meet the criteria of lands where mining is prohibited under Alabama law.

Several persons referenced a comprehensive plan developed by the City of Cordova and inferred that mining would be incompatible with that plan.

The City of Cordova is located approximately 6 miles from the proposed mine site. This land is not within the corporate limits of the city. In an article published by the Birmingham News dated August 15, 2010, the Mayor of Cordova, Jack Scott was quoted as saying about the proposed mining operation “We support it….”, “It’ll have no effect but positive for Cordova”

Several persons questioned whether studies had been performed for potential impact to endangered or threatened species and archaeologic and historic resources and cemeteries.

An on site survey report, conducted in February 2008 by Yokely Environmental Consulting Service for potential threatened or endangered species was submitted with the application. The US Fish and Wildlife Service reviewed this report and determined that no further consultation under the Endangered Species Act was required. A copy of the letter of this determination dated March 13, 2008 was included in the permit application.

An archaeologic and historic resources site survey was performed by PE Lamareaux & Associates. A copy of those survey reports dated November 27, 2007 were included in the permit application. No cemeteries or burial grounds were found on the proposed permit area. The State Historic Preservation Officer reviewed these reports and determined that the proposed mine would have no impact on cultural resources listed, or eligible for listing, on the National Register of Historic Places. A copy of the letter of this determination dated January 11, 2008 was included in the permit application.

Several persons questioned if the applicant had a valid authorization for the mining activities from the US Army Corps of Engineers (USACE). One person suggested that the USACE or ASMC should require this operation to apply for an Individual Permit under the Clean Water Act (CWA). One person noted that the Nationwide Permit 21 had been suspended for coal mine activities in Appalachia.

USACE issued a Nationwide Permit 21(NW21) on September 10, 2008 for activities that would impact waters of the United States. USACE has the sole authority for determining whether a propose activity should be authorized under a Nationwide Permit 21 or an Individual Permit under the CWA. USACE suspended that authorization by letter dated December 8, 2010 because a permit application had not been filed with ASMC. USACE reinstated the Nationwide Permit 21 by letter dated July 9, 2010. USACE extended the term of the Nationwide Permit 21 from September 10, 2010 to March 18, 2012 by letter dated September 16, 2010. Copies of these letters and authorizations were submitted in the permit application.

USACE has proposed a suspension of use of the NW21 permit for 6 states in the Appalachian region. Alabama is not one those states.

One person cited information obtained from the Alabama Department of Industrial Relations (ADIR) concerning bond requirements, reclamation costs and bond forfeitures.

The data cited applies to non-coal mining operations regulated by ADIR and do not apply to coal mining. ASMC calculates bonds based on the cost it would incur in order to reclaim the mined area should the permittee forfeit its bonds. One citizen was concerned about the bonds and bonding system from the Surface Mining Commission. The citizen had a letter from the Alabama Department of Industrial Relations dated 2001 describing their bond rates.

The Alabama Department of Industrial Relations does not regulate or determine bond amounts for coal mining operations in the State of Alabama. The Alabama Surface Mining Commission regulates and determines bond amounts for coal mining operations. Said bond determinations are site specific and are composed of many variables. As for the Shepherd Bend Mine, increment I bond determination was calculated to be $825,801 for 38 acres. This comes to $21,731.60 per acre.

One person disagreed with the adequacy of a 100 foot setback from the Mulberry Fork River.

The 100 foot stream setback requirement is established under Alabama Administrative Code 880-X-10C-.28. No disturbance related to mining under this permit will occur closer than 280 feet to Mulberry Fork River.

One person raised the possibility of ethical concerns related to the ownership of Shepherd Bend, LLC and Drummond Company, CEO Garry N. Drummond and the University of Alabama Board of Trustees. Pointing out that Mr. Drummond once served on the Board of Trustees, he questioned the propriety of a possible leasing transaction between the University and Shepherd Bend, LLC.

As of the date of this permit decision, no lease has been executed to allow the mining of property owned by the University of Alabama. The University of Alabama follows the laws of the state of Alabama regarding contracts for lease or sale of property. Such leases or sales would be subject to an open bid process. Should Shepherd Bend, LLC not secure ownership or lease of any property within the mine permit area, the company will not be allowed to disturb that property.

Several persons expressed confusion over the size of the mining operation proposed in the application submitted to ASMC. Differences were cited in the acreage permitted under the NPDES and the NW21 permits.

The NPDES permit issued by ADEM covers a proposed mine area of 1773 acres. The NW21 permit issued by the USACE covers an area of 306 acres.

ASMC permit P-3945 is for a mine area of 286 acres. The ASMC permit is the controlling authorization for this mining operation. The discharge points for outfalls on this mine are also permitted under the NPDES permit. Activities that will impact Waters of the United States are the same as those authorized under the NW21 permit. Any expansion of the mine area for this operation will require revision to the ASMC permit or application for a new permit.

Several persons expressed concern for danger to school buses and other traffic on public roads that will also be used for haulage of coal and equipment.

The ASMC has determined through contact with the Walker County Board of Education that school buses travel on the county roads in the vicinity of the mine during the hours of 6:15 a.m. and 7:00 a.m. and between 4:00 p.m. and 4:30 p.m. ASMC has placed a condition on this permit prohibiting haulage of coal or mining equipment between those hours.

ASMC has also determined that the speed limits on roads that are un-posted are 45 miles per hour for paved roads and 35 miles per hour on unpaved roads. ASMC has placed a condition on this permit that coal haulage and equipment haulage vehicles must observe these speed limits at a minimum and must reduce speed as necessary in consideration of driving or road conditions.

Several persons submitted comments or voiced concerns over potential water quality issues related to mining. These included the proximity of the Birmingham Water Works Board (BWWB) public water supply intake located on the Mulberry Fork River below the proposed mine site.

Many of the concerns over the issuance of the Shepherd Bend Mine include the water quality in the Mulberry Fork of the Black Warrior River. The greatest among these is the proximity of the Birmingham Water Works Mulberry Fork Intake pump, located over 4,500 feet from the southern most discharge basin of the permit. Also there are concerns about ADEM (the Alabama Department of Environmental Management) and the ASMC pertaining to the NPDES permit.

Additionally, there were concerns over well water loss and the potential for acid mine drainage. These concerns will be addressed separately below.

Failure to consider the appropriate water use classification.

During the review process, it was noted that the only use classification of this portion of the river was for “Fish and Wildlife.” At that time it was requested by deficiency letter that the use of the water be re-evaluated. The classification was corrected to include “Public Water Supply.” According to the ADEM map ‘Water Use Classifications for Interstate and Intrastate Waters’, Effective Date 1/12/2001 this portion of the Mulberry Fork is not designated as “Swimming and Other Whole Body Water Contact Sports.”

The NPDES permit provides little protection from post-mining impacts.

Surface water and ground water will be sampled for the life of the mine, until final bond release. Basins are sampled twice monthly until a Phase II bond release is approved. Before a Phase II bond release of an increment can be approved, six months of consecutive water quality data is submitted to the ASMC for review. This includes the NPDES parameters, as well as any additional parameters the ASMC deemed necessary for monitoring. If the basins are in compliance, and all other Phase II conditions are met, the bond release can be approved.

Other conditions that are met at the time of a Phase II bond release include topsoil replacement completed and revegetation established as well as the land not contributing suspended solids to stream flow or runoff outside the permit area in excess of permit conditions.

Birmingham Water Works Board Mulberry Fork Intake

While the original NPDES permit shows a final basin discharge 800 feet from the Birmingham Water Works Mulberry Fork Intake, as it pertains to the ASMC permit the actual distance from the final discharge basin to the Intake is over 4,200 feet.

Before this permit was submitted, baseline data was collected from four surface water sites. Two were sampled upstream of the permit area, and two downstream of the permit area. This included Barton Creek, an unnamed tributary to the Mulberry Fork, and the Mulberry Fork. Regressions were run on the unnamed tributary to the Mulberry Fork, downstream, to predict quality at 2-year low flow, average flow and 2-year high flow events before mining, during mining and after mining. The results of the regressions show pH, Specific Conductance, TSS, Fe (iron) and Mn (manganese) in compliance with EPA discharge limitations.

In addition, a study by Malcolm Pirnie was submitted with a surface-water sampling plan to determine potential impacts of the mine near the Mulberry Intake. This study utilized four locations sampled during a wet weather event, and a dry weather event in July and August of 2009. The site chosen was the Horse Creek Mining, LLC, Horse Creek Mine, approximately 1.5 miles upstream of the Mulberry Intake. The four sites were at the Mulberry Intake, 800 feet downstream of the mine outfall, the mine outfall itself, and 800 feet upstream of the mine outfall.

The laboratory analysis was performed at the Water Works Board Envirolab and the Alabama Power Company Laboratory. The test analyzed 26 parameters, including 10 metals run as soluble metals resulting in a total of 36 analyses. The results show none of the constituents sampled at any of four sites were above the MCL (maximum contaminant level) for even drinking water standards. The samples from the actual mine outfall showed elevated aluminum, iron, manganese, Total Organic Carbon and strontium, however these are not included in the Primary Drinking Water Standards list. Aluminum, iron, manganese and zinc are included on the Secondary Drinking Water Standards list, which are guidelines for contaminants that may cause cosmetic effects (such as skin or tooth discoloration) or aesthetic effects (such as taste, odor or color). Downstream of the outfall the constituents were no longer elevated.

Because the geology of the Horse Creek Mine and the Shepherd Bend mine are similar, and the study shows no contaminant from the outfall, or downstream of the mine site exceeding the Primary Drinking Water MCL, it is reasonable to conclude that if mining operations are conducted as regulated, there will be no elevated metals to 'toxic' levels. Additionally the discharge has time and distance to allow for mixing with the full stream flow.

Additionally, it was asked of a Water Works Board member at the informal conference if any adverse impacts had been seen from the Cherokee Mining, LLC, Red Star Mine. This Mine is located directly across the Mulberry Fork from the Shepherd Bend Mine on the same side of the river as the Intake. It is in the reclamation phase currently and is also located over 1/2 mile upstream of the Mulberry Intake. The only problem identified was Bromine, which was traced back to the city of Arab, not a mining operation.

Iron and manganese limits are not protective of drinking water uses.

The NPDES permit limitations include daily average total iron concentrations of 3.0 mg/L and a daily average total manganese concentration of 2.0 mg/L. As the discharge from the mine site is not a drinking water source, a drinking water standard on mine discharge is not applicable. Also, the mine discharge will co-mingle with water from the Mulberry Fork before flowing ½ mile downstream toward the Intake.

The ability of the BWWBs existing treatment facilities to remove iron and manganese in the reduced state will be threatened.

The limitations for iron and manganese are 3.0 mg/L and 2.0 mg/L respectively. If these values are exceeded, treatment becomes necessary. With normal, compliant discharge, any iron or manganese will exist in an oxidized state, as the pH will be above 6.0 s.u.

The maximum pH limit under the NPDES permit is not protective of designated uses. The NPDES permit includes a provision that allows the maximum daily pH of 10.5 s.u.

This provision is for treatment of manganese. If manganese is non-compliant, the pH may be allowed to go up to 10.5 s.u. to precipitate manganese into the sediment control pond prior to discharge. If this were to occur, the co-mingling of the small amount of higher pH water with the near neutral water of the Mulberry Fork would immediately drop the pH to near neutral conditions.

Discharges that result from Storm events have no metals limits.

The NPDES permit includes storm precipitation event limitations. A storm event of any size will wash down particulates all along the river edge, as well as from any disturbance in the rain area. This is not unique to mining. The alternative rainfall effluent limits are established in Federal Regulations for coal mine point source discharges.

There are many concerns about 'wastewater' and 'toxic pollutants' being discharged into the Mulberry Fork.

All drainage from the permit area must discharge through a certified basin. All basin discharges are sampled twice a month in accordance with the NPDES permit. While the NPDES permit only requires certain parameters be monitored, additional monitoring can be required by this agency. The ASMC has placed additional monitoring requirements on this permit for parameters that may affect the BWWB intake.

The HMP indicates that the groundwater monitoring program is not sufficient and contaminants introduced to groundwater from mining operations will discharge to the Mulberry Fork.

The HMP (Hydrologic Monitoring Plan) includes a monitoring well that will be monitored for the life of the mine. This includes replacement if the well is destroyed. Due to the hydrologic barrier of the Mulberry Fork, one down dip well is sufficient to characterize any changes in groundwater. The same hydrology exists across the river at the Red Star Mine, which has not had an adverse effect on the Mulberry Fork Intake. Like the surface water, any groundwater that contributes to the base flow of the Mulberry Fork will be commingled with existing surface water, and any increase in mineralization will be diluted upon discharge.

Groundwater directly underlying the site is designated as an "Underground Source of Drinking Water."

Research with several departments at ADEM resulted in no evidence that this area is designated as an Underground Source of Drinking Water. Due to the nature of the Pottsville Formation (fractured with limited extent), a significant supply of groundwater (capable of providing a public water supply) is not likely in this area. The same constituents that would enter the surface water system would infiltrate into the groundwater system, and it has been shown that there is little possibility of toxic metal introduction into the system.

The locks and dams upstream cause the river to flow backwards.

An investigation into the location of locks and dams on the Black Warrior River show no locks and dams upstream of this permit area. The closest lock and dam is the John Hollis Bankhead lock and dam, located approximately 10 miles downstream after the confluence of the Mulberry Fork and Locust Fork Rivers.

Private Wells may be adversely impacted

A well inventory was conducted within a ½ mile radius of the permit area. There were no residences relying solely on a groundwater well for domestic use. All the residences in the ½ mile area have municipal water as their domestic source. Generally in the Pottsville Formation of the Warrior Coal Basin, groundwater occurs along fractures, joints and bedding planes. Recharge is primarily by the infiltration of rainfall, which is transmitted downward through the soil and weathered rock into the formation. Also, the Pottsville Formation tends to have aquifers of only local extent, and as such large supplies of groundwater are not available.

In the event that it is shown that the mining company has caused interruption or contamination of a private well, ASMC Regulation 880-X-10C-.25 states "any person who conducts surface mining activities shall replace the water supply of an owner of interest in real property who obtains all or part of his or her supply of water for domestic, agricultural, industrial, or other legitimate use from an underground or surface source, where the water supply has been affected by contamination, diminution, or interruption proximately resulting from the surface mining activities."

Generally a ½ mile radius is used for a well inventory. It is possible to extend the radius of the inventory, if deemed necessary. However, at best a one-mile radius would be inventoried because of the nature of the Pottsville Formation. The fracturing, faulting and limited aerial extent of the aquifer system even makes the correlation between two wells difficult. The greater the distance between two wells, or disturbance of a well, the less likely impact from the disturbance will occur.

Potentially acid or toxic-forming materials are found in the overburden.

Four drill holes were drilled for the permit application for acid base accounting purposes. Chemical analysis was conducted on each lithologic unit. If a lithologic unit exceeded five feet, it was subdivided into smaller increments. Potential acidities for each lithologic unit were determined by an analysis of the total sulfur, which is converted to potential acidity by multiplying by 31.25*. The results are reported in tons of calcium carbonate per 1000 tons of material. The data results were then tabulated using a spreadsheet program designed by the Pennsylvania Department of Environmental Resources, Bureau of Mining and Reclamation. Material with a paste pH of less than 4.0. s.u., and with a neutralization potential and acid base account of less than 0 are considered acid forming. The results of the tests indicate a positive 3.37 tons of calcium carbonate per 1000 tons of material.

Malcolm Pirnie conducted an Acid Base Accounting (ABA) test on five coal bearing samples from the Black Warrior River watershed. The results of the test show that this coal bearing material is expected to generate acidic conditions due to the lack of neutralization potential in the samples.

Coal (coal bearing material) itself is considered acid forming. However, this material is being removed from the permit area, thus lessening any likelihood of acid production. The study did not take into account the overburden material that will be placed back after the coal is extracted. While one hundred percent of the coal will not be removed, with the mixing of the overburden, which contains a positive neutralization potential, one of the catalysts for generating acid is neutralized.

Additionally, this study noted the metals aluminum, arsenic, iron, manganese and zinc of greatest concern for leaching into the environment. These metals were again compared to drinking water standards.

Aluminum is on the secondary drinking water standard list, with a limit of 0.05 – 0.2 mg/l. Only two of the samples exceeded this limit. Arsenic did not exceed the drinking water standard, as it is set from 0.0 to 0.01 mg/l. Of the five samples, the greatest arsenic value was 0.00922 mg/l. Technologic limits of mass spectrophotometers and atomic absorption methods easily allow for certainty in the thousandths or greater place, therefore ‘rounding’ 0.00922 mg/l to 0.01 mg/l is not applicable. Iron exceeded the secondary drinking water limit on two of the five samples, with greatest being 18.6 mg/l. These values of high iron are not uncommon in natural groundwater conditions of

the Pottsville Formation, and once again the coal will be extracted and removed. Manganese exceeded the secondary drinking water limit on one of the samples, the limit being 0.05 mg/l, and the value being 0.614 mg/l.
Zinc did not exceed the secondary drinking water standard on any sample.

The results of this analysis show very little possibility of toxic metals leaching into the groundwater or running into the streams, even from the coal stockpiles, much less from the reclaimed areas.

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* "ABA consists of measuring the acid generating and acid neutralizing potential of a rock sample. These measurements of Maximum Potential Acidity (MPA) and Neutralization Potential (NP) are subtracted to obtain a Net Neutralization Potential (NNP).

The measurements of calculations of NP, MPA, and NNP are based on the following stoichiometric equation:

$$FeS_2 + 2CaCO_3 + 3.75O_2 \Rightarrow 2SO_4^{2-} + Fe(OH)_3 + 2Ca_2{+} + 2CO_2$$

For each mole of pyrite that is oxidized, two moles of calcite are required for acid neutralization. On a mass ratio basis, for each gram of sulfur present, 3.125 grams of calcite are required for acid neutralization. When expressed in parts per thousand of overburden, for each 10 ppt of sulfur (equal to 1 percent sulfur content) present, 31.25 ppt of calcite is required for acid neutralization."

<u>Coal Mine Drainage Prediction and Pollution Prevention in Pennsylvania</u> from the Pennsylvania Department of Environmental Protection.

Wells used for testing and reporting in the permit application, only 2 wells were used.

Four monitoring wells were installed and monitored for baseline. All four wells were sampled on numerous occasions over a three-year period. Thirty data points to produce a normal distribution for statistical data is not necessary. Groundwater is shown, as it existed at a point in time, and is reported in the condition of the pre-mining site.

This area is also not a wellhead protection zone. This area does not have a public groundwater source that supplies water to a community from a single well. The Pottsville Formation in this area is not capable of that amount of water storage or yield.

Several persons expressed concerns regarding blasting at the mine site. Several referred to a single incident, occurring on 9/01/06, in which fly rock was cast from the Red Star Mine.

No one was injured and property damage was minimal. A pickup truck was damaged and a small rock broke through the grill and wedged the fan on an air conditioning unit. There was also some small denting of sheet metal on a house. We interviewed a young man who reported that rock from the blast fell into the water near him as he was canoeing. He did not report being struck, but was, understandably, quite upset by the experience.

An incident of this nature in which blasting casts material beyond designated areas controlled by the operator is considered by this agency as the most serious of violations. Blasting operations were shut down pending an investigation. The investigation found that an unexpected geological condition had allowed one explosive charge to "blow out" scattering weathered rock and mud. Monitoring of the blasting also showed that the "blow out" had created air overpressure well in excess of regulatory limits. A two part notice of violation was issued to the mine operator and blaster - for the flyrock and for the air blast.

The mine operator, their blasting contractor, and state personnel developed a plan for preventing a recurrence of such an incident and blasting operations were allowed to resume. The plan included, among other things, abandoning a small part of the highwall to serve as a buffer between blasting operations and the residences, and requiring spotters on the waterfront to ensure that no one was in the potential hazard area when blasts were initiated. There was no recurrence of flyrock hazards.

All surface coal mine blasting has to be conducted by a properly trained and certified blaster. A hearing on the status of the blaster's certification was held shortly after the incident. The hearing found that the blaster was not guilty of willful negligence or other misconduct that would require surrender of his certification. Events of this kind in which flyrock causes property damage or threatens public safety are extremely rare, especially considering that there are hundreds of blasts weekly on Alabama coal mines. This incident was by far the worst of the half dozen even slightly similar incidents in the past nine years. There has been only one incident of someone off the mine site being struck by flyrock in the more than thirty-year existence of the ASMC. That was in 1990 and, tragically, was a fatality.

Events of this kind, indeed all blasting experience, offer opportunities for improving blasting safety. The Blasting Plan for the Shepherds Bend Mine contains additional safeguards for controlling the flyrock hazard, as well as ground vibration. Unfortunately, we cannot absolutely guarantee that there will be no future occurrence of flyrock; no human activity can be made absolutely safe. There are, however, very few houses in the Shepherds Bend Mine area that would have any potential for flyrock hazard.

Several persons expressed concern about the potential for property damage caused by ground vibration from blasting.

Two speakers referred to damage claims from blasting operations at the Red Star mine. Litigation began very early in mining at the Red Star Mine and is still ongoing. While the ASMC is not directly involved with that litigation, it would be inappropriate to comment in any depth on those claims. A general commentary on ASMC regulations and procedures may help clarify the situation however.

It is a violation of ASMC Regulations to damage residences and other protected structures such as schools and churches. Fines can be levied and blasting operations curtailed if necessary to protect property or public safety. However, the ASMC does not have the authority to intervene in matters of compensation should any damage ensue from blasting operations. Claims for compensation must be settled between the homeowner and mine operator. The role of the ASMC is in setting and enforcing performance standards in conducting blasting operations.

The ground vibration and air blast standards adopted by the State of Alabama for surface coal mining are identical with federal standards and are designed to greatly reduce the likelihood of damage from blasting vibration. Those standards are enforced by regular inspections of blasting records and in the majority of cases, by monitoring of ground vibration and air overpressure. Seismograph monitoring by the mine operator will be required at the Shepherd Bend Mine. Also, if requested by homeowners, the ASMC can conduct its own seismograph monitoring. If blasting violations are discovered, blasting operations will be suspended and changes ordered to bring the blasting back into compliance.

As a further measure of protecting the public, the ASMC requires the mine operator to offer pre-blast surveys to all residents within one half mile of any part of the mine permit. The surveys use photography and narrative descriptions of inspections to document the condition of residences prior to blasting and is the surest way of determining changes that may be attributed to blasting. As part of the ASMC's response to complaints of damage, the mine operator is required to attempt to resolve the complaint with the homeowner.

ASMC regulations concerning blasting are available at the ASMC website, http://www.surface-mining.state.al.us.

There were over three hundred and fifty violations from these two mines (Horse Creek and Quinton Mine) into the river.

A single violation on a single day should count as one violation, not as seven or thirty-one days of violations. When a violation is issued, it is reported, and noted what steps will be taken to abate the violation. To have a single violation one day is not the same as seven days of a violation. It is possible in most cases to have such violations back in compliance within a day or two. The number of 'three hundred and fifty' violations is an abstract and misleading representation of actual violations at a mine site. Since mid 2006, of the three surrounding mines, one has had an ADEM 5-day non-compliant violation. The Cherokee Mining LLC, Red Star mine had a pH violation in June of 2006. The pH was 9.68 s.u. It was immediately abated.

The applicant must list violations of any department or agency in the United States pertaining to air or water environmental protection incurred by the applicant for the last three years. Shepherd Bend, LLC has not received any such violations in the last three years.

Only unabated cessation orders and unabated violation notices received by any other surface coal mining and reclamation operation owned or controlled by the applicant or by any person who owns or controls the applicant are to be listed. It is understood that Drummond Company, Inc., Cane Creek, LLC, Horse Creek, LLC, Quinton Mining, LLC and Sloan Mountain Mining, LLC are related to Shepherd Bend, LLC. A review of the Alabama Surface Mining Commission's violation records and a review of the Alabama Department of Environmental Management violation records indicate that none of these companies have any unabated cessation orders or unabated violation notices at this time. A Special Order by Consent was made and entered into by the Alabama Department of Environmental Management (ADEM) and Quinton Mining, LLC on August 31, 2007. Consent Order 07-1622-CMNPS required that certain actions be taken regarding alleged violations of applicable environmental laws and regulations. On January 8, 2008 Quinton Mining, LLC was advised by ADEM that the specific actionable items required by the Consent Order had been adequately addressed or resolved.

21. CUMULATIVE HYDROLOGIC IMPACT ASSESSMENT

As required under Federal Public Law 95-87, Section 510(b)(3), the Alabama Surface Mining Commission (ASMC) must find in writing the following proposed operation has been designed to prevent material damage to the hydrologic balance outside the permit area. The applicant must submit a determination of probable hydrologic consequences of mining and reclamation operations in Part II.H of the permit application for areas both on and off the mine site. This determination will allow the ASMC to assess probable cumulative impacts of all anticipated mining activities on the surface and ground water hydrology of the permit and adjacent areas as stated in Federal Public Law 95-87, Section 507(b)(11) and ASMC Rule 880-X-8E-.06(1)(g). The following assessment and findings are intended to fulfill the above.

I. GENERAL INFORMATION

The proposed Shepherd Bend, LLC (ASMC P-3945) Shepherd Bend Mine is for a surface coal mining operation encompassing 286 acres. The proposed mine site is located in part of Section 2 Township 16 South, Range 6 West and parts of Sections 34 and 35 Township 15 South, Range 6 West, Walker County, Alabama, as seen from the Jasper, and Dora Alabama quadrangles.

The site is located above Shepherd Bend in the Mulberry Fork of the Black Warrior River. Originally the Alabama Department of Environmental Management's (ADEM) National Pollution Discharge Elimination System permit (NPDES) covered approximately 1,700 + acres, which extended into the bend. The permit applied for through the ASMC comprises approximately 16% of the NPDES permit.

The site is bound on the east side by the Mulberry Fork of the Black Warrior River, on the west by Reeds Ferry Road, and on the north and south by private property and the University of Alabama.

A. Historical Coal Mines

There are several historical surface coal mines located adjacent to the permit area. The term "historical" refers to mines that were in operation prior to the enactment of Alabama's permanent program. The mines that would potentially impact the cumulative area are located on the east side of the

Mulberry Fork. Parts of these disturbed areas have been permitted under the ASMC permanent program.

II. CUMULATIVE IMPACT AREA (CIA)

The Cumulative Impact Area (CIA) is that area, including the permit area, within which impacts resulting from the proposed operation may interact with the hydrologic impacts of all other past, current and anticipated coal mining on the surface and groundwater systems.

The CIA for surface water for Permit P-3945 has been defined as the area upstream on the Mulberry Fork that receives drainage from the Horse Creek Mine (P-3858) down to below the Quinton Mine (P-3860) which encompasses the Red Star Mine (P-3859) and the Shepherd Bend Mine. The CIA encompasses the four operations as well as some pre-law mining areas that have not been reclaimed. This includes those areas of anticipated mining operations that may impact this assessment area as well as active mines, which may lead to cumulative effects. (See Map 1a and Map 1b).

The CIA for groundwater for this permit is limited to the permit area itself. (See Map 1a and 1b). The CIA has been selected based upon the Department's assessment of the possible hydrologic impacts, which may occur as a result of mining operations. The subsurface hydrologic components considered in this assessment include all significant water-bearing units in, and within the vicinity of, the proposed permit. While other areas of proposed, future mining are not known, no cumulative impacts to groundwater are expected due the lack of a widespread, regional aquifer system, the southern groundwater movement, and the boundary that is the Mulberry Fork.

Active or Proposed Mines

Previous mining in this area of the Mulberry watershed includes pre-law and regulated mine sites. The regulated mine sites include the Cherokee Mining – Red Star Mine (ASMC Permit P-3857), the Horse Creek Mining, LLC – Horse Creek Mine (ASMC Permit P-3858), and the Quinton Mining, LLC – Quinton Mine (ASMC Permit P-3860). (See Map 1a for location of existing mines in reference to the Shepherd Bend permit). All three of the above mentioned mines are finished with active mining, and are in various phases of reclamation.

Geologic/Hydrogeologic Information

Geology

The proposed P-3945 permit area is located in the Warrior Coal Basin. According to the "Depositional Settings of the Pottsville Formation in the Black Warrior Basin", the Plateau Coal Field is a small, transitional basin which connects the Black Warrior Basin with smaller basins in southeastern Tennessee. The Pottsville Formation underlies and outcrops in this region, which is of Pennsylvanian Age.

Locally, the strata which outcrops in the immediate vicinity of the Shepherd Bend Mine site includes sandstones, shales, underclays and coal seams associated with the Mary Lee Coal Group. The target seams at this site include the New Castle, Mary Lee and Blue Creek seams.

Based on the structure contours, the strata in the permitted area dips generally to the south. It is stated in the permit application that the southern area of the permit area indicates either the continuation of an east-west trending fault or a fold of tight closure along the trend.

Potentially Acid- and Toxic-Forming Materials

Overburden analysis was conducted on four overburden sample sites (DH 30737, DH 30618, DH 30624 and DH 30619), which are located within the permit area. The analysis was run to determine the potential for acid- and toxic-forming properties. Potentially acid- and toxic-forming materials are those that exhibit a pH of less than 4.0 s. u. or a deficiency in calcium carbonate equivalent of at least 0 tons per 1,000 tons of material (T/KT). Samples were collected every 5 feet or change in lithology (with the exception of the target coal seam) and analyzed for pH (paste), total sulfur, potential acidity, neutralization potential and fizz rating.

Surface Water

The proposed permit area is located in sub-watershed 190 of the Mulberry Fork Watershed (HUC 03160109). Four basins are proposed for this site. As part of the mining operations, the pool area of Pond 008 will be mined through. During mining within the pool area of Pond 008 any drainage collected within the open pits will be pumped to Pond 007 for treatment, if necessary, before discharge. The pool area will be reconstructed when the mining is complete. The four basins will all drain to unnamed tributaries of the Mulberry Fork.

Surface water quality and quantity in the area was measured at four monitoring locations. These locations will serve as the monitoring locations during and after mining, until final bond release. Monitoring site 432-001 is located on Barton Creek above its confluence with the Mulberry Fork. The site has a drainage area of approximately 115 acres. Monitoring Site 432-004 is located upstream from the mine site on the Mulberry Fork. The drainage area is over 1,919 square miles. Monitoring Site 432-005A is located downstream on the Mulberry Fork. Monitoring Site 432-006 is located on the unnamed tributary to the Mulberry Fork on the permit area. The drainage area is approximately 143 acres.

To characterize the existing quality and quantity of water within the above-mentioned streams, baseline data were obtained and submitted in the permit application. Baseline data is show in Table 1 with corresponding sites on Map 1a.

Included in the permit application are surface water quality projections. The existing water quality at Monitoring Site 432-006 was modeled to predict changes the mine will have on the water quality of receiving streams. In conjunction with modeling Monitoring Site 432-006, the quality of sediment basin discharges at the adjacent Horse Creek Mine was also used. The Horse Creek Mine site has similar overburden material, and the discharges should reflect closely the anticipated discharges expected at this mine site. The results are given in Table 1.

Post-Mining water quality and quantity estimates are based on several factors:

1. Baseline surface water quality
2. Estimated impact during mining
3. Size of the permit area compared to the impacted watershed
4. Amount of previous mining within the watershed

<u>Ground Water</u>

Groundwater in the Warrior Basin occurs in fractures and along bedding planes in the Pottsville Formation. The sandstone beds within 250 to 350 feet of the surface generally contain the most productive water-bearing openings. Regionally, the primary source of recharge to groundwater is rainfall, which averages 55 inches per year. According to the U.S. Geological Survey Report, the Pottsville aquifer is tightly cemented and has small primary porosity and permeability, and the yields of public water for wells completed in this aquifer are less than 0.15 Mgal/d (million gallons per day). This aquifer is also commonly high in iron.

During the drilling of exploration holes, very little groundwater was encountered. Pumping of the drill holes showed rapid drawdown and slow recovery of water that was present. The aquifer that will be impacted from this operation would be one of and including the coal seams. The aquifer that is usable for domestic purposes is located below the coal seams.

Domestic Wells

A well inventory conducted on May 12, 2010 showed no residences within a ½ mile radius of the mine site. All residents within a ½ mile radius utilize a public water supply as their main source of water. There are no known areas included in a wellhead protection zone.

Company Installed Wells

To characterize existing ground water conditions at the site, baseline data was collected at four ground water monitoring wells. Groundwater monitoring sites 832-012, 832-013, 832-014 and 832-015 are drilled to below the Blue Creek seam. They are cased into a sandy shale unit and open the remainder of the well. Groundwater flow for the unconfined water table system will flow in response to strata dip and follow topography. Generally it will flow towards the Mulberry Fork. Groundwater flow direction for the unit below the coal, if following the dip of the coal, will be in a south to southwest direction. See Table 2 for a summary of baseline conditions.

Coal Processing Waste

Coal processing waste (gob and slurry) will not be generated or disposed of at the site.

Material Damages

With respect to the CHIA, material damage to the hydrologic balance means the changes to the hydrologic balance caused by surface mining and reclamation operations to the extent that these changes would significantly affect present and potential uses as designated by the regulatory authority. This includes the hydrologic impact that results from the accumulation of flows from all coal mining sites in a cumulative impact area. Examples of material damage are: permanent destruction of a major regional aquifer; temporary contamination of an aquifer in use that cannot be mitigated; and solute contributions to streams above receiving stream standards.

A CHIA is based on the best currently available data and is a prediction of mining-related impacts to the hydrologic balance. Permittees (and permit applicants) are required to monitor water quality and quantity. Exceeding material damage thresholds might also cause significant reduction of the capability of an area to support aquatic life, livestock and wildlife communities.

III. FINDINGS

Based on the information presented above, the following findings have been made relative to the proposed permit area.

A. Historical Coal Mines

With regard to the historical surface mines in, and within the vicinity of, the proposed site, the possible cumulative effect of the previous mining along with the proposed operations on surface and ground water quality/quantity will be discussed in detail in the following Surface Water and Ground Water sections.

B. Potentially Acid- and Toxic-Forming Materials

Laboratory analyses of the bedrock overlying, and immediately below, the Blue Creek Coal Seam reveal favorable overburden with the +3.37 tons $CaCO_3$/1000 tons overburden excess neutralization potential. Another important consideration is that previous mining in the Mary Lee Coal Group in the surrounding area, and throughout the Warrior Basin, have not historically created acid mine drainage. Also, the surrounding regulated mines have not had any acid mine drainage associated with them. Therefore, adverse effects to the hydrologic balance of the area are not anticipated.

The potential for acid formation will be eliminated by use of a mining method that will create a "mixing" effect with overburden having a positive acid base count to neutralize the potential acidity. This includes extensive lime neutralization and erosion control principles.

C. Surface Water

Laboratory analyses of the samples collected from the waterways reveal elevated conductivity and sulfate values due to previous coal related disturbance in this watershed. Samples taken from site 432-001 on Barton Creek show the greatest elevated conductivities and sulfates. This is due in part to the location of the sample point and the size of the receiving stream. Sample sites on the Mulberry Fork both upstream of the Shepherd Bend Mine site (downstream of the Horse Creek Mine site) show much less impact with regards to specific conductance and sulfates. According to the Alabama Department of Environmental Management the receiving streams' use classification is 'Fish and Wildlife/Public Water Supply.'

Water quality within the Mulberry Fork shows neutral pH, low iron, low manganese and low to moderate suspended solids, sulfates and conductivity.

The pre-mining land use within the permit boundary is logging – no management and permanent water impoundments. Areas adjacent to the permit area support undeveloped areas of pine trees and mixed deciduous trees. Outer areas to the west contain Reeds Ferry Road, with residences located on both sides and connecting to Highway 269. To the north, the Mulberry Fork of the Black Warrior River borders east and south. Across the river are undeveloped lands, and other surface coal mines.

Surface Water Users

The Birmingham Water Works Board utilizes an intake facility on the Mulberry Fork approximately 4500 feet downstream of the mine discharge.

A study by Malcolm Pirnie was submitted with a surface water sampling plan to determine potential impacts of the mine near the Mulberry Intake. This study utilized four locations sampled during a wet weather event, and a dry weather event in July and August of 2009. The site chosen was the Horse Creek Mining, LLC, Horse Creek Mine, approximately 1.5 miles upstream of the Mulberry Intake. The four sites were at the Mulberry Intake, 800 feet downstream of the mine outfall, the mine outfall itself, and 800 feet upstream of the mine outfall.

The laboratory analysis was performed at the Water Works Board Envirolab and the Alabama Power Laboratory. The test analyzed 26 parameters, including 10 metals run as soluble metals resulting in a total of 36 analyses. The results show none of the constituents sampled at any of four sites were above the MCL (maximum contaminant level) for even drinking water standards. The samples from the actual mine outfall showed elevated aluminum, iron, manganese, total organic carbon and strontium, however these are not included in the Primary Drinking Water Standards list. Aluminum, iron, manganese and zinc are included on the Secondary Drinking Water Standards list, which are guidelines for contaminants that may cause cosmetic effects (such as skin or tooth discoloration) or aesthetic effects (such as taste, odor or color). Downstream of the outfall the constituents were no longer elevated.

Because the geology of the Horse Creek Mine and the Shepherd Bend mine are similar, and the study shows no contaminant from the outfall, or downstream of the mine site exceeding the Primary Drinking Water MCL, it is reasonable to conclude that if mining operations are conducted as regulated, there will be no elevated metals to 'toxic' levels. Additionally, the discharge has time and distance to allow for mixing with the full stream flow.

Changes in the quantity and quality of the waters in the streams draining the site are expected to be minimal due to the proposed mining activities. During mining, runoff from the disturbed areas will be diverted into sediment basins that have been designed to allow sediment to settle out prior to discharging. Effluent from the sediment basins will be monitored by the permittee in accordance with National Pollution Discharge Elimination System (NPDES) permit requirements issued by the Alabama Department of Environmental Management. The effluent will be chemically treated, if necessary, in accordance with the NPDES permit. The basins will be monitored quarterly through final bond release in order to characterize and document any effects the mining may have on the surface-water hydrologic balance. The basins are all proposed as permanent water impoundments.

Once mining has begun, the applicant will continue to sample and monitor sites 432-001 (upstream on Barton Creek), 432-006 (upstream on an unnamed tributary to the Mulberry Fork) and site 432-005A (downstream on the Mulberry Fork below all mining disturbance, but above the Birmingham Water Works Mulberry Fork Intake) quarterly through final bond release in order to characterize and document any effects the mining may have on the surface-water hydrologic balance.

D. Ground Water

Laboratory analyses of samples collected from the four installed wells reveal the ground water within the bedrock strata below the Blue Creek seam is neutral to slightly acidic with relatively neutral pH and very low (if present) acidity concentrations. Conductivity and sulfates show little impact from any previous disturbance. For a summary of the baseline data collected from the bedrock wells, please refer to Table 2 presented at the end of this assessment.

The proposed operations are not expected to have a permanent adverse impact on the overall quality of the ground water at the site or surroundings. As noted previously, little water was encountered above the Blue Creek seam. Also, no great impact is anticipated to the ground water quality for the aquifer below the Blue Creek. Groundwater flow is to the south and southwest.

A well inventory was conducted within a ½ mile radius of the permit area. There were no residences relying solely on a groundwater well for domestic use. All the residences in the ½ mile area have municipal water as their domestic source. Generally in the Pottsville Formation of the Warrior Coal Basin, groundwater occurs along fractures, joints and bedding planes.

Recharge is primarily by the infiltration of rainfall, which is transmitted downward through the soil and weathered rock into the formation. Also, the Pottsville Formation tends to have aquifers of only local extent, and as such large supplies of groundwater are not available.

As discussed previously, the bedrock strata that will be excavated during the mining operations are predominantly non-acid and non-toxic. Mining and management practices/techniques and contemporaneous reclamation should result in less water quality issues as compared to historical mining. Should any increase in mineralization occur in the ground water as a result of the proposed activities, it is anticipated the levels will diminish and return to pre-mining concentrations once mining and reclamation activities are complete. Ground water will be further protected by properly sealing and abandoning all drill holes completed at the site (with the exception of blast holes) that will not be used for monitoring purposes. With regard to the availability of ground water after mining and reclamation is complete as compared to existing quantities, the backfilled spoil material will have a greater recharge capacity as compared to the undisturbed strata.

IV. CONCLUSION

The assessment of probable cumulative impacts of the Shepherd Bend, LLC, P-3945, Shepherd Bend Mine, finds the proposed operations have been designed to prevent material damage to the hydrologic balance outside the proposed permit area.

Table 1
Ranges/Averages of Surface-Water Quality/Quantity
Stream Points
P-3945

Parameter	426-001	426-004	426-005	426-006
Discharge Rate (cfs)	0.10 – 7.92 (1.72)	Not reported	Not reported	0.02 – 1.66 (0.26)
Field pH (S. U.)	6.90 – 7.88 (7.19)	6.00 – 8.10 (6.93)	5.95 – 7.46 (6.54)	5.8 – 6.95 (5.99)
Acidity (mg/L)	0	0	0	0
Alkalinity (mg/L)	44 - 192 (99.2)	24 - 100 (44.9)	24 - 100 (43.3)	8 - 20 (16)
Total Suspended Solids (mg/L)	0.8 – 2.0 (1.0)	3.2 – 90.0 (16.0)	2.8 – 47.2 (9.14)	1.2 - 10 (4.95)
Total Iron (mg/L)	0.03 – 0.17 (0.10)	0.11 – 1.93 (0.58)	0.11 – 1.55 (0.42)	0.27 – 0.97 (0.46)
Total Manganese (mg/L)	0.03 – 0.12 (0.07)	0.06 – 0.0.26 (0.14)	0.07 – 0.27 (0.12)	0.02 – 0.06 (0.05)
Conductivity 25 ^{0}C (μmhos/cm)	261 - 1360 (822)	85 - 342 (136)	82 - 411 (135)	47 - 61 (52)
Sulfate (mg/L)	90 - 600 (293)	11 - 56 (20.8)	11 - 83 (32)	5 – 7.3 (6.4)

Average values are set in parentheses.
Averages calculated as geometric means.

Table 2
Ground Water Data
P-3945

Parameter	832-012	832-013	832-014	832-015
Water elevation (MSL)	54.2 – 190.2 (126.0)	120 – 138.3 (130)	101 – 105 (103.3)	113.5 – 125.1 (122)
pH (s.u.)	5.83 – 6.9 (6.18)	5.64 – 6.32 (5.86)	5.74 – 6.72 (5.97)	5.76 – 6.70 (6.08)
Total Fe (mg/l)	0.07 – 3.55 (0.94)	0.05 – 4.98 (1.51)	0.11 – 6.50 (1.18)	0.08 – 3.8 (1.13)
Total Mn (mg/l)	0.03 – 0.24 (0.10)	0.16 – 0.33 (0.35)	0.11 – 0.35 (0.23)	0.03 – 0.18 (0.09)
Alkalinity (mg/l)	120 – 360 (204)	44 – 80 (66)	200 – 260 (243)	140 – 220 (185)
Acidity (mg/l)	0	0	0	0
Conductivity 25 ^{0}C (μmhos/cm)	225 – 740 (369)	108 – 165 (142)	418 – 480 (440)	294 - 391 (362)
Sulfates (mg/l)	7 – 34 (13.5)	4 – 9 (6.43)	25 – 36 (31)	27 – 45 (37.8)

Average values are set in parentheses.
Averages calculated as geometric mean

Table 3
Predicted Water Quality
Monitoring Site 432-006

Predicted quality at 2-year low flow (0.13 csm)

	BEFORE MINING	DURING MINING	AFTER MINING
pH	7.48 s.u.	7.53 s.u.	7.47 s.u.
Specific Conductance	298 umhos	306 umhos	310 umhos
TSS	2.71 mg/l	3.46 mg/l	3.43 mg/l
Fe	0.32 mg/l	0.40 mg/l	0.40 mg/l
Mn	0.04 mg/l	0.04 mg/l	0.04 mg/l

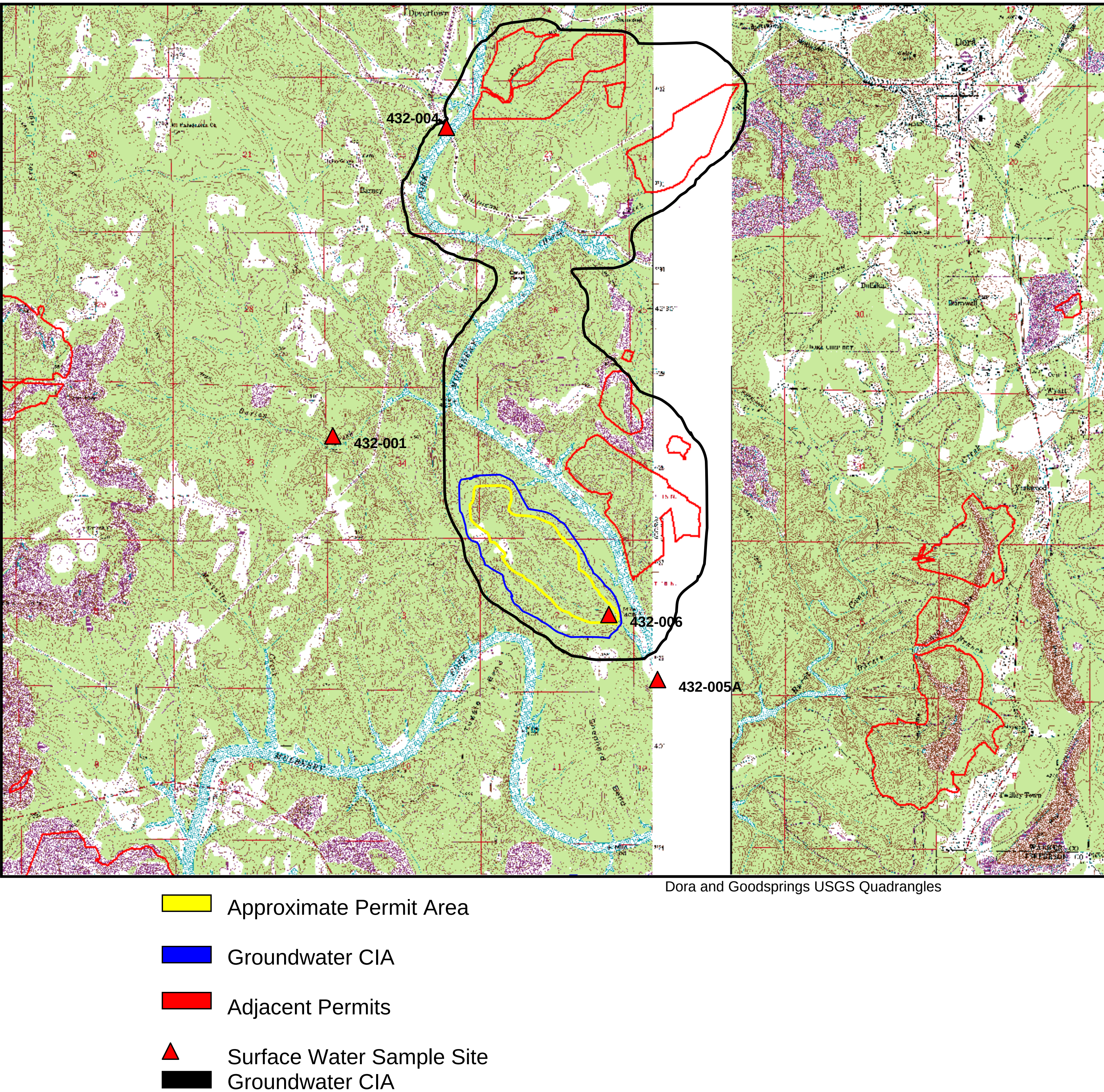
Predicted quality at average flow (1.50 csm)

	BEFORE MINING	DURING MINING	AFTER MINING
pH	7.10 s.u.	7.19 s.u.	7.12 s.u.
Specific Conductance	195 umhos	193 umhos	207 umhos
TSS	5.38 mg/l	5.89 mg/l	5.86 mg/l
Fe	0.66 mg/l	0.71 mg/l	0.70 mg/l
Mn	0.08 mg/l	0.09 mg/l	0.09 mg/l

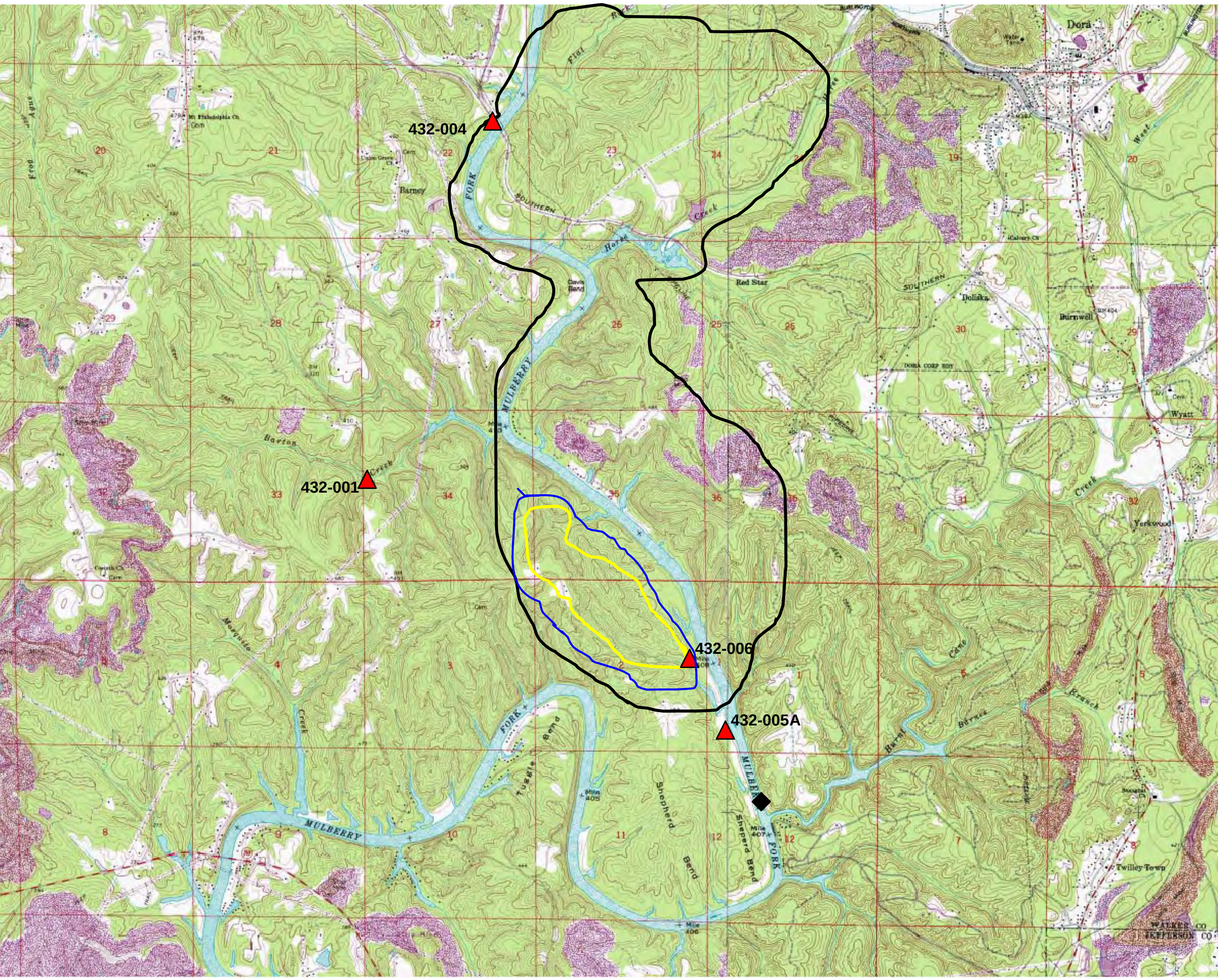
Predicted quality at 2-year high flow (191.11 csm)

	BEFORE MINING	DURING MINING	AFTER MINING
pH	6.34 s.u.	6.50 s.u.	6.43 s.u.
Specific Conductance	77 umhos	103 umhos	90 umhos
TSS	20.84 mg/l	19.91 mg/l	19.89 mg/l
Fe	2.68 mg/l	2.55 mg/l	2.54 mg/l
Mn	0.41 mg/l	0.38 mg/l	0.38 mg/l

Map 1a


432-004
432-001
432-006
432-005A
Dora and Goodsprings USGS Quadrangles
Approximate Permit Area
Groundwater CIA
Adjacent Permits
Surface Water Sample Site
Groundwater CIA

Map 1b



Dora and Goodsprings Quadrangles

Approximate Permit Area

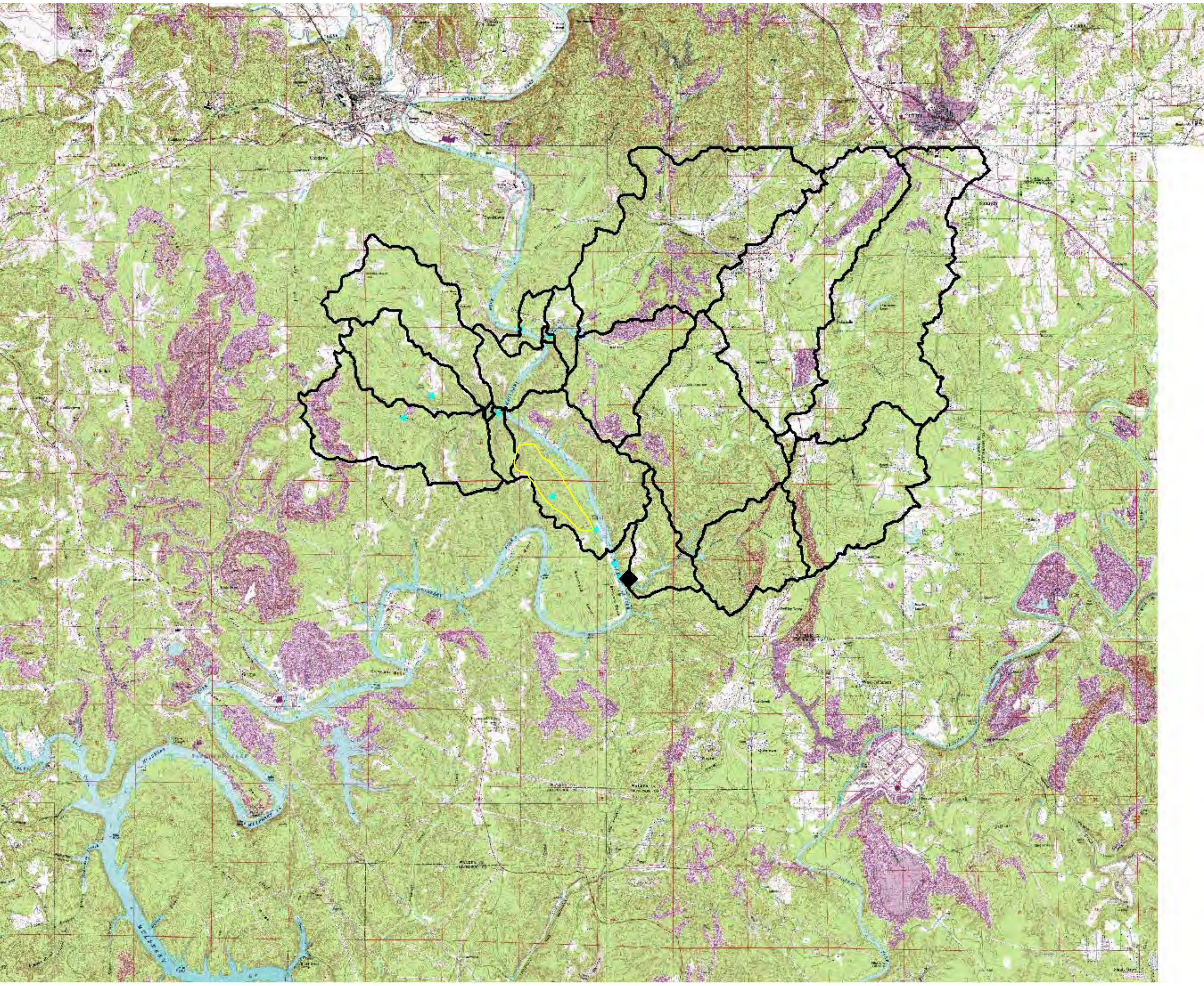
Groundwater CIA

Surface Water Sample Site

Groundwater CIA

Birmingham Water Works Intake Pump

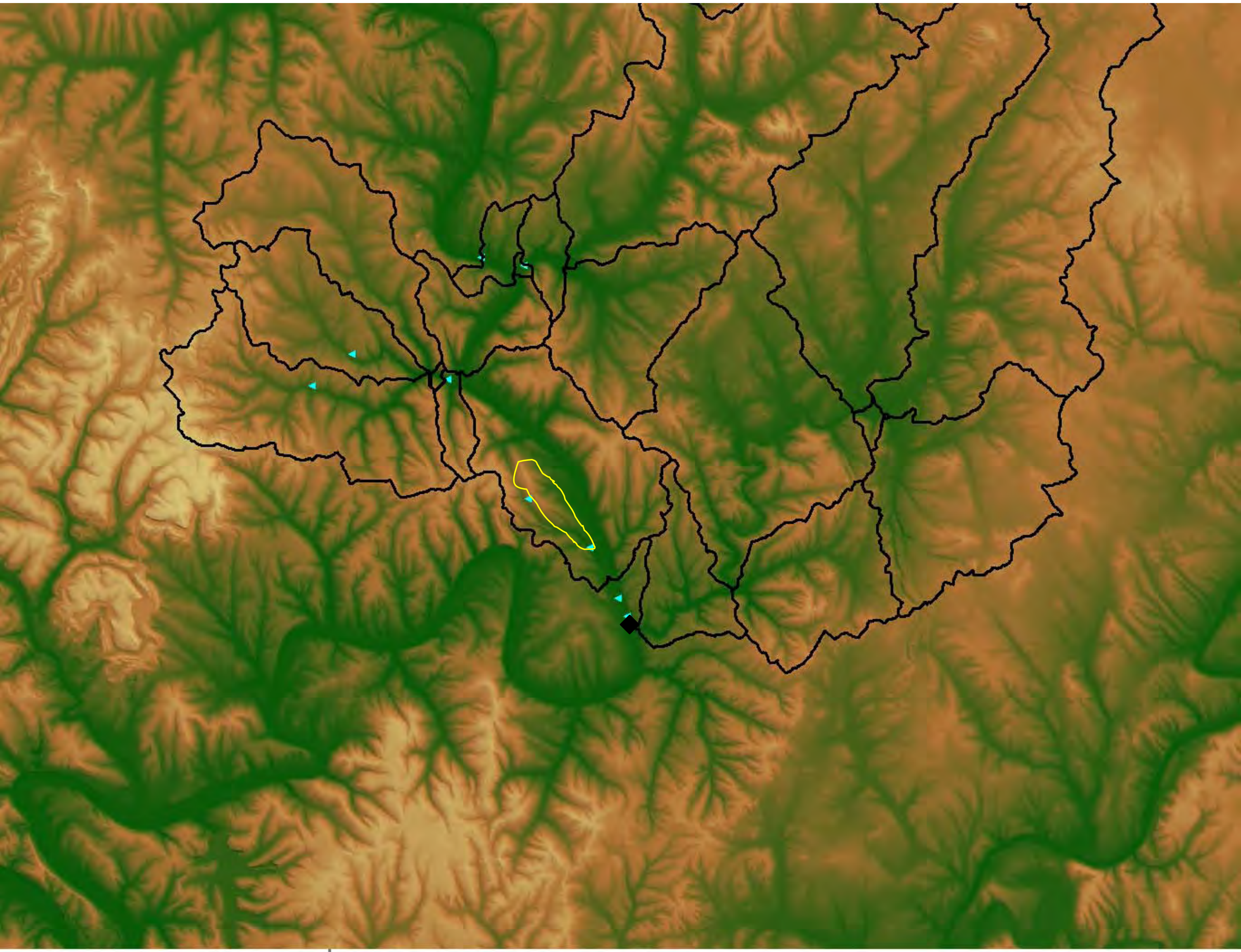
Map 2a
Watershed Delineation



Approximate Permit Area

Birmingham Water Works Intake Pump

Map 2b
Watershed Delineation
Digital Elevation Model Map



Approximate Permit Area
Birmingham Water Works Intake Pump

BASED ON THESE FINDINGS, I RECOMMEND THAT THIS PERMIT BE ISSUED.

DATE: OCTOBER 19, 2010

Mark Woodley

Mark Woodley, Permit Manager

/ns

EXHIBIT 4

THE BIRMINGHAM
WATER WORKS BOARD

December 16, 2010

Mr. Russell A. Kelly, Chief
Permits and Services Branch
Alabama Department of Environmental Management
P. O. Box 301463
Montgomery, AL 36130-1463

Re: **Comments Regarding Reed Minerals Mine No. 5 NPDES Draft Permit AL0079936**

Dear Mr. Kelly:

The Water Works Board of the City of Birmingham (Board) would like to provide the following comments regarding the Department issued draft permit for the Reed Minerals Mine No 5 (AL0079936) located in Walker County. This facility would discharge to the Mulberry Fork, upstream of the Board's primary drinking water intake. The Mulberry Intake has been in operation since 1989 and serves approximately 200,000 people in the Birmingham area. The Board is concerned that this proposed mine has the potential to adversely impact the Birmingham area drinking water. We understand that coal mining is a very important industry in Alabama and are not opposed to coal mining activities in the Black Warrior River basin. However, steps must be taken to protect water resources when mining activities have the potential to impact the Birmingham area drinking water supply. The Board's concerns for this draft permit are given below:

- The proximity of the proposed mining operation to such a major municipal water supply intake poses a potential hazard to drinking water users. The proposed permit appears to have been developed primarily from federal guidelines for coal mining operations. These guidelines were developed for use in permitting typical mining operations across the entire nation, not for the circumstance where a surface mining operation would be conjoined with a major municipal water supply intake. A review of these guidelines and their supporting documents reveals that protection of major public water supplies was not explicitly considered in their development. The permit limits and monitoring requirements are wholly inadequate to protect the Board and its customers from many pollutants commonly associated with mining activities.

- The iron and manganese limits are not protective of drinking water uses. The NPDES permit limitations include daily average total iron concentrations of 3.0 mg/L (with daily maximum of 6.0 mg/L), daily average total manganese concentrations of 2.0 mg/L (daily maximum of 4.0 mg/L), daily average total suspended solids (TSS) of 35.0 mg/L (with a daily maximum of 70.0 mg/L), and pH ranging from 6.0-9.0 (daily minimum and maximum, respectively). The permit also notes that the manganese limitations are not applicable if pH is 6.0 or higher and total iron is less than 10 mg/L.

The Safe Drinking Water Act includes secondary maximum contaminant levels (MCLs) for total iron concentrations of 0.3 mg/L and total manganese of 0.050 mg/L. The average concentrations allowed by the NPDES permit are ten times the secondary MCL for iron and forty times the secondary MCL for manganese. By comparison, the daily average raw water concentrations for iron and manganese for the Western Filter Plant in 2007 were 0.057 mg/L and 0.079 mg/L, respectively. Iron and manganese can cause significant aesthetic problems in drinking water, including consumers' perceptions of the quality of the drinking water, staining of clothes and basins, and taste of the water.

The proposed NPDES permit specifies discharge limits for total iron and manganese concentrations, however, the speciation of the iron and manganese (i.e. whether Fe and Mn are in reduced or oxidized states) will significantly impact the ability of the Board's existing treatment facilities to remove iron and manganese. For example, if Fe^{2+} and Mn^{2+} are primarily present in the discharge waters and enter the plant in the reduced oxidation states rather than as particulate iron and manganese, the current treatment process train will not be able to remove them. Speciation of iron and manganese in the discharges is needed to assess whether additional treatment would be required to oxidize the Fe^{2+} and Mn^{2+} and then remove the precipitates. However, even if the iron and manganese is present in particulate form in the discharge waters, opportunities may exist for the particulate iron and manganese to become reduced either in the riverbed sediments or in the treatment plant. Costly operational changes to the treatment plant may be required if iron and manganese precipitation and subsequent reduction occurs in the raw water storage tanks or in the sedimentation basins.

The Board's Western Filter Plant may also be impacted by higher particle loading from TSS, iron, and manganese, which would require additional operations and maintenance (e.g. removing solids from the raw water storage tanks, increasing coagulant dosages to remove additional turbidity, more frequent backwashing of filters due to reduced filter run times, and generation of more wastewater) and may reduce the overall treatment flow rating of the plant.

- The permit does not address the protection of the public water supply from pollution by many other mining-related pollutants, including toxic metals. Of significant concern is the potential presence of other contaminants in the discharge waters that may impact the source water. Coal in this region of Alabama has been associated with other elements that may impact water treatment, including arsenic, (described by the USGS as "well above the average for all U.S. coal"), sulfur, salinity, mercury and others. Drainage from coal mines often has elevated concentrations of not just iron and manganese, but many other metals including lead, zinc, copper, and cadmium. **Appendix A** provides a summary of data collected for the National Coal Resources Data System (NCRDS). Based on our review of data from the NCRDS trace elements can be found in very high concentrations at sites near the Mulberry Fork intake. It is expected that these trace metals will also be found in high concentrations in stormwater runoff from exposed coal. Coal samples taken near the Reed Minerals Mine No 5 site exhibit relatively high concentrations of aluminum, arsenic, lead, and mercury. See the attached Technical Memoranda **Appendix B** *Coal Mine Drainage and Water Quality Study* and **Appendix C** *Surface Water Quality Analysis* for results of water quality studies conducted at a nearby mining site.

If the NPDES permit allows discharges of iron and manganese concentrations over 10-40 times higher than maximum contaminant levels, it is reasonable to presume that other pollutants associated with coal mine drainage could also greatly exceed levels necessary to protect aquatic life and drinking water. These elements, which are not currently included in the discharge permit, could significantly impact the treatment process needs of the water supply and drastically increase costs of treatment and potentially impact public health. For example, arsenic removal would require additional processes, and demand and require increased chemical dosages. Further, the presence of ammonia would significantly complicate the disinfection strategy employed at the Western Filter Plant. Additional discharge limitations on the range of elements found in the coal that could impact the Board drinking water source should be established. Further, total dissolved solids (TDS) may be high in the coal beds and should be limited to avoid exceeding the 500 mg/L TDS secondary MCL; if high TDS levels are observed at the Western Filter Plant intake, the only (and very costly) option for reducing TDS is reverse osmosis. To better evaluate the probable impacts of these discharges on operations at the Board's Western Filter Plant, additional analysis is needed beyond what is included in the NPDES permit. The impact of the flow rates at the various outfalls should be evaluated on a seasonal basis relative to river flows to estimate the anticipated concentrations of iron, manganese, and TSS at Mulberry Fork Intake. Further study is also required to determine what other elements/compounds may occur in the discharges and additional costs of treatment associated with those discharges.

- Attached as **Appendix D** is a presentation given to ADEM on December 5th, 2008 regarding the potential impacts of a newly proposed coal mine on the Western Filter Plant. Based on our findings in this presentation, we recommend that the following contaminants be added to the permit with the limits identified in the table below:

Parameter	**Suggested Limit (mg/L)**
Antimony	0.1
Copper	0.4
Chromium	0.2
Zinc	0.8
Mercury	<0.0003
Lead	<0.01
Arsenic	<0.01
Bromide	<0.05

Further, we request the following contaminants be included in the NPDES permit for reporting:

- Aluminum
- BETX
- Lithium
- Molybdenum
- Pyritic Sulfur
- Selenium
- Strontium
- Turbidity
- TOC
- DOC

- The permit does not address the fact that there is no assimilative capacity for Bromide in this stretch of the river. **Appendix E** is a presentation given at the annual American Water Works Association (AWWA) meeting regarding the impacts of Bromide on the Mulberry Intake. Pilot testing presented in this presentation proves that Bromide at 0.05 mg/L can cause significant treatment problems at the Western Filter Plant, thereby jeopardizing public health of customers in the Western Filter Plant's service areas. Furthermore, the effluent limits negotiated with Umicore consumes all the assimilative capacity or the river in a drought. Since Bromide is known to occur naturally in the environment and since it is not certain that it does not exist at this mine, we request that a limit be placed on Bromide for the Reed Minerals No 5 Mine to be less than 0.05 mg/L for Bromide.

- The Board is currently regulated under the Stage 1 Disinfectants/Disinfection Byproducts (D/DBP) Rule and, in 2012, will be regulated under the Stage 2 D/DBP Rule. Under these rules, the maximum contaminant levels for Total Trihalomethanes and Haloacetic acids have been established based on potential health risks to the public. A major influence on the formation of these compounds is the amount of Total Organic Carbon (TOC) in the source water. The water treatment process can remove some TOC, but not all of it. **Appendix F** is a summary of the findings of the literature regarding coal mine runoff and the organic content of that runoff. This information supports the addition of TOC as a monitored parameter.

- The reasonable potential analysis (RPA) completed is not protective of the public water supply. It is not appropriate to set background concentrations to zero for this analysis. There are sample data available for the river, and we believe those should be used in this analysis. Furthermore, to be conservative regarding the potential to exceed water quality limits, the background concentrations should be assumed to be no less that the detection limits for a given contaminant.

- The EPA Form 2C and 2D analyses and predictions submitted with this application and required as part of the permit are not protective of the public water supply. In each case, the assumed water quality from the mine's outfalls is predicted based on a single sample. In the case of the Form 2D prediction, the sample is taken from a mine with minerals that may, or may not, be similar to the mine in question. A more robust analysis is required to accurately predict the water quality of the mine discharge.

- The maximum pH limit is not protective of designated uses. The NPDES permit includes a provision that would allow a maximum daily pH of 10.5 standard units. This is well outside the range of water quality criteria deemed protective of aquatic life uses. Additionally, this pH level would exacerbate the toxicity of other constituents. The solubility of many toxic metals (for which the permit includes no limits) would increase. At this pH, even extremely low concentrations of ammonia could be toxic to aquatic life.

- A recent study titled *Comparison of Sewage and Coal Mine Wastes on Stream Macroinvertebrates Within an Otherwise Clean Upland Catchment, Southeastern Australia* **(Appendix G)** was able to isolate the effect of mine drainage on macroinvertebrates in a clean stream network. The researchers detected biological impairment from the mine pollution source without other polluting effects to confound the source of impairment.

- The permit application does not adequately address controls on metals in stormwater runoff from mining operations. The NPDES metals limits on stormwater runoff are even less protective than for the non-precipitation-related discharges. No limits are included for any metals except iron for small precipitation events, and these iron limits are over 20 times the MCL. Larger storm events have no metals limits at all. Of special note, runoff of acid or ferruginous drainage from coal refuse disposal piles include no metals limits at all, even for 1-year, 24-hour storm events.

- The NPDES Permit could allow large slugs of suspended solids to Mulberry Fork: The permit includes no limits for total suspended solids in stormwater runoff (only settleable solids), essentially allowing unlimited discharges of fine, non-settleable suspended solids such as clays and fine silts. Given the extreme land disturbance associated with surface mining-and high rate of erosion expected - this could allow large slugs of suspended solids in runoff from even small precipitation events. This in turn could have deleterious effects on aquatic life and greatly increase solids removals costs in the water treatment plant.

  Of special concern is the potential for catastrophic movement of solids into the stream during large storm events, either as the result of impoundment failure or precipitation-induced mass wastage of mining materials on high slopes. The permit includes no limits on solids for >10-year storm events, essentially providing no protection from such events. Similarly, the permit includes no hard requirement for the permittee to develop a BMP plan to contain solids, and no such plan was available to the reviewers. Catastrophic solids loading events could not only affect the water quality at the intake, it could endanger the intake itself by burial, clogging, or other damage.

- The NPDES permit provides little protection from post-mining impacts. According to section I.A.2 of the permit, permit limits would cease to apply upon revegetation of the site and Phase II bond release. This provides no long-term protection of the drinking water intake from potential post-mining drainage problems such as failure of vegetation, acid mine seepage, or other inadequacies of post-mining reclamation.3

- The SPCC plan should be modified to include language that the Board be notified immediately of any on-site fuel spills or any other spills of potentially hazardous materials.

- ADEM's surface mining rules have design specifications for sedimentation basins and emergency spillways, including special requirements for those in the drainage course of a public water supply. However, no design plans were submitted with the permit application. How will ADEM ensure the applicant meets these regulations?

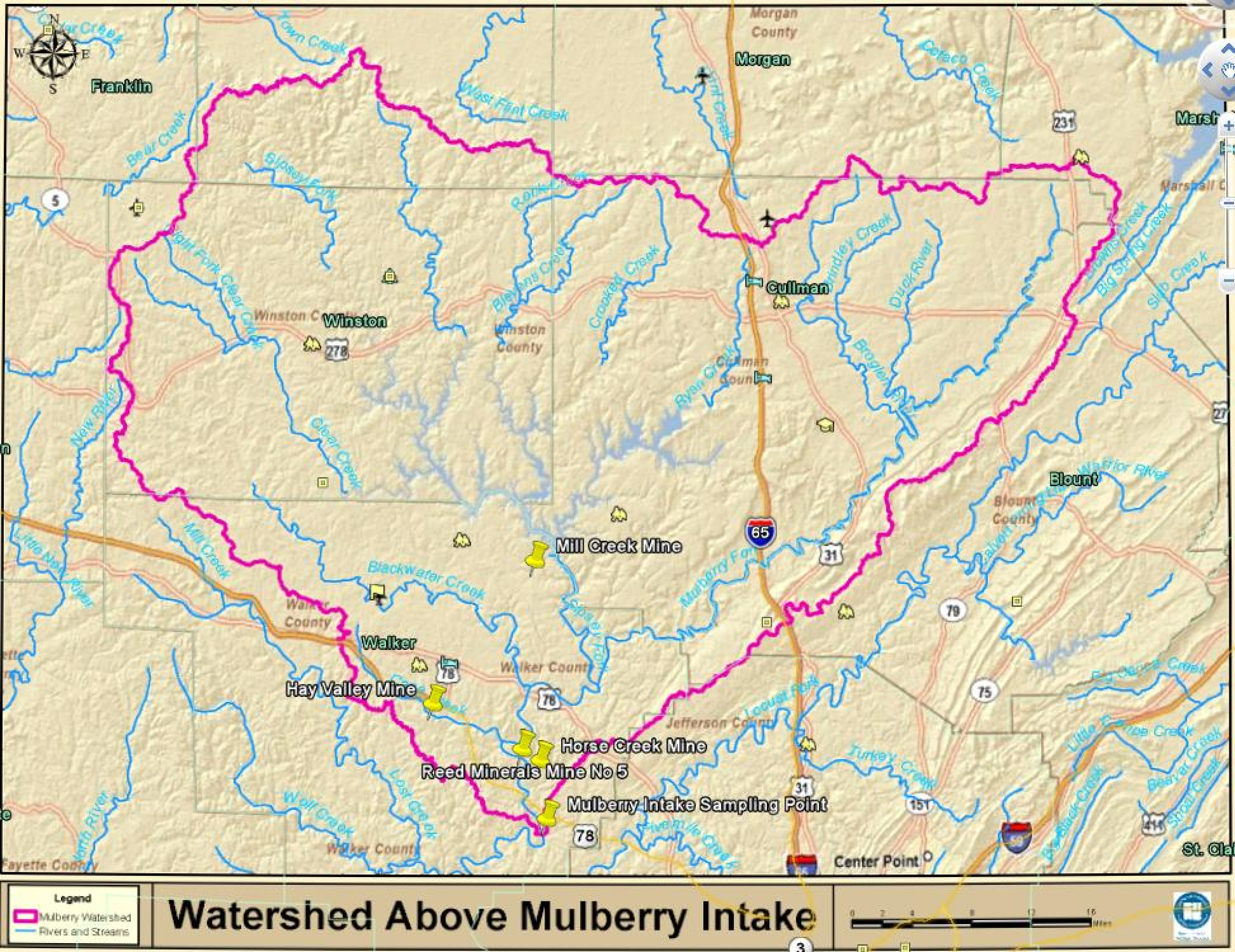
The Board appreciates the opportunity to provide information regarding this issue. Please email me at djones@bwwsb.com or call 205-244-4404 if you have any questions or comments.

Very Truly Yours,

Darryl R. Jones

Darryl R. Jones, P.E.
Assistant General Manager
Operations and Technical Services

Cc:
Mr. Vernon H. Crockett, Chief, Stormwater Management Branch
Mr. Jonathan Hall, Chief, Mining and Natural Resources Section



Watershed Above Mulberry Intake

APPENDIX A

Trace Elements in Samples Collected from Coal Fields in the Vicinity of the BWWB Public Water Supply Intake

Introduction

A review was completed to determine concentrations of specific trace elements in coal fields in the vicinity of the BWWB public water supply intake located on the Mulberry Fork of the Black Warrior River in Walker County, Alabama (Figure 1). Trace element concentrations are provide in the *U.S. Geological Survey Open File Report 97-134,* which contains a database of analytical data, sample locations, descriptive information, analytical methods and sampling techniques, database perspective, and bibliographic references for selected coal field samples in Walker County, Alabama. All sample locations were mapped to determine the concentration of trace elements within the vicinity of the BWWB public water supply intake and local watershed. The attached table (Table 1) represents the concentrations of trace elements in samples collected from coal fields near the BWWB public water supply intake. All concentrations are provided in parts per million or milligrams per kilogram.

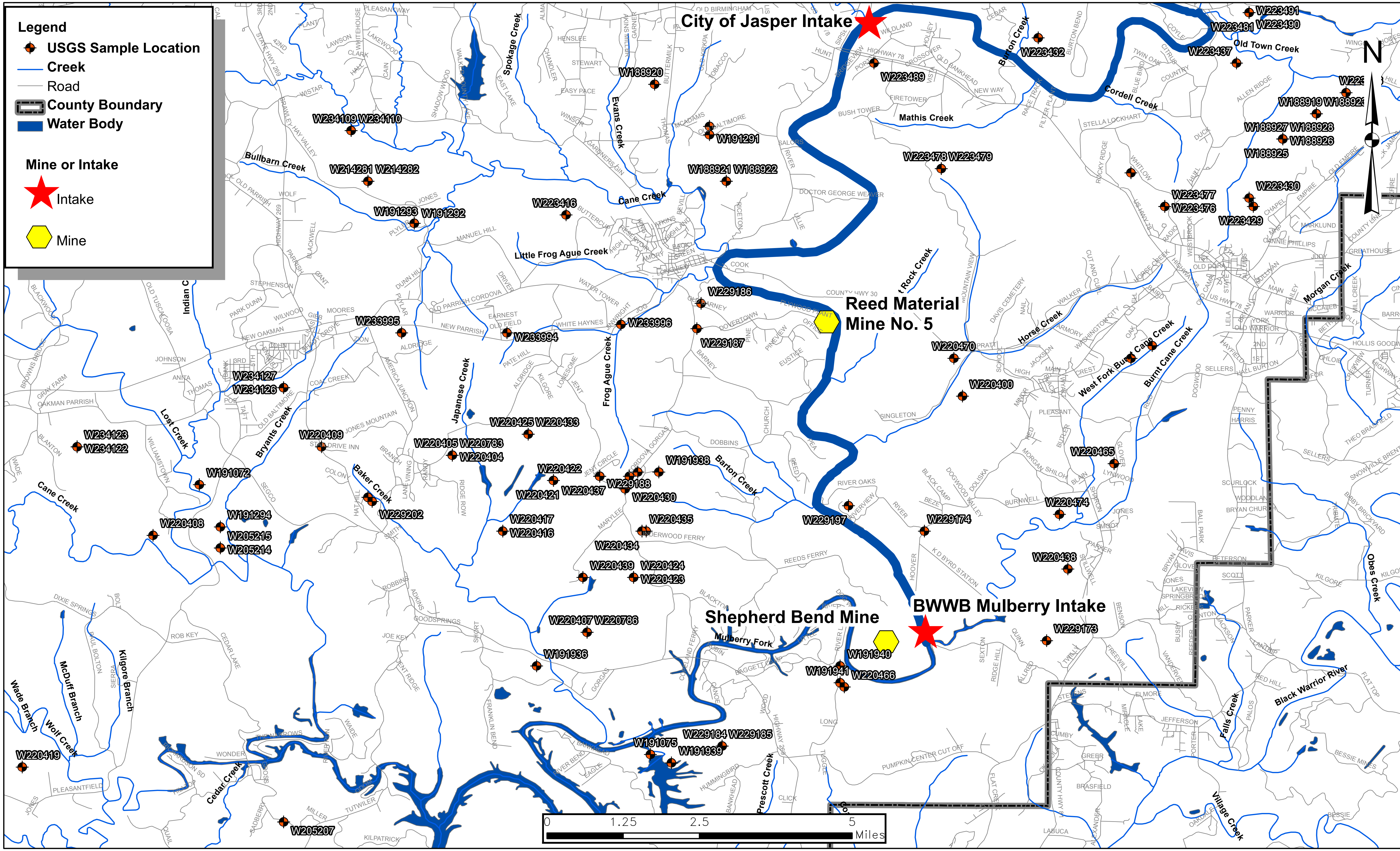
USGS Database Background

During the energy crisis of the mid-1970s the U.S. Geological Survey (USGS), in cooperation with State Geological Surveys, initiated a project to create a comprehensive national coal information database. This database, known as the National Coal Resources Data System (NCRDS), was to contain information on the quantity and quality of domestic coal resources. A major objective was to locate, measure, and characterize all of the Nation's coal resources, without regard to bed thickness, depth, location, or quality. An initial goal of the project was to obtain and characterize at least one sample per coal bed from every geographic quadrangle (approximately 50 sq. miles) underlain by coal. During the nearly 30 years since its inception, the NCRDS's Coal Quality database has developed into the largest publicly available database of coal fields. The data are used primarily by state Geological Surveys, university researchers, and other federal and state agencies.

The EPA utilizes the USGS Coal Quality database for Clean Water Act and Clean Air Act evaluations. The 1990 Amendments to the Clean Air Act (U.S. Statutes, 1990) cite more than a dozen elements as potential hazardous air pollutants and EPA uses the USGS Coal Quality database to conduct studies of the toxic air emissions from coal burning utilities. The EPA also uses the Coal Quality database for evaluations of coal bed methane (CBM) wastewater and water quality and runoff from coal mining sites.

Conclusion

Review of the database indicates that trace elements are present at significant concentrations in coal fields located near the BWWB intake (Table 1). Further, concentrations of these trace elements would be expected in stormwater runoff from mine tailings, abandoned mines, and coal piles.



USGS SAMPLE LOCATIONS OF TRACE ELEMENTS IN ALABAMA COAL FIELDS
NEAR THE BWWB PUBLIC WATER SUPPLY INTAKE

December 10, 2008

FIGURE 1

Table 1. Total Trace Element Concentrations in Samples Collected from Coal Fields Near the BWWB Public Water Supply Intake
(All concentrations in mg/Kg or parts per million)

USGS Sample No.	Aluminum	Iron	Sulfur	Arsenic	Bromine	Chromium	Mercury	Manganese	Molybdenum	Lead	Antimony	Selenium	Strontium	Zinc
W191072	35,000	8,200	1,200	11	2	31	0.14	13	3.2	9.1	0.61	5.2	470	6.4
W191074	8,000	8,000	1,100	18	1	9.1	0.22	12	2.3	1.1	0.31	3	110	4
W191075	27,000	16,000	1,100	13	4	23	0.31	11	4	6.4	1.3	6	160	10
W191292	24,000	7,400	990	10	4	20	0.22	20	1.6	5.8	0.53	1	69	8.4
W191293	23,000	5,800	760	7.1	4	19	0.28	13	1.9	5.1	0.39	1.5	120	8.3
W191294	27,000	9,400	1,200	8.1	2	32	0.11	11	5.6	11	1.8	6.8	360	5
W191936	34,000	8,400	920	20	1	25	0.22	13	2.9	7.5	0.74	4.5	250	8.7
W191937	40,000	16,000	1,100	40	2	35	0.39	18	5.1	16	3	6.3	460	11
W191938	12,000	9,600	510	20	2	10	0.23	7.7	4	3.6	3.1	2	62	9.5
W191939	14,000	13,000	970	7.8	1	12	0.21	7	2.7	3.7	0.67	2.7	200	5.1
W191940	21,000	10,000	990	5.6	1	20	0.02	16	2.9	4.4	0.56	4.9	140	7
W191941	26,000	12,000	660	18	1	25	0.24	14	13	11	2	6	180	7.6
W205206	12,000	5,600	1,300	39	2.1	14	0.09	14	8.6	5.7	0.9	2.7	110	9.4
W205207	12,000	11,000	1,600	21	2.3	16	0.2	17	4.8	7	2	2.1	110	9.8
W205214	14,000	4,300	710	8	2.1	16	0.02	17	2.7	6.9	4	1	90	19
W205215	15,000	7,400	1,200	15	2.5	17	0.2	9.9	1.8	6.2	0.6	1.8	630	5.5
W220400	19,000	7,200	930	3.3	4.7	20	0.24	240	0.17	3.8	2.2	5.3	160	31
W220404	14,000	13,000	870	22	1	19	0.21	9.6	2.2	3.8	1.5	3.4	330	3.6
W220405	9,500	5,900	630	29	1.7	16	0.25	4.9	3.9	3.5	4.3	2	76	10
W220407	12,000	3,000	510	3.6	1.1	14	0.05	13	4.9	3.7	1.7	2.1	240	15
W220408	20,000	8,000	850	48	1.8	25	0.23	10	3	5.5	0.77	3.2	740	4.8
W220409	27,000	9,600	750	140	2	30	0.24	11	2.4	4.9	1.9	4.9	400	4.2
W220416	16,000	3,800	560	11	1	18	0.22	6.3	1.6	5.6	0.44	3.4	88	13
W220417	9,400	4,800	640	5.8	1.7	18	0.25	6	3	2.7	5.8	2.7	170	3.7
W220421	17,000	8,900	870	32	1.3	20	0.19	14	1.7	4.3	1.1	3.7	380	3.7
W220422	12,000	3,900	340	4.7	1.3	15	0.08	8.2	1.3	4.3	4.3	2	46	7.8
W220423	15,000	30,000	1,200	140	0.92	42	0.53	13	5.3	2.8	3.7	4.5	150	7.3

Table 1. Total Trace Element Concentrations in Samples Collected from
Coal Fields Near the BWWB Public Water Supply Intake
(All concentrations in mg/Kg or parts per million)

USGS Sample No.	Aluminum	Iron	Sulfur	Arsenic	Bromine	Chromium	Mercury	Manganese	Molybdenum	Lead	Antimony	Selenium	Strontium	Zinc
W220424	9,400	11,000	240	100	1.1	12	0.39	14	1.4	4.1	5.5	2.2	48	28
W220425	18,000	12,000	820	76	1.3	18	0.21	8.9	1.8	3.8	0.72	4.8	310	3.7
W220430	12,000	2,900	420	11	1.5	15	0.08	7.2	2	4.3	6.9	1.6	67	6.3
W220432	30,000	18,000	1,500	12	1	31	0.2	26	1.5	6.2	0.34	4.7	540	6.8
W220433	11,000	3,200	420	15	1.2	14	0.12	15	4.9	3.9	3.6	2.6	61	7.3
W220434	17,000	12,000	950	15	1.3	20	0.4	12	2.6	5.4	1.3	4.3	530	4.3
W220435	8,400	9,600	560	130	1.4	13	0.19	5.8	2.8	3.1	5.3	2.2	38	7.7
W220436	23,000	9,500	1,100	20	1.7	27	0.3	14	2.4	5.6	1.5	4.4	520	4.5
W220437	10,000	4,600	720	15	1.4	16	0.17	7.4	4.6	3.6	3.3	2	120	5.4
W220438	16,000	2,900	300	13	1.6	15	0.34	11	0.37	4.1	1.4	0.7	95	6.3
W220439	9,000	2,500	360	7	2.7	13	0.08	3.9	2.1	3.3	5.5	4.1	50	6.6
W220464	3,000	11,000	690	19	1.8	6.2	0.43	7.6	0	0.3	2.2	2.1	27	8.4
W220465	13,000	13,000	390	28	5.4	15	0.34	5.9	1.6	2.7	1.1	8.4	32	8.1
W220466	16,000	7,500	640	29	0.95	20	0.25	10	2.9	3.3	1.3	3	150	4.8
W220470	22,000	4,200	620	4	6.8	21	0.05	7.8	0.91	3.6	0.6	1.6	88	8.4
W220471	4,300	17,000	310	170	1.7	8.4	0.19	6.7	12	1	5.8	1.8	17	9
W220472	5,200	4,600	290	15	2.8	8.8	0.24	3	3.3	1.3	3.2	1	14	9.4
W220473	12,000	33,000	1,100	130	1.6	14	0.2	110	11	0.89	2	1.8	31	15
W220474	22,000	6,600	3,000	26	8.7	28	0.05	11	0.48	3.2	3.9	1.3	30	17
W220783	27,000	8,700	680	19	1.2	31	0.38	7.3	6.7	5.6	2.1	7.5	280	4.7
W220786	12,000	18,000	870	86	0.78	13	0.4	11	4.7	0.84	1.4	2.7	140	5.5
W223416	18,000	16,000	530	600	5.8	19	0.41	7.8	0.43	4.3	3.4	1.4	62	4.9
W223429	9,000	14,000	400	150	2.3	20	0.35	17	5.7	4.9	4.3	2.5	25	20
W223476	22,000	3,500	320	6.9	2.2	19	0.2	7.9	1.1	3.8	0.36	1.4	160	4.9
W223477	16,000	9,200	400	61	2.2	15	0.25	13	5.8	3.1	3.5	1.5	22	26
W229173	17,000	5,800	680	4.9	4.8	15	0.05	25	1.8	5.6	1.3	1.3	140	11
W229174	16,000	9,800	240	110	3.5	15	0.13	17	0.68	3.8	1.7	1.3	92	26

Table 1. Total Trace Element Concentrations in Samples Collected from Coal Fields Near the BWWB Public Water Supply Intake
(All concentrations in mg/Kg or parts per million)

USGS Sample No.	Aluminum	Iron	Sulfur	Arsenic	Bromine	Chromium	Mercury	Manganese	Molybdenum	Lead	Antimony	Selenium	Strontium	Zinc
W229184	15,000	10,000	580	26	2.1	15	0.22	11	2.5	6.8	1.5	2.2	120	7.4
W229185	17,000	49,000	570	170	2.2	18	0.52	7.7	0	13	14	3.4	77	26
W229186	29,000	14,000	980	69	3	24	0.18	20	1.1	12	0.98	2.3	250	14
W229187	9,800	22,000	550	150	1.9	16	0.52	12	0	4.9	2.5	1.8	63	6.2
W229188	5,300	1,600	260	1.1	2.4	4.9	0.06	2.7	0.9	2.2	3.8	0.52	23	3.7
W229197	14,000	30,000	670	320	2.2	14	0.44	15	1.4	5.2	1.8	1.4	52	9.1
W229202	9,200	3,600	4,100	2.4	4.1	13	0.06	15	0.75	7.3	4.5	1.2	36	21
W229203	41,000	14,000	700	44	4	43	0.29	13	5.9	19	2.6	9.4	840	7.9
W229204	11,000	2,300	450	6.9	2.8	14	0.05	4.7	4.2	5.4	4.2	1.9	48	10
W233994	4,100	36,000	860	120	1.7	6.2	0.12	29	0	3.4	10	1.7	45	9.4
W233995	45,000	23,000	1,100	110	2.3	72	0.06	30	3.4	31	6.5	9	250	88
W233996	22,000	24,000	680	150	3	21	0.04	18	1.5	7.8	2.1	1.6	140	15
W234124	18,000	10,000	1,000	98	3.4	18	0.09	18	4	7.6	0.53	4.3	380	9.7
W234125	10,000	8,400	780	15	2.4	16	0.09	7.1	7.2	5.7	3.6	2.9	79	7.3
W234126	31,000	17,000	1,100	32	2	34	0.15	34	7.1	15	3.1	10	860	23
W234127	11,000	6,200	770	15	1.8	14	0.04	4.7	8.7	5.9	5	1.9	73	28

APPENDIX B

1. Executive Summary

The Birmingham Water Works Board (Board) utilizes the Mulberry Fork as a primary water source for the Western Filter Plant (WFP). A coal mine has recently been proposed adjacent to the Board's Mulberry intake with outfalls being located approximately 800 feet upstream. The Board has raised concern regarding the impact of this mine on the raw water quality and subsequent treatment at WFP. Therefore, a sampling and analysis plan was developed to determine the possible increase in concentrations of metals and organics due to mine runoff. The mine to be evaluated is approximately 1.5 miles upstream of the Board's Mulberry intake on the east bank of Mulberry Fork.

The Board has conducted Acid Base Accounting (ABA) tests on five coal bearing samples collected from the Black Warrior River watershed in July 2009. Based on test results, this coal bearing material is expected to generate acidic conditions. As no reported natural neutralization potential exists in these samples, the acidic waters produced are likely runoff dumps during rain events. Therefore, operational processes should be considered to reduce the potential of acidic runoff. The operational processes may either be directed toward the control and treatment of the runoff or the implementation of controls to reduce the oxidation of sulfides in these materials on the dumps and waste dumps.

Should acidic conditions become pervasive, these coal bearing materials are likely to leach metals into the environment, some at concentrations above current Mulberry Fork levels and various local and federal limits. Based on the synthetic leaching tests (SPLP) the metals of greatest concern are: aluminum, arsenic, iron, manganese, and zinc.

Only one of the five samples was reported to leach BETX. Both benzene and toluene were leached at concentrations above the EPA drinking water standards for this sample.

Total organic carbon concentrations reported within the leachate from the SPLP tests ranged from 2.7 to 4.5 weight %. The impact of this additional amount of organic carbon to Mulberry Fork watershed is unknown at this time.

2. Study Background

The Board utilizes the Mulberry Fork as a primary water source for the Western Filter Plant. A coal mine has recently been proposed adjacent to the Board's Mulberry intake with outfalls being located approximately 800 feet upstream. The Board has raised concern regarding the impact of this mine on the raw water quality and subsequent treatment at WFP. Therefore, a sampling and analysis plan (SAP) was developed to determine possible increases in concentrations of metals and organics due to mine runoff (*Sampling and Analysis Plan for the Shepherd Bend Coal Mine Waste Rock & Coal Rejects; Coal Mine Drainage and Water Quality Study dated October 2008*). The mine to be evaluated is approximately 1.5 miles upstream of the BWWB's Mulberry intake on the east bank of Mulberry Fork.

3. Material Sampling

Five (5) samples of coal bearing materials were collected in accordance with the SAP authorized by the Board. These samples were collected within the Black Warrior River watershed near an active coal mine that uses the nearby site for processing the coal bearing materials. Each of the five samples were split and placed into two Ziploc bags and sent to the two ALS laboratories for analysis.

4. Sample Analysis

Two splits from each of the five (5) samples were analyzed by two ALS laboratories: ALS Environmental Division located in Houston Texas; and, ALS Minerals Division located in Reno Nevada. The samples were analyzed in accordance with the SAP authorized by the Board. ALS Houston performed the metal/organic leaching tests and ALS Reno performed the acid base accounting (ABA) tests.

Synthetic Precipitation and Leaching Potential (SPLP) anlyses (EPA Method 1312) were performed at the ALS Houston facility. The SPLP metals extraction / leachate were performed using a 1:1 ratio of sample to extraction fluid. Normally EPA Method 1312 calls for a 1:20 extraction / leachate ratio. The use of the 1:1 ratio was done to lower the methods detection limits for leached metals and organics and to increase the likelihood of observing potential impacts that might occur from the leaching of the coal bearing materials. The dissolved organic carbon (DOC) analyses were performed on the 7 day distilled water leachate from the five samples. All reported sample results passed laboratory QA/QC procedures and requirements and are considered a fair representation of the likely leachate chemistry from a rain event. Metals analyzed included: aluminum, antimony, arsenic, cadmium, chromium, copper, iron, lead, lithium, manganese, mercury, molybdenum, nickel, selenium, silver, strontium, titanium, and zinc. Organics and non-metals analyzed included: BETX (Benzene, Ethyl Benzene, Toluene, and Xylenes), Bromide, dissolved organic carbon, and total organic carbon.

Acid Base Accounting (ABA) tests were performed at the ALS Reno facility. The ABA tests were performed using industry standard methods based on Sobek (*Sobek, A., Schuller, Freeman, W.J. and Smith, R. (1978), Field and Laboratory Methods Applicable to Overburdens* *and Minesoil, EPA report no. EPA-600/2-78-054 p.47-50*). The results are reported in tons of calcium carbonate required to neutralize the acid for every 1000 tons of ore that may be oxidized. The pH reported is a paste pH thus reflecting the pH of small amounts of water that are in contact with this material, such as after a rain event. Additionally, the laboratory quantified the total sulfur in each sample and the amount of sulfur that was present in the form of sulfide sulfur. Sulfide sulfur is the form that may be oxidized and form sulfuric acid, initiating the condition referred to as acid mine drainage. The lowering of the pH under these types of conditions may also increase the leaching of the metals contained within the coal bearing materials, simulated by the SPLP tests described above.

5. Sample Results

5.1 Synthetic Precipitation and Leaching Potential (SPLP) – EPA Method 1312.

Metal concentrations above the method detection limits (MDL) in the SPLP leachate were observed for: aluminum, antimony, arsenic, chromium, iron, lithium, manganese, mercury, nickel, strontium, titanium, and zinc (see Table 1). Metal concentrations associated with four (4) or five (5) of the samples were reported above the MDL including: **aluminum** (average value 0.85 mg/L), **lithium** (average value 0.01 mg/L), **strontium** (average value 0.03 mg/L), and **zinc** (average value 0.07 mg/L).

- Metal concentrations in SPLP leachate that exceeded current average Mulberry Fork concentrations for one or more samples included: aluminum, iron, manganese, nickel, titanium, and zinc.
- Metal concentrations in SPLP leachate that exceeded anti-degradation limits for one or more samples included: arsenic and zinc.
- Metal concentrations in SPLP leachate that exceeded suggested mine permit limits for one or more samples included: arsenic and mercury.
- Metal concentrations in SPLP leachate that exceeded EPA Primary (or Secondary) Drinking Water Standards for one or more samples included: aluminum, antimony, arsenic (secondary), iron (secondary), manganese (secondary), and mercury.

Organics and non-metal concentrations (see Table 2) above the method detection limits in the SPLP leachate were observed for: benzene and toluene only in one of the five samples (sample number 4).

- Organics and non-metal in SPLP leachate that exceeded EPA Primary (or Secondary) Drinking Water Standards for one or more samples included: benzene and toluene.

Dissolved organic carbon from the distilled water leach was reported in two of the five samples while total organic carbon concentration ranged from 2.7 to 4.5 weight percent for the five SPLP leachate samples.

5.2 Acid Base Accounting (ABA)

Maximum potential acidity (MPA) ranged from 7.8 to 84.4 tons $CaCO_3$/1000 tons of ore. Based on industry best practices (*Managing Sulphidic Mine Wastes and Acid Drainage, Environment Australia, 1997; Best Practice Environmental Management in Mining*) and government guidelines (*EPA/DOE Mine Waste Technology Program, various annual reports*). Materials having MPA values less than 10 are generally considered to be non-acid producing material. Materials having MPA values from 10 to 20 are considered to be non-definitive for acid generation. Materials with an MPA greater than 20 are considered likely to produce acidic conditions if no natural conditions or operational procedures are available to counter-act the acid generation and/or oxidation of sulfide sulfur (most prevalently pyrite).

The neutralization potential of a material may arise from many sources which may include: contained carbonates, silicates, and other minerals that consume acid when in contact with acidic conditions. The neutralization potential of the material is determined through titration of the material with an acid. For the five samples, the neutralization potential was reported between 0 and 2 tons $CaCO_3$/1000 tons of ore. These values are very low and represent material that has little buffering capacity towards acidic conditions.

If the neutralization potential of a material is greater than the potential to generate acid and the kinetics of these reactions is adequate, then the material on balance would not be considered to be acid generating. The net neutralization potential (NNP) represents this overall acidic reaction of the materials. For the five samples these are all negative numbers indicating that there is a propensity to generate acid with no buffering capacity to mediate the resultant acidic waters.

The paste pH results show that oxidization of sulfides within the coal bearing material sampled is not currently occurring (pH >7). However, the potential for sulfide oxidation is present based on ABA results, with the exception of Sample #2 where the paste pH suggests that oxidation is occurring and that sufficient sulfides are present to lower the pH of water in contact with this material to acidic conditions (pH = 4.1). It is not unusual for samples with high pyrite contents to show this type of analysis pattern.

The total sulfur and sulfide sulfur results support the MPA and paste pH results described above. Sulfide sulfur is found in all five samples and comprises most all of the sulfur found in the samples. These reported results indicate that sulfide sulfur is present in the coal bearing materials sampled and analyzed, and this sulfide sulfur may be oxidized to generate acidic conditions.

6. Summary Findings

Five samples of coal bearing material were sampled and sent to ALS analytical laboratories located in Houston and Reno for leaching and acid generation testing. All samples were under standard chain-of-custody procedures throughout the collection and transfer to the analytical facilities.

Based on the ABA tests, this coal bearing material is expected to generate acidic conditions. As no reported natural neutralization potential exists in these samples, the acidic waters produced are likely runoff dumps during rain events. Therefore, operational processes should be considered to reduce the potential of acidic runoff. The operational processes may either be directed toward the control and treatment of the runoff or the implementation of controls to reduce the oxidation of sulfides in these materials on the dumps and waste dumps.

Should acidic conditions become pervasive, these coal bearing materials are likely to leach metals into the environment, some at concentrations above current creek levels and various local and federal limits. Based on the SPLP tests the metals of greatest concern are: aluminum, arsenic, iron, manganese, and zinc.

Only one of the five samples was reported to leach BETX. Both benzene and toluene were leached at concentrations above the EPA drinking water standards for this sample.

Total organic carbon concentrations reported within the leachate from the SPLP tests ranged from 2.7 to 4.5 weight %. The impact of this additional amount of organic carbon to Mulberry Fork watershed is unknown at this time and not part of this study.

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Table 1. Leachable Metal Concentrations.
Results of Synthetic Precipitation and Leaching Procedure (SPLP) [USEPA Method 1312]
(All concentrations are reported in mg/L)

	Aluminum	Antimony	Arsenic	Cadmium	Chromium	Copper	Iron	Lead	Lithium
Sample 1	**3.400**	*<0.005*	*<0.005*	*<0.00060*	*<0.00060*	*<0.005*	**0.822**	*<0.00040*	**0.0255**
Sample 2	**0.104**	*<0.005*	**0.00922**	*<0.00060*	*<0.00060*	*<0.005*	**18.6**	*<0.00040*	**0.0064**
Sample 3	**0.308**	**0.00793**	*<0.005*	*<0.00060*	*<0.00060*	*<0.005*	*<0.036*	*<0.00040*	**0.0292**
Sample 4	**0.163**	*<0.005*	**0.00672**	*<0.00060*	*<0.00060*	*<0.005*	*<0.036*	*<0.00040*	*<0.0050*
Sample 5	**0.149**	*<0.005*	*<0.005*	*<0.00060*	**0.00705**	*<0.005*	*<0.036*	*<0.00040*	**0.0063**
Average Value in Mulberry Fork [1]	0.060	0.01	0.01	0.015	0.05	0.05	0.11	0.01	___
Antidegradation Limit [2]	NS	0.0104	0.009	NS	0.0505	0.0516	NS	0.0092	NS
Suggested Mine Permit Limit [3]		<0.1	<0.01		0.2	0.4		<0.01	
EPA Primary Drinking Water Standards [4]	0.05 to 0.2 [5]	0.006	0.01 0.0 [6]	0.005	0.1	1.3	0.3 [5]	0.015 0.0 [6]	NS

	Manganese	Mercury	Molybdenum	Nickel	Selenium	Silver	Strontium	Titanium	Zinc
Sample 1	**0.0141**	*<0.000042*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	**0.03030**	**0.0246**	**0.095**
Sample 2	**0.0614**	**0.000262**	*<0.005*	**0.0536**	*<0.005*	*<0.005*	**0.08970**	*<0.005*	**0.198**
Sample 3	*<0.005*	*<0.000042*	*<0.005*	**0.0050**	*<0.005*	*<0.005*	**0.00691**	*<0.005*	**0.019**
Sample 4	*<0.005*	*<0.000042*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	**0.00746**	*<0.005*	**0.011**
Sample 5	*<0.005*	*<0.000042*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	**0.022**
Average Value in Mulberry Fork [1]	0.06	0.0003	___	0.05	___	0.05	___	0.01	0.05
Antidegradation Limit [2]	NS	0.0003	NS	NS	NS	NS	NS	NS	0.0537
Suggested Mine Permit Limit [3]		<0.0003							0.8
EPA Primary Drinking Water Standards [4]	0.05 [5]	0.002	NS	NS	0.05	0.10 [5]	NS	NS	5 [5]

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Table 1. Leachable Metal Concentrations.

Results of Synthetic Precipitation and Leaching Procedure (SPLP) [USEPA Method 1312]

(All concentrations are reported in mg/L)

1) Average Value in Mulberry Fork from "Shepheard Bend Mine: Potential Impacts on the Mulberry and Drinking Water Concerns" presented by Patty Barron, P.E. and Patrick Flannelly, P.E. October 2008

2) Antidegradation Limit from "Shepheard Bend Mine: Potential Impacts on the Mulberry and Drinking Water Concerns" presented by Patty Barron, P.E. and Patrick Flannelly, P.E. October 2008

3) Suggested Mine Permit Limit from "Shepheard Bend Mine: Potential Impacts on the Mulberry and Drinking Water Concerns" presented by Patty Barron, P.E. and Patrick Flannelly, P.E. October 2008

4) EPA Primary Drinking Water Standards - Natioinal Primary Dinking Water Regulations

5) EPA Secondary Drinking Water Standards - Natioinal Secondary Dinking Water Regulations

6) EPA Primary Drinking Water Standards - Public Health Goal

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Table 2. Leachable Concentrations (Miscellaneous Constituents)
Results of Synthetic Precipitation and Leaching Procedure (SPLP) [USEPA Method 1312]
(SPLP concentrations are reported in ug/Kg)

	Benzene	Bromide	EthylBenzene	DOC	TOC	Toluene	Xylenes
Sample 1	*<25*	*<0.30*	*<25*	***11.0***	***32,200***	*<25*	*<25*
Sample 2	*<25*	*<0.30*	*<25*	***2.67***	***42,500***	*<25*	*<25*
Sample 3	*<25*	*<0.30*	*<25*	*<1*	***45,400***	*<25*	*<25*
Sample 4	**37**	*<0.30*	*<25*	*<1*	***27,100***	***31***	*<25*
Sample 5	*<25*	*<0.30*	*<25*	*<1*	**36,900**	*<25*	*<25*
Average Value in Mulberry Fork (mg/L) [1]	***0.060***						
Antidegradation Limit (mg/L) [2]	***NS***	***NS***	***NS***	***NS***	***NS***	***NS***	***NS***
Suggested Mine Permit Limit (mg/L) [3]		***<0.05***					
EPA Primary Drinking Water Standards (mg/L) [4]	***0.005*** ***0.0*** [6]	***NS***	***0.7***	***NS***	***NS***	***1***	***10***

DOC = Dissovled Organic Carbon; TOC = Total Organic Carbon

1) Average Value in Mulberry Fork from "Shepheard Bend Mine: Potential Impacts on the Mulberry and Drinking Water Concerns" presented by Patty Barron, P.E. and Patrick Flannelly, P.E. October 2008

2) Antidegradation Limit from "Shepheard Bend Mine: Potential Impacts on the Mulberry and Drinking Water Concerns" presented by Patty Barron, P.E. and Patrick Flannelly, P.E. October 2008

3) Suggested Mine Permit Limit from "Shepheard Bend Mine: Potential Impacts on the Mulberry and Drinking Water Concerns" presented by Patty Barron, P.E. and Patrick Flannelly, P.E. October 2008

4) EPA Primary Drinking Water Standards - Natioinal Primary Dinking Water Regulations

5) EPA Secondary Drinking Water Standards - Natioinal Secondary Dinking Water Regulations

6) EPA Primary Drinking Water Standards - Public Health Goal

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Table 3. Acid Generation Potential and Sulfide Sulfur Leachability
Results of Synthetic Acid Base Accounting Procedure (ABA) [Industry Standard Method]

	Maximum Potential Acidity (MPA)	Neutralization Potential (NP)	Net Neutralization Potential (NNP)	NP:MPA Ratio	pH	Total Sulfur (%)	Sulfide Sulfur (%)
Sample 1	7.8	2	-6	0.26	7.1	0.25	0.25
Sample 2	84.4	0	-84	0.00	4.1	2.70	2.66
Sample 3	8.4	1	-7	0.12	7.4	0.27	0.26
Sample 4	10.9	0	-11	0.00	7.9	0.35	0.35
Sample 5	14.1	1	-13	0.07	7.1	0.45	0.45
Average Value in Mulberry Fork (mg/L) [1]	*0.060*						*21*
Antidegradation Limit (mg/L) [2]	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*
Suggested Mine Permit Limit [3]							
EPA Primary Drinking Water Standards [4]	*NS*	*NS*	*NS*	*NS*	*6.5 - 8.5*	*NS*	*NS*

MPA / NP / NNP reporting units = tCaCO3/1000t ore

1) Average Value in Mulberry Fork from "Shepheard Bend Mine: Potential Impacts on the Mulberry and Drinking Water Concerns" presented by Patty Barron, P.E. and Patrick Flannelly, P.E. October 2008

2) Antidegradation Limit from "Shepheard Bend Mine: Potential Impacts on the Mulberry and Drinking Water Concerns" presented by Patty Barron, P.E. and Patrick Flannelly, P.E. October 2008

3) Suggested Mine Permit Limit from "Shepheard Bend Mine: Potential Impacts on the Mulberry and Drinking Water Concerns" presented by Patty Barron, P.E. and Patrick Flannelly, P.E. October 2008

4) EPA Primary Drinking Water Standards - Natioinal Primary Dinking Water Regulations

5) EPA Secondary Drinking Water Standards - Natioinal Secondary Dinking Water Regulations

6) EPA Primary Drinking Water Standards - Public Health Goal

APPENDIX C

1. Summary

The Birmingham Water Works Board (Board) utilizes the Mulberry Fork as a primary water source for the Western Filter Plant (WFP). A surface water sampling plan was developed to aid in determining the potential impacts of a proposed mine near the current Mulberry intake. Since there is an existing coal mine currently in operation upstream of the Mulberry Intake, it was utilized as the focal point for our sampling locations. The mine that was evaluated is approximately 1.5 miles upstream of the Board's Mulberry intake on the east bank of Mulberry Fork. Four locations were sampled a total of seven times between July 2009 and July 2010; two of the events were during wet weather and five events were during dry weather. Below is a list of the locations that were sampled followed by a map of the sites in Figure 1.1.

- Site 1 – Mulberry Intake
- Site 2 – 800 feet downstream of mine outfall
- Site 3 - Mine Outfall
- Site 4 – 800 feet upstream of mine outfall

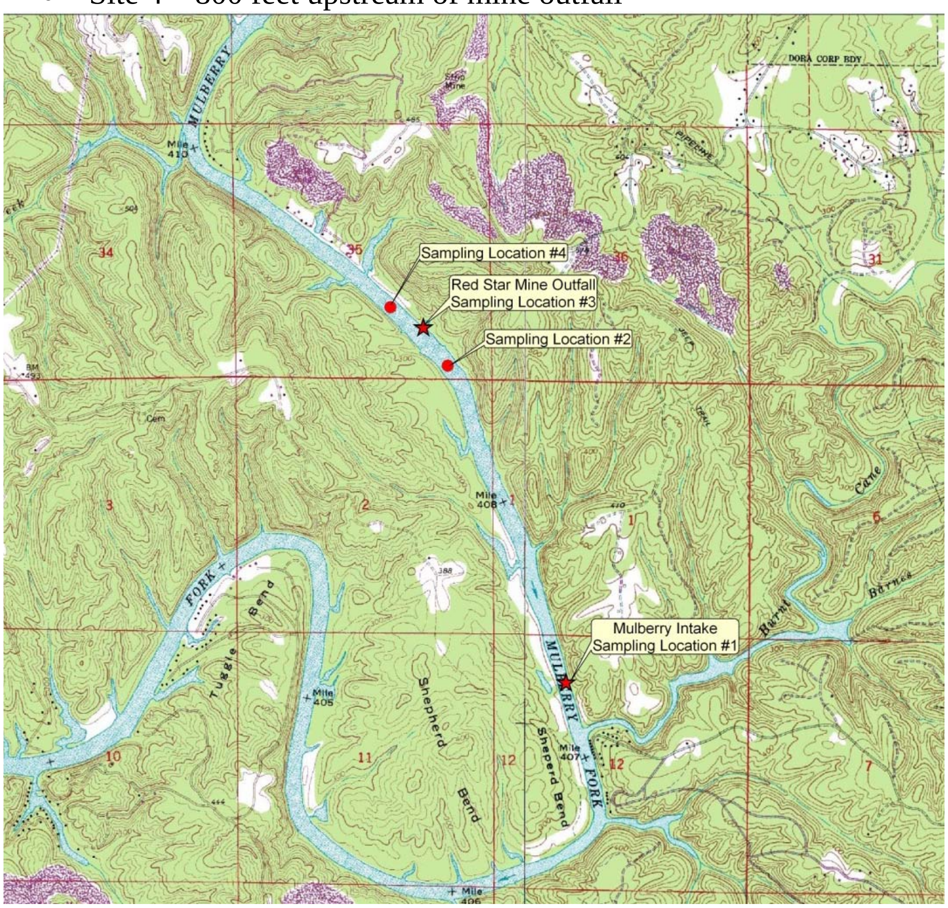

Figure 1.1 – Sampling Site Locations

The sampling results confirmed the potential for several metals to be discharged from the mine outfall at elevated levels as compared to the typical water quality in this reach of the Mulberry Fork. Four of the metals found were consistent with the ones listed as potential concerns in the *Coal Mine Drainage and Water Quality Study* memo (Malcolm Pirnie, September 2009) with the addition of one parameter. The potential metals of concern are aluminum, iron, manganese, zinc, and strontium. All of these metals are regulated except for strontium.

Total organic carbon (TOC) concentrations were elevated at all locations during the July 2009 wet weather sampling event. The concentration discharged from the outfall was greater than that of the other three locations, however the elevated concentration at the intake can not be solely attributed to the mine outfall.

None of the constituents sampled at the mine outfall location were beyond the limits of the mine's current permit. However, it is important to note that aluminum, zinc, strontium, and TOC are not monitoring requirements of the current ADEM permit but were being discharged from the mine outfall at elevated levels.

The following section provides summary tables of the data collected during the sampling events on the Mulberry Fork.

2. Water Quality Data

Background data was collected from the Board's Envirolab for samples collected at the Mulberry Intake. Table 2.1 shows the average water quality seen at the Mulberry intake from monthly samples collected during 2007 and 2008 to be used as a comparison for sampling performed for this effort.

Table 2.1
Mulberry Intake Water Quality

Mulberry Fork Characteristics				
Parameter	**AVG**	**Max**	**Min**	**Units**
Metals*				
Aluminum	0.065	0.270	<0.05	mg/L
Antimony	<0.005	<0.005	<0.005	mg/L
Arsenic	<0.005	<0.005	<0.005	mg/L
Chromium	<0.005	0.06	<0.005	mg/L
Copper	0.024	0.402	<0.01	mg/L
Iron	0.10	1.01	<0.05	mg/L
Lead	<0.005	0.007	<0.005	mg/L
Manganese	0.040	0.148	<0.01	mg/L
Zinc	0.064	0.230	<0.01	mg/L
Mercury	<0.001	<0.001	<0.001	mg/L
IC*				
Bromide	<0.25	<0.25	<0.25	mg/L
Chloride	5.11	23.30	2.08	mg/L
Fluoride	0.06	0.24	<0.05	mg/L
Nitrate as N	0.72	5.89	<0.06	mg/L
Nitrite as N	<0.08	0.36	<0.08	mg/L
Orthophosphate a	<0.17	<0.17	<0.17	mg/L
Sulfate	26.2	82.7	8.3	mg/L
Conductivity	167	370	86	ms/cm
Fecal Coliform	F11	F65	0	cfu/100mL
Hardness	77	126	34	mg/L
TDS	132	280	60	mg/L
TOC	3.1	5.7	1.0	mg/L
TSS	5.0	15	1.2	mg/L
*Data from Envirolab Nov 2007 - 2008 Project 77				

Laboratory analysis was performed at the Board's Envirolab and the Alabama Power Laboratory as noted in the following tables. Table 2.2 and 2.3 shows the data collected during the wet and dry weather events in July 2009 through July 2010.

It is important to note that the wet weather sampling event in November is not an accurate representation of wet weather conditions due to the Site 3 location not producing any runoff at the time of the event. At the time of collection there was not enough precipitation to cause the outfall to discharge. Therefore the samples were collected from the middle of the river in front of the outfall location. The data is however shown below for future comparison purposes when the outfall discharge is flowing and when it is not flowing. Impacts could potentially be noticeable for the future wet weather events.

Table 2.2
Wet Weather Event Water Quality

WET WEATHER EVENTS	Sample Location								
	Site 1 - Mulberry Intake		Site 2 - Downstream of Outfall		Site 3 - Outfall of Mine		Site 4 - Upstream of Outfall		MCL[1]
Parameter	7/22/2009	11/30/2009	7/22/2009	11/30/2009	7/22/2009	11/30/2009[2]	7/22/2009	11/30/2009	
Aluminum (mg/L)	<0.05	<0.05	<0.05	<0.05	0.206	<0.05	<0.05	<0.05	0.2
Antinomy (mg/L) Method 200.9	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.006
Arsenic (mg/L)	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.01
Benzene (mg/L)	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.005
Bromide (mg/L)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-
Chromium (mg/L)	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.1
Chromium-Hexa (Diss) (mg/L)	<0.01	-	<0.01	-	<0.01	-	<0.01	-	-
Copper (mg/L)	<0.01	<0.01	<0.01	<0.01	<0.01	0.025	<0.01	<0.01	1
Dissolved Organic Carbon (DOC) (mg/L)	2.94	2.48	2.75	2.47	3.43	2.36	2.78	2.49	4
Ethlylbenzene (mg/L)	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.7
Iron (mg/L)	0.109	<0.05	0.11	<0.05	0.667	0.136	0.128	<0.05	0.3
Lead (mg/L)	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.015
Lithium (mg/L)*	0.007	<0.003	0.005	<0.003	0.013	<0.003	<0.003	<0.003	-
m,p,-Xylene (mg/L)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.01
Manganese (mg/L)	<0.01	<0.01	0.059	<0.01	0.188	<0.01	0.09	<0.01	0.05
Mercury (mg/L)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.002
Molybdenum (mg/L)*	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-
o-Xylene (mg/L)	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.01
Selenium (mg/L) EPA 200.9	<0.005	-	<0.005	-	<0.005	-	<0.005	-	0.05
Strontium (mg/L)*	0.058	0.032	0.055	0.033	0.401	0.032	0.047	0.029	-
Sulfate (mg/L)	25.1	14.2	22.1	13.5	22.4	14.4	22.7	11.3	250
Sulfide (mg/L)*	<0.01	0.2	0.11	0.11	<0.01	0.07	0.08	0.09	-
Sulfide, Dissolved (mg/L)*	-	0.04	-	0.04	-	<0.01	-	<0.01	-
Toluene (mg/L)	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	1
Total Dissolved Solids (TDS) (mg/L)	78	18	83	23	83	15	88	<5	-
Total Organic Carbon (TOC) (mg/L)	3.61	2.37	3.59	2.41	4.09	2.38	3.33	2.37	4
Zinc (mg/L)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	5
Soluble Aluminum (mg/L)	0.0643	<0.05	0.0635	<0.05	0.0811	<0.05	0.0648	<0.05	-
Soluble Antimony (mg/L)	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	-
Soluble Arsenic (mg/L)	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	-
Soluble Copper (mg/L)	0.025	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-
Soluble Iron (mg/L)	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-
Soluble Lead (mg/L)	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	-
Soluble Lithium (mg/L)*	0.005	<0.003	0.004	<0.003	0.009	<0.003	<0.003	<0.003	-
Soluble Manganese (mg/L)	-	<0.01	-	<0.01	-	<0.01	-	<0.01	-
Soluble Molybdenum (mg/L)*	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-
Soluble Strontium (mg/L)*	0.043	0.031	0.039	0.031	0.307	0.033	0.036	0.028	-
Soluble Zinc (mg/L)	0.028	<0.01	0.0162	<0.01	0.0126	<0.01	0.0469	<0.01	-

*Samples analyzed at AL Power Lab

[1]MCL - for drinking water

Higher than other locations but not regulated

Greater than MCL

Table 2.3
Dry Weather Event Water Quality

DRY WEATHER EVENTS	Sample Location																				
	Site 1 - Mulberry Intake					Site 2 - Downstream of Outfall					Site 3 - Outfall of Mine[2]					Site 4 - Upstream of Outfall					MCL[1]
Parameter	8/18/2009	11/5/2009	3/30/2010	5/28/2010	7/13/2010	8/18/2009	11/5/2009	3/30/2010	5/28/2010	7/13/2010	8/18/2009	11/5/2009	3/30/2010	5/28/2010	7/13/2010	8/18/2009	11/5/2009	3/30/2010	5/28/2010	7/23/2010	MCL
Aluminum (mg/L)	<0.05	0.052	<0.05	0.053	<0.05	<0.05	0.056	<0.05	0.103	<0.05	0.106	<0.05	0.058	0.090	<0.05	<0.05	<0.05	0.065	0.076	<0.05	0.2
Antimony (mg/L) Method 200.9	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.006
Arsenic (mg/L)	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.01
Benzene (mg/L)	<0.0005	<0.0005	<0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005	-	<0.0005	0.005
Bromide (mg/L)	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	-
Chromium (mg/L)	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.1
Chromium-Hexa (Diss) (mg/L)	<0.01	<0.01	<0.01	-	<0.01	<0.01	<0.01	<0.01	-	<0.01	<0.01	<0.01	<0.01	-	<0.01	<0.01	<0.01	<0.01	-	<0.01	-
Copper (mg/L)	<0.005	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.0156	<0.01	<0.01	<0.01	<0.01	1
Dissolved Organic Carbon (DOC) (mg/L)	2.76	3	2.46	2.67	2.87	2.81	3.12	2.37	2.66	2.89	2.71	3.28	2.33	2.75	2.91	2.66	3.55	2.36	2.64	2.91	4
Ethlylbenzene (mg/L)	<0.0005	<0.0005	<0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005	-	<0.0005	0.7
Iron (mg/L)	0.076	0.143	<0.05	0.108	<0.05	0.083	0.055	<0.05	0.177	<0.05	0.396	0.056	<0.05	0.161	<0.05	0.0776	<0.05	<0.05	0.125	<0.05	0.3
Lead (mg/L)	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.015
Lithium (mg/L) *	<0.003	<0.003	<0.003	<0.003	0.021	<0.003	<0.003	<0.003	<0.003	0.02	<0.003	<0.003	<0.003	<0.003	0.02	<0.003	<0.003	<0.003	<0.003	0.02	-
m,p,-Xylene (mg/L)	<0.001	<0.001	<0.001	-	<0.001	<0.001	<0.001	<0.001	-	<0.001	<0.001	<0.001	<0.001	-	<0.001	<0.001	<0.001	<0.001	-	<0.001	0.01
Manganese (mg/L)	0.0241	<0.01	<0.01	0.148	<0.01	-	<0.01	<0.01	0.218	<0.01	0.242	<0.01	<0.01	0.213	<0.01	0.0592	<0.01	<0.001	0.123	<0.01	0.05
Mercury (mg/L)	<0.001	<0.001	-	<0.001	<0.001	<0.001	<0.001	-	<0.001	<0.001	<0.001	<0.001	-	<0.001	<0.001	<0.001	<0.001	-	<0.001	<0.01	0.002
Molybdenum (mg/L) *	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-
o-Xylene (mg/L)	<0.0005	<0.0005	<0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005	-	<0.0005	0.01
Selenium (mg/L) EPA 200.9	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.05
Strontium (mg/L) *	0.051	0.036	0.033	0.035	0.058	0.033	0.034	<0.029	0.037	0.057	0.036	0.037	0.043	0.038	0.056	0.033	0.034	0.029	0.039	0.058	-
Sulfate (mg/L)	29.1	16.5	13	18.7	30.4	15	15.3	13	18	31	15.8	19.8	17.2	20.2	31	18.7	16.6	12.9	19.1	31.2	250
Sulfide (mg/L) *	0.06	0.02	0.03	0.02	0.01	0.06	0.01	0.06	0.04	0.01	<0.01	0.04	0.03	0.04	0.01	0.02	0.02	0.01	0.02	0.02	-
Sulfide - Dissolved (mg/L) *	<0.01	<0.01	0.03	0.02	<0.01	0.02	<0.01	<0.01	0.04	<0.01	<0.01	<0.01	0.03	0.01	0.01	<0.01	<0.01	<0.01	0.01	0.02	-
Toluene (mg/L)	<0.0005	<0.0005	<0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005	-	<0.0005	1
Total Dissolved Solids (TDS) (mg/L)	28	50	53	65	103	23	58	43	55	20	20	58	53	60	23	60	55	28	55	48	-
Total Organic Carbon (TOC) (mg/L)	3	2.72	2.22	2.54	2.68	2.75	2.78	2.15	2.65	3.05	2.99	3.12	2.16	2.59	3.15	2.93	2.68	2.62	2.65	2.94	4
Zinc (mg/L)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.010	<0.01	<0.01	<0.005	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	5
Soluble Aluminum (mg/L)	<0.05	<0.05	<0.05	0.058	<0.05	<0.05	<0.05	<0.05	0.098	<0.05	<0.05	<0.05	<0.05	0.104	<0.05	<0.05	<0.05	<0.05	0.079	<0.05	-
Soluble Antimony (mg/L) EPA 200.8	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	-
Soluble Arsenic (mg/L)	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	-
Soluble Copper (mg/L)	<0.01	<0.01	<0.01	0.0157	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.005	<0.01	<0.01	<0.01	<0.01	<0.01	-
Soluble Iron (mg/L)	<0.05	<0.05	<0.05	0.125	-	<0.05	<0.05	<0.05	0.177	-	<0.05	<0.05	<0.05	0.174	-	<0.05	<0.05	<0.05	0.127	-	-
Soluble Lead (mg/L)	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	-
Soluble Lithium (mg/L)	<0.003	<0.003	<0.003	<0.003	0.017	<0.003	<0.003	<0.003	<0.003	0.016	<0.003	<0.003	<0.003	<0.003	0.017	<0.003	<0.003	<0.003	<0.003	0.016	-
Soluble Manganese (mg/L)	-	<0.01	<0.01	0.149	-	-	<0.01	<0.01	0.192	-	-	<0.01	<0.01	0.207	-	-	<0.01	<0.01	0.119	-	-
Soluble Molybdenum (mg/L)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-
Soluble Strontium (mg/L) *	0.047	0.033	0.03	0.035	0.055	0.032	0.035	0.03	0.035	0.055	0.033	0.039	0.038	0.038	0.055	0.032	0.036	0.029	0.036	0.055	-
Soluble Zinc (mg/L)	0.0345	<0.01	<0.01	0.093	<0.005	<0.01	<0.01	<0.01	0.013	<0.01	0.212	<0.01	<0.01	<0.01	<0.01	0.063	<0.01	<0.01	<0.01	<0.01	-

*Samples analyzed at AL Power Lab

[1]MCL - for drinking water

[2] Sampled in mid-river due to lack of discharge from mine outfall

Higher than other locations but not regulated

Greater than MCL

3. Summary Findings

Focusing on the July 2009 event, while concentrations of the parameters of concern were not seen downstream at elevated levels they are still cause for potential concern if a mine outfall were to be within a close proximity of the Mulberry Intake as proposed for the Shepherd Bend Mine. Also, it is apparent from the data that there are additional contaminants that need to be considered as monitoring requirements for current and future coal mine permits. The following parameters which were seen at elevated levels in the outfall discharge consist of aluminum, iron, manganese, zinc, strontium, and TOC.

An important factor to bring forth when analyzing this data is that the time periods in which these wet weather sampling events took place were particularly wet seasons. Therefore, this data does not represent the typical seasonal weather patterns for this area. It will be important to closely observe future data during the potentially dryer summer and fall conditions in comparison to the current data.

APPENDIX D

Shepherd Bend Mine: Potential Impacts on the Mulberry and Drinking Water Concerns

Presented by:
Patty Barron, P.E.
Patrick Flannelly, P.E.

December 2008

Serving Your Community
Preserving The Environment

Solutions for Life™

Agenda

1. Background
2. BWWB Analysis of Water Quality Impacts
3. Conclusions

Agenda

1. Background
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Alabama Surface Mining Commission Regulations: Chapter 880-X-7C-.04

(2) Upon petition an area may be (but is not required to be) designated as unsuitable for certain types of surface coal mining operations, if the operations will –

- (a) Be incompatible with existing State or local land use plans or program;
- (b) Affect fragile or historic lands in which the operations could result in significant damage to important historic, cultural, scientific, or aesthetic values or natural systems;
- **(c) Affect renewable resource lands in which the operations could result in a substantial loss or reduction of long-range productivity of water supply or of food or fiber products; or**
- (d) Affect natural hazard lands in which the operations could substantially endanger life and property, such lands to include areas subject to frequent flooding and areas of unstable geology.

EPA Antidegradation Policy

Source: EPA website

- Water quality standards include an antidegradation policy and implementation method. The water quality standards regulation requires States and Tribes to establish a three-tiered antidegradation program.
  - **Tier 1** maintains and protects existing uses and water quality conditions necessary to support such uses. An existing use can be established by demonstrating that fishing, swimming, or other uses have actually occurred since November 28, 1975, or that the water quality is suitable to allow such uses to occur. Where an existing use is established, it must be protected even if it is not listed in the water quality standards as a designated use. Tier 1 requirements are applicable to all surface waters.

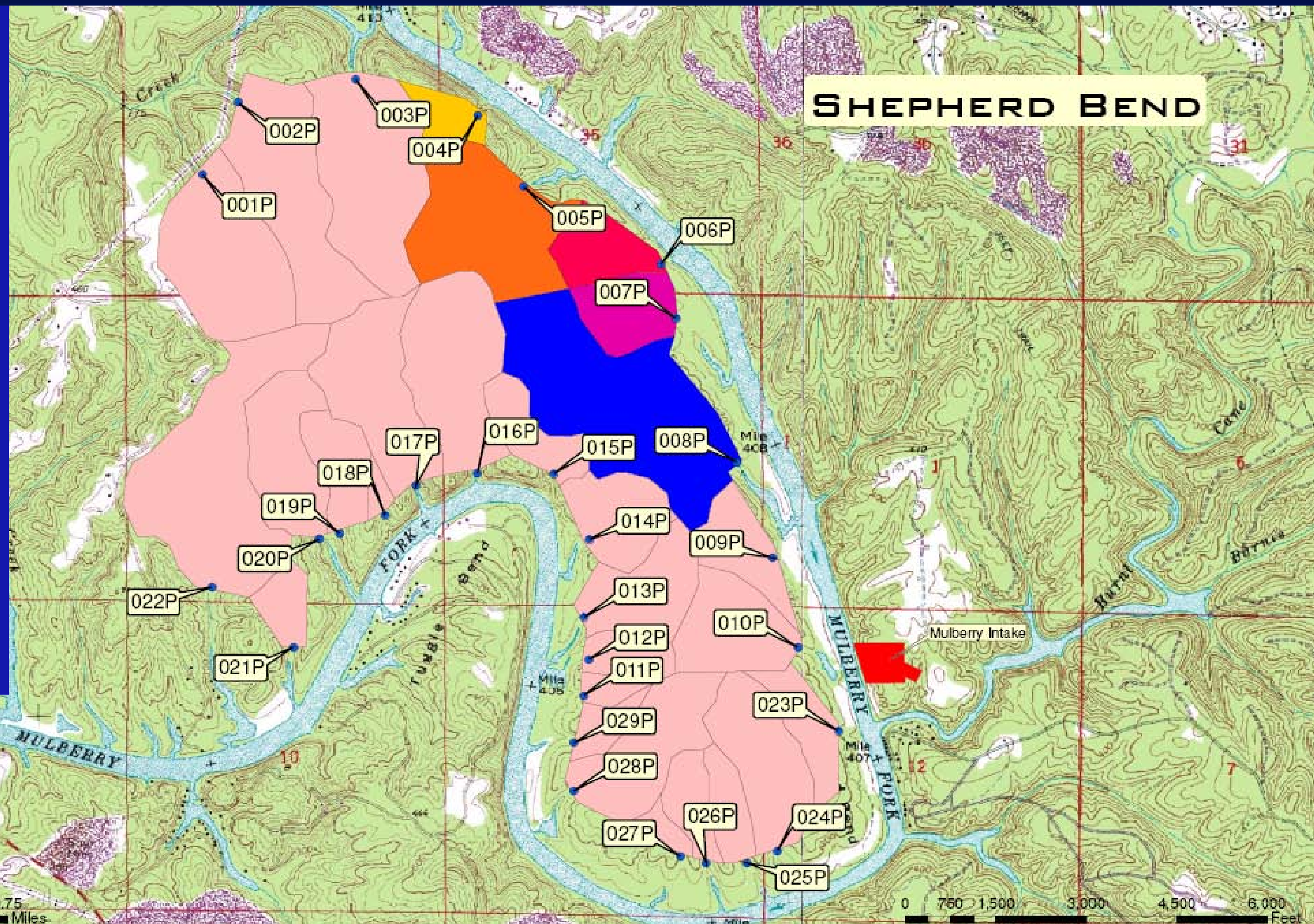
Shepherd Bend Site

- 1773 Total Acres

- 300 Acres will be actively mined during years 1-3 (highlighted)

- 22 proposed total outfalls

-10 proposed outfalls upstream of intake



Mulberry Intake

- Proposed Location of Shepherd Bend Mine is immediately adjacent and upstream of the BWWB's Mulberry Intake
- Mulberry Intake supplies raw water to Western Filter Plant (up to 55 MGD)
- Western Filter Plant supplies water to approximately 200,000 customers
- Several large industrial customers receive raw water from the Mulberry Intake

Timeline of Events

- **November 13, 2007** - ADEM issued the Draft NPDES Permit for Shepherd Bend Mine
- **December 14, 2007** - BWWB issued comment letter to ADEM regarding proposed permit
- **January 30, 2008** - BWWB and Malcolm Pirnie met with Drummond and Shepherd Bend Mine Representatives
- **February 1, 2008** - Malcolm Pirnie sent email to Shepherd Bend Representatives Requesting Data from Meeting - Shepherd Bend Representatives sent several emails with requested data.
- **February 18, 2008** - Shepherd Bend Representatives send letter to Malcolm Pirnie - Dan Holliman - outlining data provided to Malcolm Pirnie .

Timeline of Events

- **<u>March 6, 2008</u>** - BWWB sent response letter to Shepherd Bend Representatives outlining the deficiencies with data provided and requested additional data. (ADEM - Richard Hulcher - copied on letter)

- **<u>March 24, 2008</u>** - Shepherd Bend Representatives submitted a response for BWWB's March 6, 2008 letter. This response included some additional data to review.

- Our evaluation of the information provided by Shepherd Bend Representatives on March 24, 2008 included the following deficiencies:
  - Material storage areas not described – size, location, etc.
  - The description of expected water quality of stormwater coming in contact with stored materials, including a discussion of acid- or toxic-forming potential was not adequate.
  - Location of BMPs was not provided on site maps other than their treatment ponds.
  - No description of chemical treatment was provided.
  - Groundwater base flows were not accounted for in their responses.
  - The basis for water quality design including target pollution rates was not provided.

Timeline of Events

- **July 21st, 2008** – ADEM Issued Permit for Shepherd Bend Mine
- **August 1st, 2008** – Shepherd Bend Mine Permit Active

Agenda

1. Background
2. BWWB Analysis of Water Quality Impacts
3. Conclusions

Screening Level Antidegradation Analysis

- Estimate Impact of Mine on WQ in the Mulberry
- Using Mixing Equation:

$$C_{mixed} = \frac{C_1Q_1 + C_2Q_2}{Q_1 + Q_2}$$

Where:

- C_1 = Concentration from mine (Maximum Suggested Limit)
- C_2 = Background Concentration (ADEM)
- Q_1 = Flow from Mine
- Q_2 = Mulberry Flows (7Q10 – Worst Case)
- C_{mixed} = Concentration in River

Screening Level Antidegradation Analysis

Steps in Calculating Maximum Suggested Permit Limits for Mine:

1. Calculate C_{mixed} which = 10% of the assimilative capacity of the river

2. Enter known data into equation:
   - C_2 = Background Concentration (ADEM)
   - Q_1 = Flow from Mine
   - Q_2 = Mulberry Flows (7Q10 – Worst Case)
   - C_{mixed} = Assimilative Capacity of River

3. Solve for C_1 = Maximum Suggested Permit Limit for Mine

Mixing Calculation..

- Yields a conservative assessment of the water quality impact on the Mulberry and and identifies which parameters we should be concerned about.

- Flows from the mine are based on the areas to be mined in years 1-3 (~300 acres) due to lack of information regarding coal pile storage areas.

- River Flows are based on 7Q10 conditions.

Background Data in Mulberry Fork

Average 2005-2006 Sample Events (provided by ADEM)

Parameters	Avg. Concentration (mg/L)
Ag	0.05
Al	0.06
As	0.01
Cd	0.015
Cr	0.05
Cu	0.05
Fe	*0.11*
Hg	0.29
Mn	*0.06*
Ni	0.05
Pb	0.01
Sb	0.01
Ti	0.01
TSS	*21*
Zn	0.05

Maximum Suggested Limits

- EPA Region 4 Antidegradation Guidance
  - Federally antidegradation policy (40 CFR Section133.12 (a)(2))
  - The lowering of water quality by a pollutant may be considered de minimis if it satisfies all the following criteria:
    - The lowering of water quality uses less than 10 percent of the total assimilative capacity.
    - at least 10 percent of the total assimilative capacity remains unused after the lowering of water quality.“
    - If, after appropriate application of such an alternative, the degradation is not significant, the Tier II decision process is complete without further analysis.
    - Assimilative capacity is defined as the difference between the existing water quality and the set ADEM water quality criteria.

Maximum Suggested Limits

Original Pollutants of Concern (Included in November 2007 Letter to ADEM)

Parameter	WQ Standard	Antidegradation Limit mg/l	Q1 cfs	Q2[3] cfs	C2 mg/l	Suggested Mine Permit Limit C1 mg/l	Literature Review Concentrations mg/l
Al[2]	NS	NS	1	200	0.060		440
As[1]	0.0001205	0.009	1	200	0.01*	<0.01	0.6
Bromide	NS	NS	1	200	-	<0.05	
BTEX	NS	NS	1	200	-		
Cu[1]	0.066	0.0516	1	200	0.050	0.4	6.1
Hg[1]	0.0000419	0.0003	1	200	0.0003*	<0.0003	0.1
Li	NS	NS	1	200	-		
Mo	NS	NS	1	200	-		<1
Pyritic Sulfur	NS	NS	1	200	-		
Sb[1]	0.01379	0.0104	1	200	0.01*	0.1	
Se[1]	0.163	NS	1	200	-		0.03
Sr	NS	NS	1	200	-		
Sulfate[2]	NS	NS	1	200	-		21920
TDS[2]	NS	NS	1	200	-		16000
Turbidity [1]	NS	NS	1	200	-		
Zn[2]	0.0873	0.0537	1	200	0.050*	0.8	23

- = No Data **NS** = No Standard [1] Primary DWS [2] Secondary DWS [3] Estimated 7Q10 flow * MDL used

Maximum Suggested Limits

Additional Pollutants of Concern

Parameter	WQ Standard	Antidegradation Limit mg/l	Q1 cfs	Q2[1] cfs	C2 mg/l	Suggested Mine Permit Limit C1 mg/l	Literature Review Concentrations mg/l
Cr [1]	0.0553	0.0505	1	200	0.05*	0.2	15.7
Pb [1]	0.0017	0.0092	1	200	0.01*	<0.01	0.2

- = No Data **NS** = No Standard [1] Primary DWS [2] Secondary DWS [3] Estimated 7Q10 flow ***** MDL used

Maximum Suggested Limits

- Data Gaps:

Parameter	Reason for not Calculating Limit
Al	No ADEM water quality standard
Bromide	No data and no ADEM water quality standard
BTEX	No data and no ADEM water quality standard
Li	No water quality data for Mulberry
Mo	No data and no ADEM water quality standard
Pyritic Sulfur	No data and no ADEM water quality standard
Se	No water quality data for Mulberry
Sr	No water quality data for Mulberry
Sulfate	No data and no ADEM water quality standard
TDS	No data and no ADEM water quality standard
Turbidity	No water quality data for Mulberry

Agenda

1. Background
2. BWWB Analysis of Water Quality Impacts
3. Conclusions

Conclusions

- The proposed draft permit is not consistent with ASMC Regulations and EPA Antidegradation Policy
- The proposed draft permit is not consistent with the current water use of this segment of the Mulberry – Public Water Supply
- Pollutants listed in our original complaint letter can be found in very high concentrations in coal pile runoff based on reviewed literature.
- Recommended permit limits for: Antimony, Copper, Chromium, Zinc, Mercury, Lead, Arsenic, and Bromide

Conclusions

Based on our analysis using EPA's Region 4 Antidegradation Analysis we request that the following additional limits be added to the NPDES Permit for the mine with appropriate monitoring requirments:

Parameter	Suggested Limit (mg/L)
Antimony[1]	0.1
Copper[1]	0.4
Chromium[1]	0.2
Zinc[2]	0.8
Mercury[1]	<0.0003
Lead[1]	<0.01
Arsenic[1]	<0.01
Bromide	<0.05

Conclusion

Based on the potential for degradation associated with the following parameters, we request that they be added as a monitoring requirement to the NPDES permit for the mine for all active permitted outfalls.

Additional Parameters to be Monitored:

- Al
- BTEX
- Li
- Mo
- Pyritic Sulfur
- Sb
- Se
- Sr
- Sulfate
- TDS
- Turbidity
- TOC

Proposed Future Actions

- BWWB has two sampling programs planned:
  - Surface Water Sampling – (upstream, downstream, and outfall for active mine on the Mulberry)
  - Bench Test – Will be used to characterize spoil material from an active mine near the Mulberry Intake.
- BWWB request additional time to assess the potential impacts of mining activity on the Mulberry Intake.

Questions?

APPENDIX E

Industrial Bromide Waste Increases Disinfection By-Products at a Utility Located 100 Miles Downstream

Adrianna Dimperio, PE

Malcolm Pirnie, Inc.

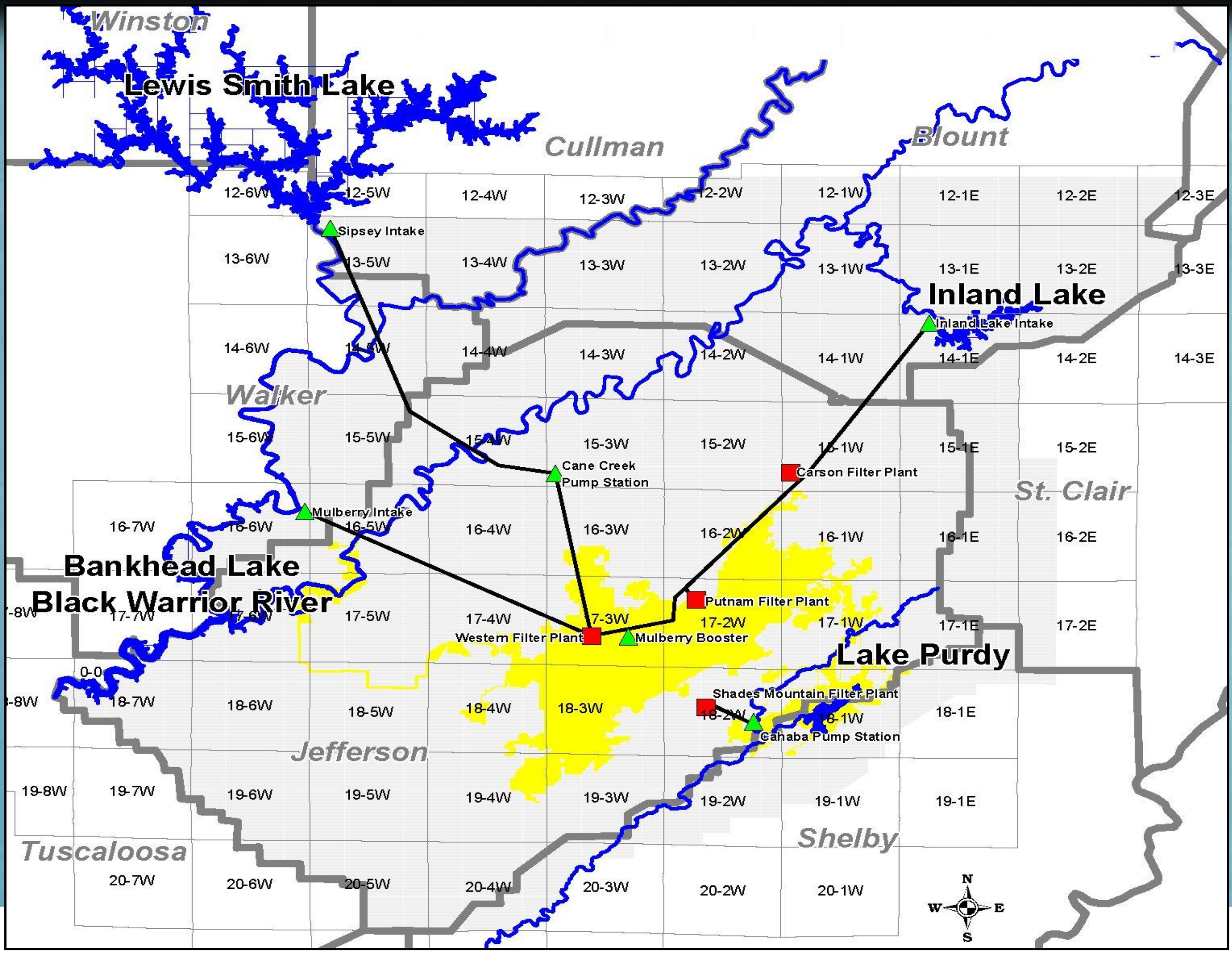
Patty Barron, PE

Birmingham Water Works and Sewer Board

BWWSB Overview
Customers and Demands

- **Largest drinking water utility in Alabama**
- **Supply approximately 680,000 people (approximately 20% of the State of Alabama)**
- **Average daily demand in excess of 100 MGD**
- **28 MGD of raw water is also provided to industrial customers**

BWWSB Overview
Source Water Supply



4 Raw Water Intakes

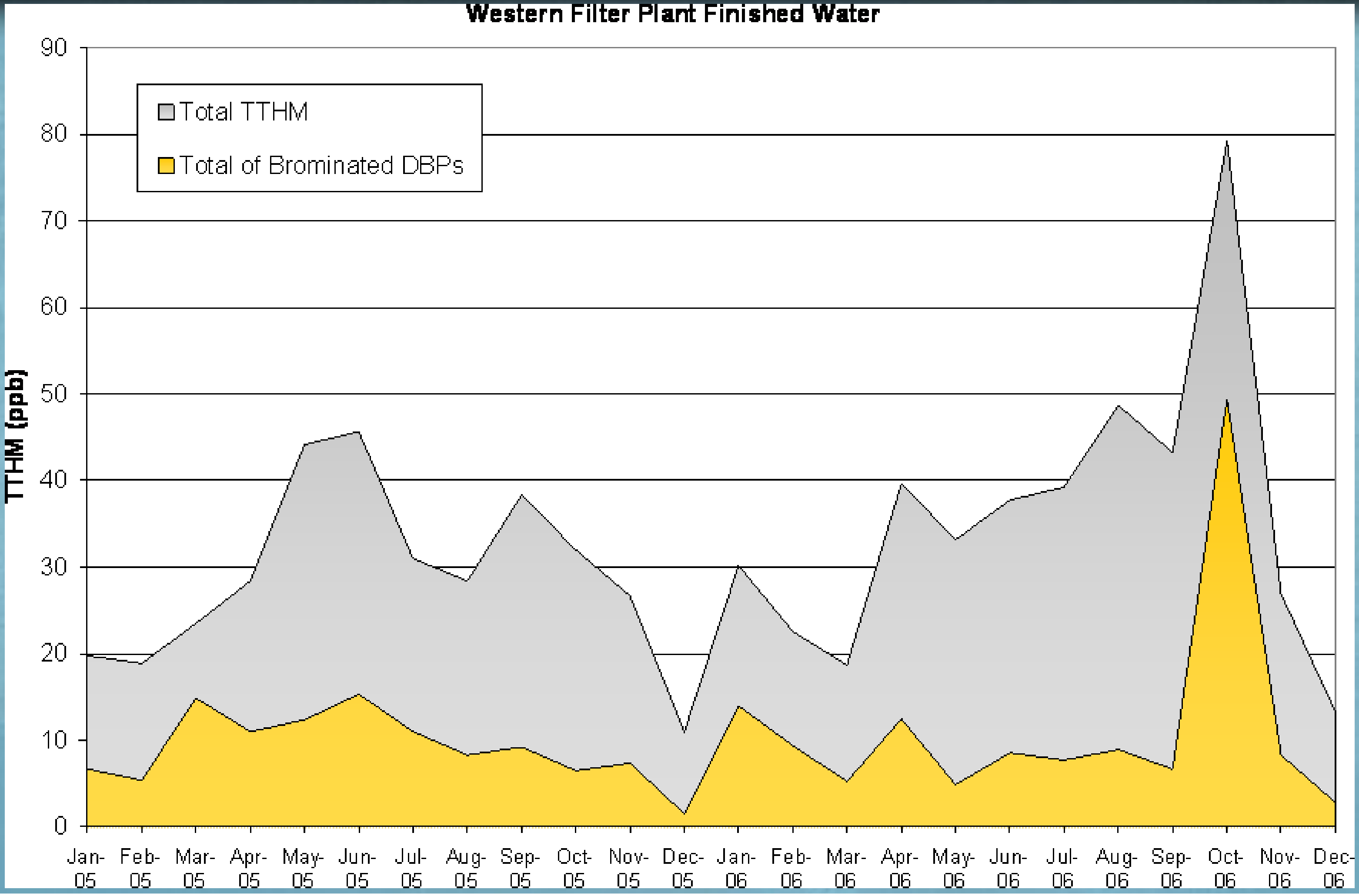
4 Water Treatment Plants

Elevated DBP Occurrence
Timeline of Events

- **Mid-October, 2006 – monthly monitoring DBP samples were collected from the distribution system**
- **October 27, 2006 – ADEM notified BWWSB that a neighboring utility on the Black Warrior River was experiencing increased DBPs**
- **October 27, 2006 – BWWSB Mobile Pilot Plant used to collect DBP samples at Western Filter Plant**
- **October 31, 2006 – PAC dose increased at Western Filter Plant**
- **November 1, 2006 – Mulberry Intake shut down pending further investigation**

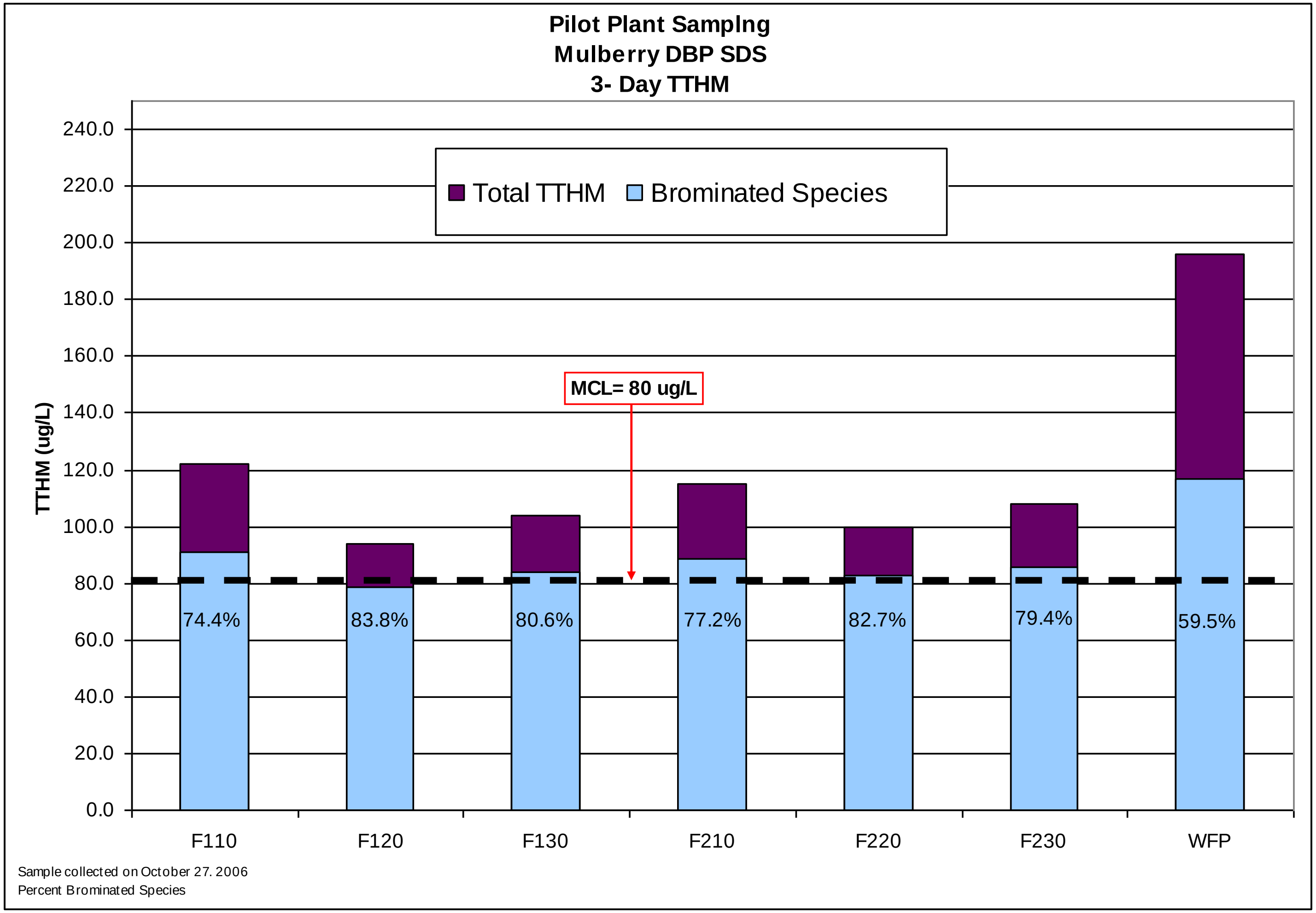
Elevated DBP Occurrence

October Monthly DBP Samples



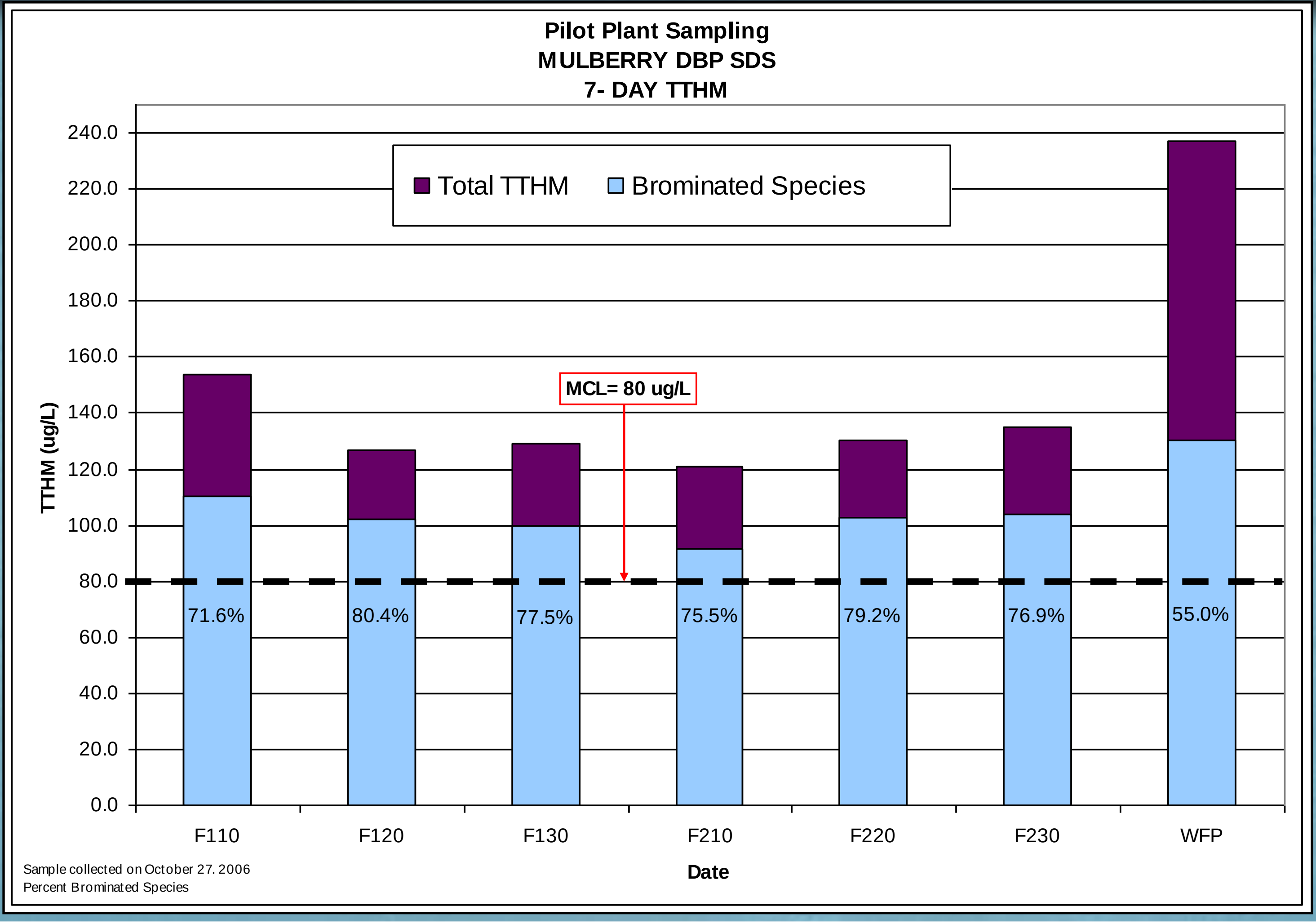
Elevated DBP Occurrence

Pilot Plant DBP Samples



Elevated DBP Occurrence

Pilot Plant DBP Samples



Elevated DBP Occurrence
Brominated Species

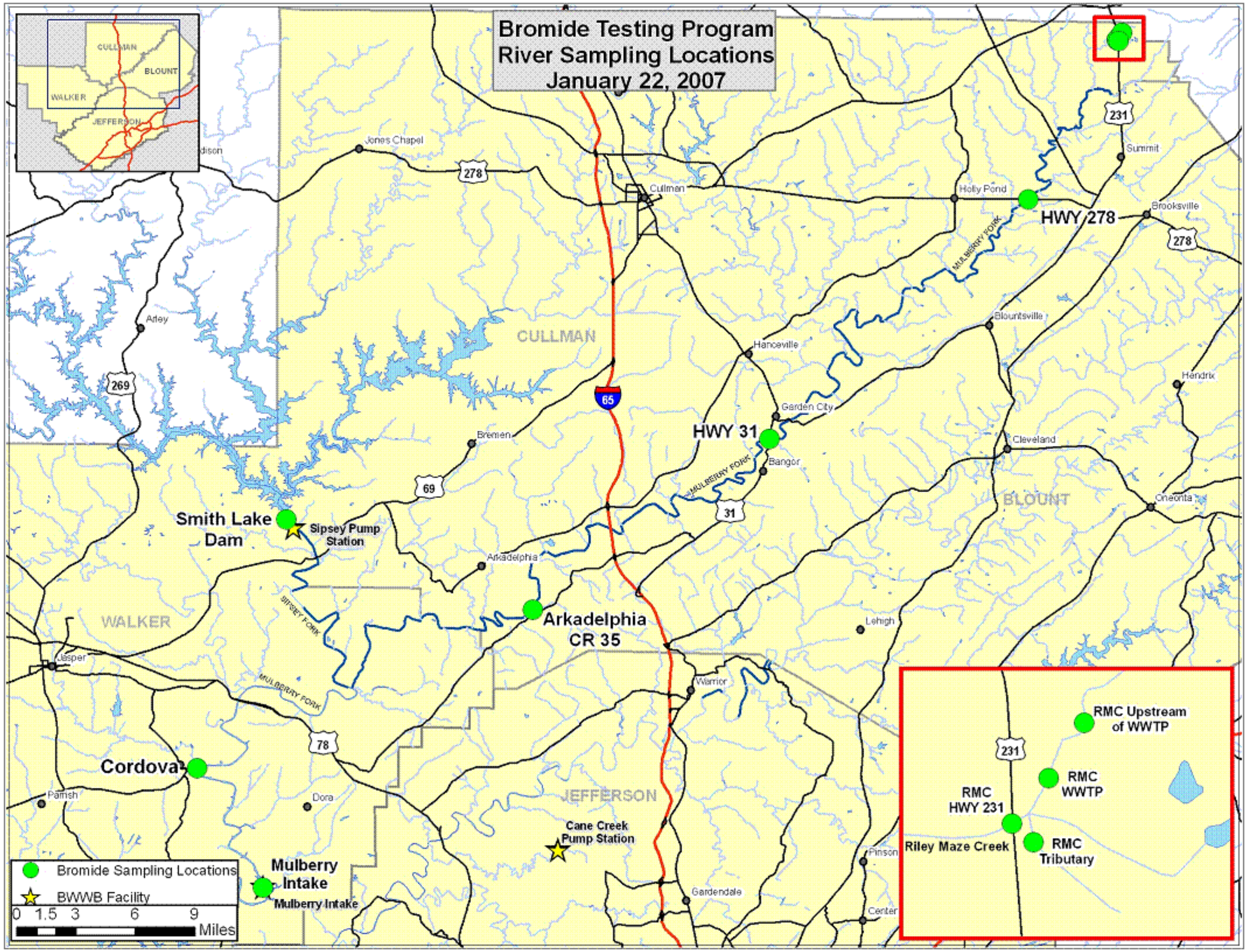
- **TTHMs and brominated THMs were at unprecedented levels**
- **The 7-day samples showed 130 ug/L of brominated THMs in the finished water**
  - **Bromodichloromethane ($CHCl_2Br$) 72.3 ug/L**
  - **Dibromochloromethane ($CHClBr_2$) 50.5 ug/L**
  - **Bromoform ($CHBr_3$) 7.5 ug/L**

Identifying the Source

- **November 10, 2006 – BWWSB initiated a comprehensive sampling program for the Black Warrior River**

- **90 locations over a 100-mile stretch along the Black Warrior River were sampled for bromide**

Identifying the Source



Identifying the Source

- **November 17, 2007 – samples indicated that the source of bromide was a wastewater treatment plant on the Riley Maze Creek, a tributary of the Black Warrior River**

- **Bromide levels as high as *212 mg/L* were detected at the wastewater treatment plant**

- **Bromide levels as high as *0.6 mg/L* were detected at the Mulberry Intake**

- **November 22, 2006 – ADEM initiated their own sampling program of permit holders and identified an industrial facility discharging into the suspected wastewater treatment plant as the bromide source**

Pilot Testing

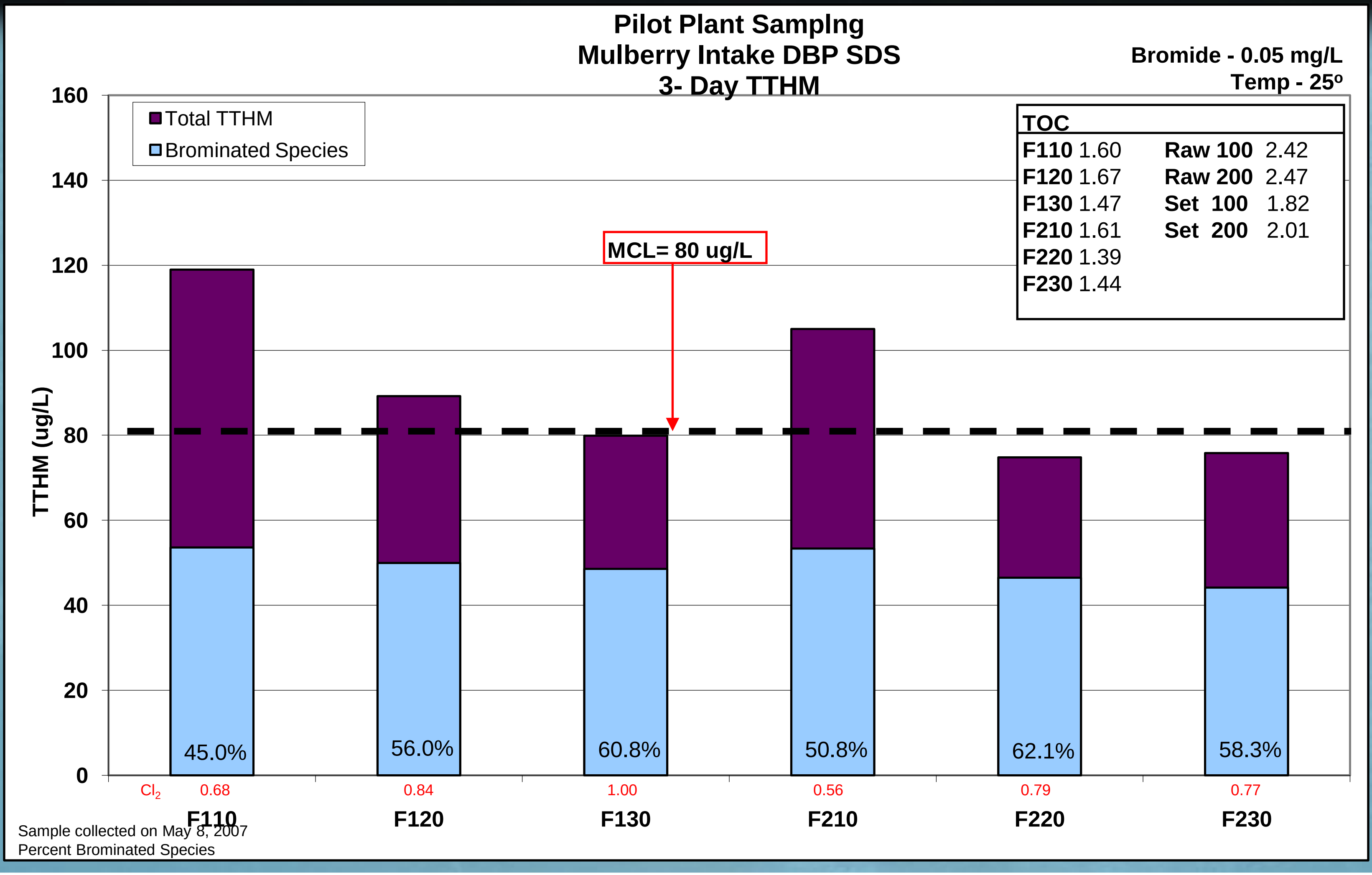
- Mobile Pilot Plant was moved to Mulberry Intake
- Two objectives:
  - Determine lowest acceptable bromide level with regards to DBP formation
  - Examine treatability of bromide

Pilot Testing

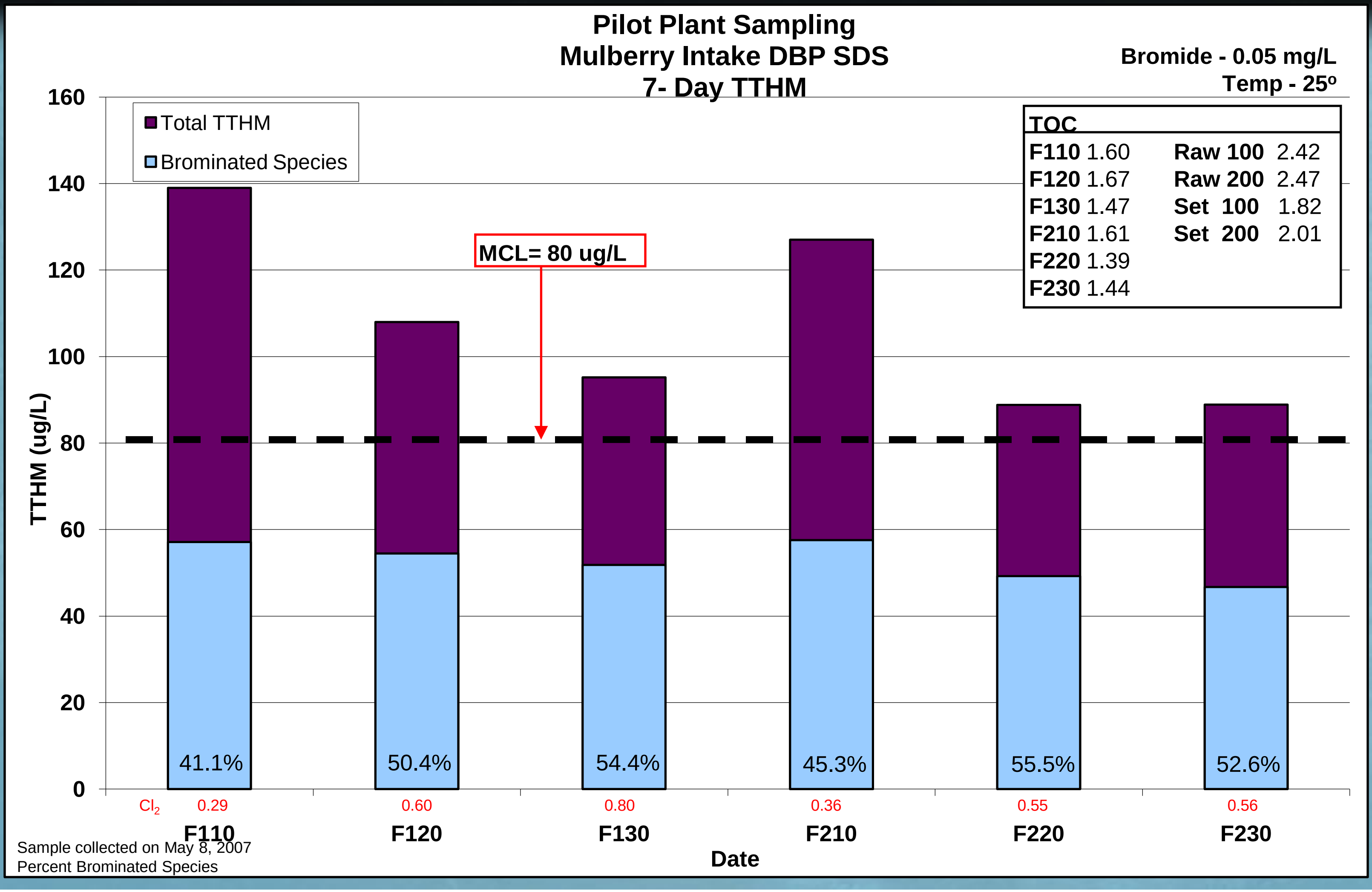
- **March 14, 2007 through May 8, 2007**
  - **11 sets of DBP SDS samples collected**

- **Range of raw water bromide levels**
  - **0.05 mg/L – 0.20 mg/L**

Pilot Testing



Pilot Testing



Drought Conditions

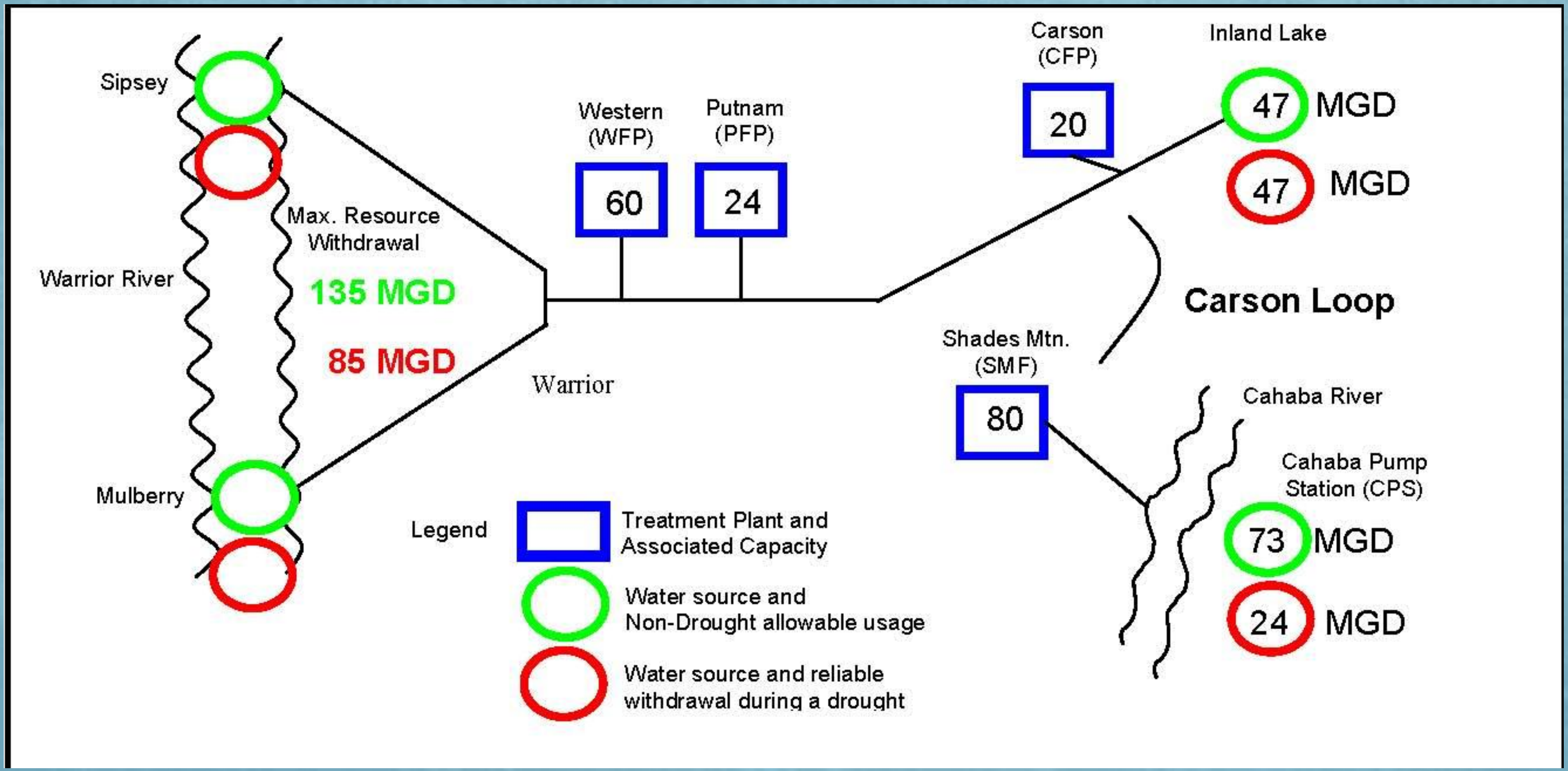
- **Spring 2007 - Southeastern US, particularly Alabama, was experiencing a drought**

- **BWWSB needed to utilize the Black Warrior River and turn the Mulberry Intake back on**

- **May 7, 2007 – BWWSB was awarded an emergency preliminary injunction to limit the load of bromide discharged by the industrial facility**
  - **< 50 lb/day bromide, based on allowable amount of bromide that Western Filter Plant could handle**
  - **Must truck wastewater discharge to another facility**

- **May 21, 2007 – Black Warrior River bromide levels at the Mulberry Intake were <0.05 mg/L and the Intake was turned back on**

Drought Conditions



Drought Conditions

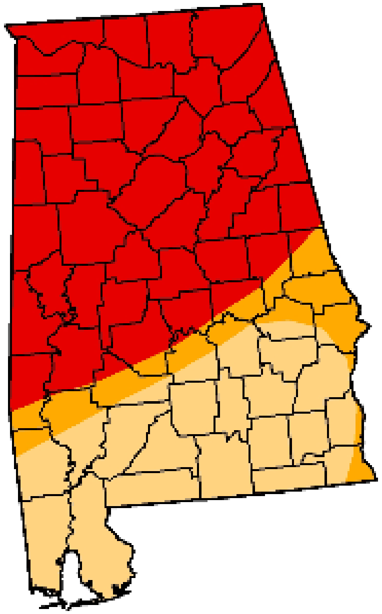
U.S. Drought Monitor

May 22, 2007
Valid 7 a.m. EST

Alabama

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	0.0	100.0	100.0	69.1	58.7	0.0
Last Week (05/15/2007 map)	0.0	100.0	84.7	64.9	51.0	0.0
3 Months Ago (02/27/2007 map)	37.6	62.4	3.7	0.0	0.0	0.0
Start of Calendar Year (01/02/2007 map)	51.9	48.1	0.0	0.0	0.0	0.0
Start of Water Year (10/03/2006 map)	0.0	100.0	73.3	0.0	0.0	0.0
One Year Ago (05/23/2006 map)	94.8	5.2	0.3	0.0	0.0	0.0



Intensity:

- D0 Abnormally Dry
- D1 Drought - Moderate
- D2 Drought - Severe
- D3 Drought - Extreme
- D4 Drought - Exceptional

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements

http://drought.unl.edu/dm

USDA National Drought Mitigation Center

Released Thursday, May 24, 2007

Author: Mark Svoboda, National Drought Mitigation Center

Drought Conditions

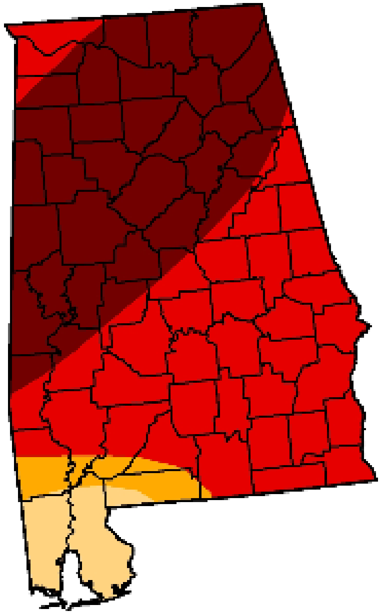
U.S. Drought Monitor

Alabama

June 19, 2007
Valid 7 a.m. EST

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	0.0	100.0	100.0	94.0	90.0	42.7
Last Week (06/12/2007 map)	0.0	100.0	100.0	99.5	62.8	37.9
3 Months Ago (03/27/2007 map)	0.0	100.0	77.8	43.3	3.8	0.0
Start of Calendar Year (01/02/2007 map)	51.9	48.1	0.0	0.0	0.0	0.0
Start of Water Year (10/03/2006 map)	0.0	100.0	73.3	0.0	0.0	0.0
One Year Ago (06/20/2006 map)	35.6	64.4	37.1	6.6	0.8	0.0



Intensity:

- D0 Abnormally Dry
- D1 Drought - Moderate
- D2 Drought - Severe
- D3 Drought - Extreme
- D4 Drought - Exceptional

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements

http://drought.unl.edu/dm

Released Thursday, June 21, 2007

Author: Rich Tinker, CPC/NCEP/NWS/NOAA

Drought Conditions

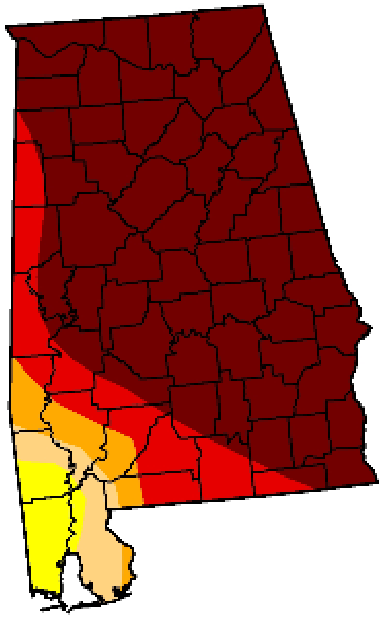
U.S. Drought Monitor

Alabama

August 21, 2007
Valid 7 a.m. EST

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	0.0	100.0	96.0	91.7	87.5	74.4
Last Week (08/14/2007 map)	0.0	100.0	96.0	91.7	85.5	73.1
3 Months Ago (05/29/2007 map)	0.0	100.0	100.0	69.1	60.1	0.0
Start of Calendar Year (01/02/2007 map)	51.9	48.1	0.0	0.0	0.0	0.0
Start of Water Year (10/03/2006 map)	0.0	100.0	73.3	0.0	0.0	0.0
One Year Ago (08/22/2006 map)	0.0	100.0	100.0	92.8	19.7	0.0



Intensity:

- D0 Abnormally Dry
- D1 Drought - Moderate
- D2 Drought - Severe
- D3 Drought - Extreme
- D4 Drought - Exceptional

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements

USDA National Drought Mitigation Center

http://drought.unl.edu/dm

Released Thursday, August 23, 2007

Author: Richard Heim/J. Lawrimore/L. Love-Brotak, NOAA/NESDIS/NCDC

Drought Conditions

- Bromide is inorganic and persistent as it flows down the Black Warrior River

- At low flows, a bromide load of 50 lb/day as required in the preliminary injunction is still too much bromide!

- Western Filter Plant can only handle bromide concentrations as low as 0.05 mg/L, based on pilot testing and DBP sampling

- 0.05 mg/L of bromide at low flows ~ bromide load of 10 lb/day

- July 2, 2007 - BWWSB sought an amended preliminary injunction
  - < 10 lb/day bromide, based on allowable amount of bromide that Western Filter Plant could handle and low flow due to drought conditions in the Black Warrior River

Outcome

- **Industrial facility has installed process equipment to remove bromide from their wastewater discharge**
- **BWWSB continues to monitor the Black Warrior River at the Mulberry Intake and the wastewater treatment plant on a daily basis**

Questions?

APPENDIX F

Literature Review Summary: Total Organic Carbon (TOC) Originating from Coal Mining Activity and Runoff

The Black Warrior Basin, located in west and north central Alabama, contains vast coal reserves which have been utilized for over a century. This mineral resource provides economic wealth essential to the livelihood of many Alabama residents. However, with this great wealth comes some particularly unpleasant baggage. Various chemicals found in Alabama's coal eventual make their way into the streams of the Black Warrior basin, which provides many communities drinking water, including the state's largest metropolitan area. Mercury (Diehl 2004, Goldhaber 2000), arsenic (Goldhaber 2000, Zielinski 2007), molybdenum (Goldhaber 2000), selenium (Goldhaber 2000), copper (Goldhaber 2000), and titanium (Goldhaber 2000) present in Alabama coal and coal mining operations contaminates surrounding streams. Acid mine drainage is also a factor leading to the stream quality decay created by coal mining runoff (Savrda 2007).

Another chemical of concern is total organic carbon (TOC). TOC, present in natural waters, is known to be a precursor of disinfectant byproducts (DBP's), which are potentially carcinogenic or cause other heath problems (Wallace 2001). The Birmingham Water Works Board (BWWB) is conducting a study to quantify TOC concentrations in source water. The BWWB is interested in determining agricultural and industrial point sources, including any impact from mining activity.

There is a small amount of literature addressing the direct relationship between TOC and coal mine activity runoff. Several articles address the threat of polycyclic aromatic hydrocarbons as a result TOC's (Rockne 2002) derived from active mining and deposited in floodplain soils (Yang 2008a, Yang 2008b, Hoffman 2007). PAH's inspire great concern because of their persistence and toxicity (Pies 2007). The Pies 2007 study implies a potential threat from coal mine runoff containing high concentrations of organic carbon.

Black carbon, various carbonaceous products of incomplete combustion of fossil fuels and vegetation (Goldberg 1985, Gustafsson 2001), can also contribute to PAH formation. However, PAH's formed by black carbon differ from PAH's formed by organic carbon (Yang 2008a). Specifically, heavier PAH's showed a correlation to black carbon while two-ring PAH's showed a closer relationship to organic carbon (Yang 2008a, Yang 2008b). Therefore, an accurate accounting of PAH's formed by TOC's originating from mine runoff, while discounting other sources such as combustion products, appears feasible.

Two-ring PAH's include azulene and its much more toxic and well known isomer, naphthalene (Applequist 1982). Acute exposure of humans to naphthalene by inhalation, ingestion, and dermal contact is associated with hemolytic anemia, damage to the liver, and, in infants, neurological damage. Symptoms of acute exposure include headache, nausea, vomiting, diarrhea, malaise, confusion, anemia, jaundice, convulsions, and coma (ATSDR 1995). Chronic exposure can result in cataracts and severe organ damage

(USDH 1993). The Environmental Protection Agency (EPA) has classified naphthalene as a possible human carcinogen (USEPA 1999)

Relationships between soil TOC and coal mining have been explored on the petrographic scale (Yang 2008a, Yang 2008b). These studies discovered significant amounts of TOC, derived from coal mines, in German floodplain soils (Yang 2008a, Yang 2008b). TOC from coal mining operations, as opposed to naturally occurring coal sediment or any other sources of organic matter, could be discerned because coal grains originating from mining operations are more angled and less weathered (Yang 2008b). Crushed coal originating from mining operations shows discernable microscopic characteristics. These unique characteristics could identify TOC, originating from mining activity, present in stream samples as well.

Thermally treated organic matter shows different microscopic traits depending on the origin of the carbon (Yang 2008a). In the Yang 2008a study TOC and black carbon, freed from soil samples, were differentiated using elemental analysis. Organic carbon showed unique microscopic features after high temperature oxidation (Yang 2008a). It is reasonable to conclude that similar methods could analyze carbon extracted from water samples.

Currently, TOC is not regulated under the Alabama National Pollutant Discharge Elimination System (NPDES). However, TOC is monitored in southern California as part of their NPDES and is listed by the California Environmental Protection Agency as a Class 1 Pollutant. Given potential seriousness of unregulated TOC, many states may follow the lead of the California EPA Colorado River Basin Regional Water Quality Control Board. The reasons behind the California monitoring of TOC are ecological (Decreasing oxygen demand in natural streams) and toxicological (DBP production in drinking water).

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APPENDIX G

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Comparison of Sewage and Coal-Mine Wastes on Stream Macroinvertebrates Within an Otherwise Clean Upland Catchment, Southeastern Australia

Ian A. Wright · Shelley Burgin

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Abstract Macroinvertebrates have been widely used in freshwater ecosystems as surrogates to assess the impacts of waste discharges and water pollution. However, often interpretations have been made on the impact of one pollutant in the presence of others that may provide an unidentified additive effective or otherwise confound the results. There have been few opportunities to study the impact of pollutants without such potentially confounding effects. We studied macroinvertebrates using a replicated kick sampling technique and identified to the family level to assess and compare the effects of zinc-rich coal-mine waste and organic pollution from treated sewage on an otherwise clean upland stream network within a world heritage area. We used multivariate analysis of macroinvertebrate assemblages from polluted and clean sites to measure and compare the effect of each waste impact to community structure. We also calculated three widely used biotic indices (Ephemeroptera, Plecoptera and Trichoptera (EPT) family richness, family richness, and abundance) and found that the EPT index was the only one to respond to both pollution types. Macroinvertebrate abundance was an important attribute of the study, with each source of pollution having a contrasting effect on total abundance. It also helped us to measure the relative response of families to each pollutant. There was an initial significant modification of macroinvertebrate assemblages below the outflow of each of the pollutants, followed by different degrees of recovery downstream.

Keywords Organic · Heavy metal · Zinc · Pollution · Water quality · NMDS · Abundance · EPT richness

I. A. Wright (✉) · S. Burgin
College of Health and Science,
University of Western Sydney,
Locked Bag 1797, South Penrith Distribution Centre,
1797 Sydney, NSW, Australia
e-mail: i.wright@uws.edu.au

1 Introduction

Macroinvertebrates are widely regarded as one of the best indicators of the ecological condition of rivers and streams (Hynes 1960; Hellawell 1986; Rosenberg and Resh 1993; Metzeling et al. 2006). They have been used to assess impacts of different types of water pollution, including sewage wastes (Jolly and Chapman 1966; Pinder and Far 1987; Cosser 1988; Whitehurst and Lindsey 1990; Growns et al. 1995; Wright et al. 1995), mine drainage (Winner et al. 1975; Norris et al. 1982; Mackey 1988; Malmqvist and Hoffsten 1999; Sloane and Norris 2003), urban landuses (Chessman and Williams 1999; Walsh et al. 2001; Gresens et al. 2007) and forestry activities (McCord et al. 2007). However, detailed investigations of freshwater macroinvertebrates have demonstrated the difficulty of isolating the effects of the target impact (e.g. sewage waste, mine drainage pollution) from other disturbances generated by human activities in often highly modified hydrological catchments.

There have been a large number of biotic indices developed to help interpret stream macroinvertebrate results from biological assessment of waterways. Two of the most popular and simply calculated indices are taxa richness and total abundance (see Resh and Jackson 1993). Abundance is often ignored due to the proliferation of qualitative rapid assessment methodologies (e.g. Lenat 1988). The Ephemeroptera, Plecoptera and Trichoptera (EPT) richness index is one of the most widely used biotic indices, based on the taxonomic richness of three common and sensitive macroinvertebrate orders (Lenat 1988; Lenat and Penrose 1996). The EPT index has been widely reported to be a robust and effective index for measuring impairment to stream macroinvertebrates (e.g. Sheehan 1984; Plafkin et al. 1989; Barbour et al. 1992; Hickey and Clements 1998; Camargo et al. 2004; Kitchin 2005; Metzeling et al. 2006). Other biotic indices have been developed, such as the Australian SIGNAL and SIGNAL2 pollution tolerance indices (Chessman 1995, 2003) and the South African Chutter index (Chutter 1972) based on the relative tolerance of macroinvertebrate taxonomic groups to water pollution within a geographical area.

Studies on the response of macroinvertebrates to organic and heavy-metal pollution impacts within a single catchment are very rare. Such situations are ideal for testing the response of the whole community, biotic indices and individual taxonomic groups to different pollution types. One of the only previous examples was the Nent River (Northern England), where macroinvertebrates (Armitage 1980; Armitage and Blackburn 1985) and algae (Say and Whitton 1981) were used to assess the dual impacts of contamination from several centuries of mining and organic pollution wastes within an agricultural catchment. While strong impairment of the target biota was observed, there may have been additional effects on macroinvertebrate communities other than the target pollutants due to background contamination, together with the potential for synergistic and/or overlapping effects (e.g. Connell and Miller 1984) of the pollutants that were the focus of the study. It is desirable, therefore, to conduct studies on macroinvertebrate communities that focus on the contribution of the effects of a single pollutant within a 'clean' background.

We used quantitative surveys to compare the effects of contamination from two separate discharges of heavy-metal contamination and treated sewage on stream macroinvertebrates within a small otherwise clean stream network to investigate the impact of each of these pollution types on resident macroinvertebrate communities. The use of a small catchment for the study increased the likelihood of waterways sharing similar fauna (Corkum 1989) and minimised biogeographic variation of animals across sampling sites (Cranston 1995). Although our preference would have been to conduct a before versus after, control versus impact (BACI) design (see Underwood 1991), both waste discharges in the Grose River catchment were constructed many decades previously (Wright 2006). To compensate, we sought to compare macroinvertebrate and water quality results from waste affected sites with results from multiple reference sites (Fairweather 1990) across the catchment, away from the influence of any known disturbance or waste discharges to represent the spectrum of undisturbed catchment physio-chemical and biological conditions.

The questions we addressed in this study are (1) do macroinvertebrates respond differently to different types of pollutants, (2) what is the relative effectiveness of commonly used biotic indices, and (3) is measurement of macroinvertebrate abundance important for pollution assessment?

2 Materials and Methods

2.1 Study Area and Sampling Sites

Field work was carried out on waterways (Table 1) in the upper Grose River catchment in the Blue Mountains (33°35′ S, 150°15′ E), which forms part of the Great Dividing Range in southeastern Australia (Fig. 1). Most of the study area is protected as part of Blue Mountains National Park estate, nested within the Greater Blue Mountains World Heritage Area (NPWS 2001; BMCC 2002). Whilst most of the study area is undisturbed wilderness, roads run along the outer rim of the catchment to service urban centres, including Mount Victoria and Blackheath (NPWS 1999). Only a very small proportion of the two townships lie within the hydrological catchment of the study area, and urban lands cover less than 2% of the study area. Further details of the study area are given in Wright (2006).

Table 1 Summary information for each of the sampling sites used in this study

Site name	Site code	Co-ordinates	Width	Vegetation (Keith and Benson 1988)	Stream order	Altitude (m ASL)
Grose River above Engineers track	GEN	33° 32.8′ S, 150° 16.5′ E	1–2 m	Tall open forest form	2nd	750
Grose River below Koombanda Brook	GDK	33° 32.9′ S, 150° 18.1′ E	2–4 m	Tall open forest form	2nd	670
Grose River below Dalpura Creek	GDD	33° 32.9′ S, 150° 18.1′ E	2–4 m	Tall open forest form	2nd	585
Grose River at Burra Korrain	GBK	33° 34′ S, 150° 18.2′ E	2–4 m	Open forest form	2nd	485
Grose River at Hungerfords Track	GHU	33° 34.7′ S, 150° 20.2′ E	2–4 m	Open forest form	2nd	375
Victoria Creek	VIC	33° 34′ S, 150° 18.2′ E	2–3 m	Closed forest form	2nd	485
Dalpura Creek	DAL	33° 32.9′ S, 150° 18.1′ E	1–2 m	Tall open forest form	1st	590
Hat Hill Creek above STP discharge	HHU	33° 37.1′ S, 150° 18′ E	1 m	Blue Mountains Sedge Swamp	1st	965
Hat Hill Creek below STP	HHD	33° 36.9′ S, 150° 18.1′ E	1 m	Blue Mountains Sedge Swamp and cleared grassland	1st	950
Hat Hill Creek above Grose River	HHG	33° 34.7′ S, 150° 19.5′ E	1–2 m	Closed forest form	1st	440

Two waste sources discharge into tributaries of the upper Grose River. One is coal-mine drainage from a disused underground coal mine 'Canyon Colliery' which operated, under various owners, from the 1920s (Macqueen 2007) until 1997 (EPA 2001). A horizontal mine drainage shaft (Macqueen 2007) discharges from the abandoned mine into Dalpura Creek, which shortly thereafter flows into the Grose River (Fig. 1). The second point source is the Blackheath sewage treatment plant (STP). It was constructed in the 1930s and, at the time of sampling, discharged approximately 0.92 ML/day of secondary treated effluent to Hat Hill Creek (Sydney Water 2004). Previous monitoring results reported ammonia levels in the STP effluent discharged to Hat Hill Creek at mean levels of 4 mg/L (Sydney Water 2004).

Ten sampling sites were selected in the study area (Table 1; Fig. 1). Four sites were clean reference sites, unaffected by waste discharges, to represent natural conditions (GEN, GDK, VIC, HHU). The remaining six sites were downstream from waste discharges. Three received mine-drainage (DAL, GDD, GBK) and two sewage effluent (HHD, HHG). DAL was not sampled for macroinvertebrates but was sampled only for water quality, as it was considered to be a point-source impact of mine drainage into the Grose River. The site GHU was the furthest downstream in the study and was subject to a mixture of the two waste sources (Fig. 1).

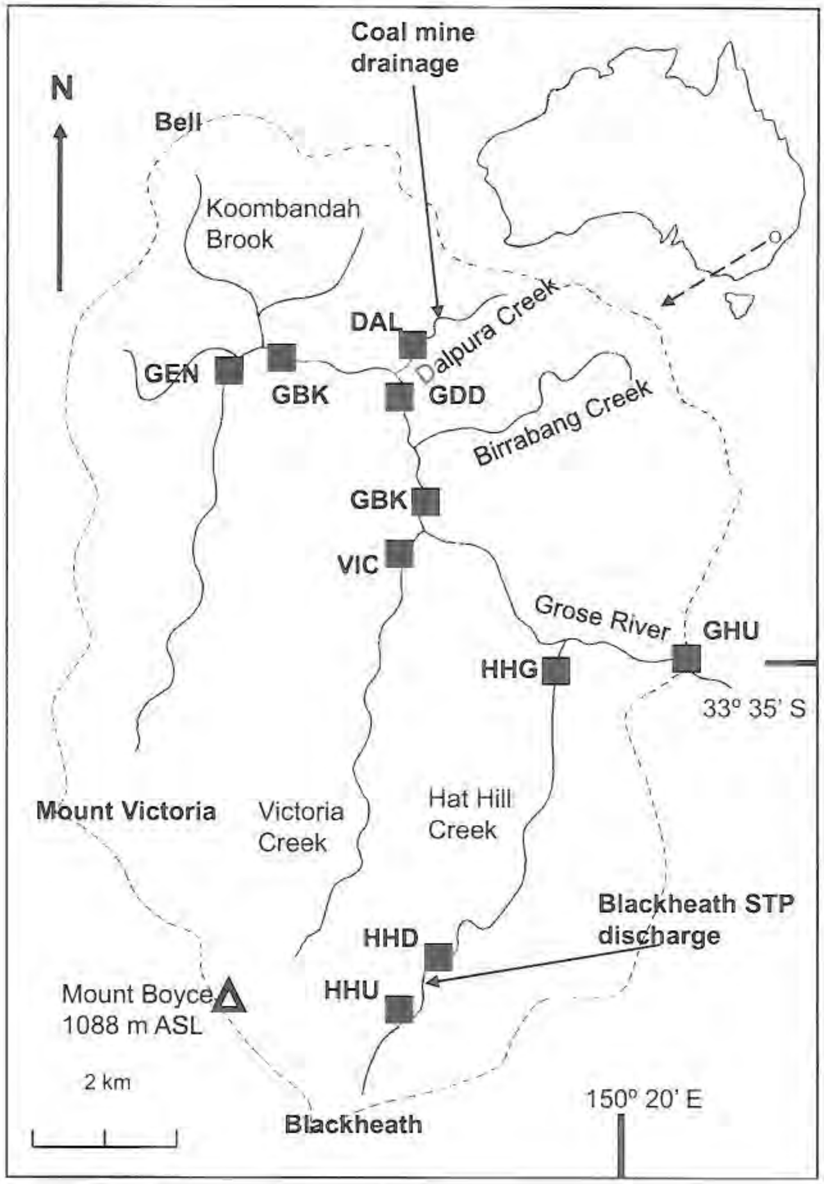
2.2 Macroinvertebrate Sampling

Macroinvertebrates were collected from nine sites in the upper Grose River catchment on three occasions (Fig. 1; Table 1) between April and June 2003. On each sampling occasion and at each of the nine macroinvertebrate sites, five quantitative benthic samples were collected from cobble riffle zones (cf. Resh and Jackson 1993; Wright et al. 1995). The location of each replicate was randomly selected within a 15-m stream reach.

Samples were collected by 'kick sampling'. A 'kick' net with a frame of 30×30 cm and 250 μm mesh was used (Rosenberg and Resh 1993; Wright 1994). Sampling was achieved by disturbing the stream bottom for a period of 1 min over a 900-cm^2 area, immediately upstream of the net. The net contents, including stream detritus and macroinvertebrates, were immediately placed into a labelled storage container and preserved in 70% ethanol.

In the laboratory, the sediment below 250 μm was washed from the sample. The remaining material was then sorted under a dissecting microscope (×40) to extract the macroinvertebrates from stream detritus (e.g. leaves, sticks, rocks, gravel). Macroinvertebrate identification was determined using the identification keys recommended by Hawking (1994). All insect groups were identified to family as these data have been demonstrated to provide adequate taxonomic resolution for impact

Fig. 1 Map of survey sites (*square symbols*), waterways and waste discharge points in the upper Grose River. Site DAL was sampled only for water chemistry. Approximate catchment boundary is *dashed line*. *Inset* shows location of study area in southeastern Australia. Details on sampling sites given in Table 1



assessment (Wright 1994; Wright et al. 1995). Some non-insect groups (Oligochaeta, Temnocephalidae, Hydracarina, non-Ancylidae Gastropoda) were not identified to the family level due to identification difficulties.

2.3 Water Quality Sampling

Water quality data were collected from ten sites on three occasions, including samples from Dalpura Creek downstream of the mine drainage outflow (Fig. 1). They were collected immediately prior to the macroinvertebrates to minimise disturbance due to kick-sampling. At each site, on each occasion, water quality was monitored in situ at the centre of the waterway using a portable field chemistry meter (WTW Multiline P4; Universal Meter, Weilheim, Germany) to measure stream electrical conductivity, pH and water temperature. Water samples were also collected in 200 mL plastic bottles for later laboratory analysis. Water samples were cooled and analysis was conducted within 72 hours of collection. Replicated measurement of water quality samples was conducted with multiple field meter readings taken on each sampling occasion and duplicate bottles collected for later laboratory analysis on three different sampling occasions.

These samples were analysed using standard chemical analysis methods (APHA 1998). Chemical analysis comprised total zinc (TZn), hardness, alkalinity, total nitrogen (TN) and total phosphorus (TP). On the first sampling occasion, samples were also assessed for the metals aluminium, arsenic, boron, barium, cadmium, chromium, cobalt, copper, iron, lead, manganese, mercury, molybdenum, nickel, selenium, silver, tin, uranium and zinc. When only zinc was found to exceed ANZECC (2000) guidelines for ecosystem protection, subsequent metal analyses were restricted to zinc, and it is the only metal data presented.

2.4 Data Analysis

Multivariate analyses of macroinvertebrate community studies have been demonstrated to be a sound technique to evaluate the ecology of macroinvertebrates (Corkum 1989) of freshwater (Norris et al. 1982; Marchant et al. 1994; Wright et al. 1995) and marine pollution (Clarke 1993; Warwick 1993). Non-metric multidimensional scaling (NMDS) was performed on the similarity matrix, computed with square-root transformed macroinvertebrate taxon abundance data, using the Bray-Curtis dissimilarity measure (Clarke 1993; Warwick 1993). Two-dimensional ordination plots represented the dissimilarity among samples. All reference sites were grouped to test differences by two-way analysis of similarity (ANOSIM: Clarke 1993) between reference sites and sites downstream of the waste discharges. In the ordinations, the influence of particular taxa on dissimilarities between communities was quantified using the similarity percentage procedure (SIMPER). These multivariate analyses were achieved using the software package PRIMER version 5 (Clarke 1993).

Macroinvertebrate and chemical data were also analysed using a mixed model analysis of variance (SPSS V14) with 'sites' treated as a fixed factor and sampling 'time' as a random factor. Data were checked for normality using PP plots and for homogeneity of variance using Levene's test. Linear contrasts were used to test for differences between clean reference sites and those polluted with either waste discharge.

3 Results

3.1 Macroinvertebrates

A total of 48,069 (54 taxa) macroinvertebrates were collected with a majority being insects (Table 2). Family ($F_{8,108}$ 18.95, $p<0.001$) and EPT family richness ($F_{8,108}$ 27.46, $p<0.001$) differed significantly among sites. Linear contrasts showed that family and EPT family richness were significantly lower immediately downstream of both waste sources compared to reference sites (Table 3; Fig. 2). Total abundance also differed significantly between sites ($F_{8,108}=5.25$, $p=0.002$) and was significantly higher immediately downstream of the STP organic outflow compared to the reference sites and was significantly lower downstream of the zinc-rich coal-mine effluent compared to the reference sites (Table 3; Fig. 2). When biotic indices were compared between the most downstream site sampled (i.e. where both waste sources were mixed; GHU) and the reference sites using linear contrasts, only total abundance was significantly different (Table 3; Fig. 2).

Based on community structure, multivariate analysis showed that the site immediately downstream of the STP (HHD) and the two sites downstream of the mine outflow (GDD, GBK) were well separated from all other sites which tended to cluster (i.e. samples were grouped in the NMDS ordination; Fig. 3). Stress values (range 0.20–0.17) indicated that, in two dimensions, the MDS was a fair representation of the original data (*cf.* Clarke 1993). The ANOSIM results (Table 4) showed that the differences between sampling sites were more influential than time (Global R 0.772 vs. 0.126). Pairwise comparison of sites (Table 4) confirmed that there were differences in community structure in the presence of the waste discharges (GDD, HHD) compared to reference sites (*R*-statistic values, 0.930 and 0.927). Comparison of assemblages at the two sites downstream of the zinc pollution point source (GBK, GDD) and the organic pollution outflow (HHG, HHD) showed that the coal-mine waste sites were more similar (*R*-statistic 0.297) than the sewage discharge sites (*R*-statistic 0.980). Different degrees of recovery were detected below each waste source. Community structure at the lower site downstream of the zinc pollution (GBK) was less similar to reference sites (*R*-statistic 0.770) than at the lower sewage site (HHG) compared to the reference sites (*R*-statistic 0.323).

Using SIMPER, data from the reference sites were compared with the sites immediately downstream of the STP (HHD) and mine drainage (GDD) site (Table 5). Of the ten taxa that contributed most to the separation between the mine drainage and

Table 2 Summary list of most abundant macroinvertebrate groups (comprising >0.1% of total abundance) collected from all sites in the Grose River catchment, between April and June 2003

Phylum	Class (Order)	Family	VIC	GEN	GDK	GDD	GBK	GHU	HHU	HHD	HHG
Plathelminthese	Turbellaria (Tricladida)	Dugessidae	4		1		2	83		46	38
Nemertea		Tetrastemmatidae								737	
Annelida	Oligochaeta		229	698	1,023	6	15	171	82	148	197
Mollusca	Gastropoda	Ancylidae	8		139			1		2,476	349
	Gastropoda (Non-Ancylidae)				2					271	
	Bivalvia	Corbiculidae						5		106	
Arhtropoda	Arachnida (Acariformes)		27	19	21	3	15	104	89	4	10
		Orobatidae	3	1	6		1	36	11	45	4
	Insecta (Ephemeroptera)	Baetidae	786	101	714	3	40	6,202	213	6	392
		Caenidae	376		392						118
		Leptophlebiidae	682	413	378		4	85	536		811
	Insecta (Odonata)	Aeshnidae	8	8	19	3	12	37	28	1	14
		Gomphidae	84	1	10	3	19	35			
	Insecta (Plecoptera)	Gripopterygidae	292	705	489	94	274	78	1,011	94	43
	Insecta (Megaloptera)	Corydalidae	19	3	8		4	29			
	Insecta (Coleoptera)	Elmidae larvae	433	474	449	4	14	118	323	75	987
		Elmidae adults	131	227	408	22	59	136	72	30	108
		Psphenidae	18	329	92			32	8	6	9
		Hydrophilidae	17	1	12		18	31	1	8	
		Scirtidae	146	31	83	6	144	200	40		2
	Insecta (Diptera)	Ceratopogindae	16	68	183	10	8	22	2	34	12
		Chironomidae	490	800	1,043	147	369	1,153	1,425	2187	688
		Simuliidae	100	5	97	11	77	1,931	305	746	67
		Empididae	57	7	24	46	93	36	44	1	6
		Tipulidae	49	43	39	2	6	140	48	2	12
	Insecta (Trichoptera)	Hydrobiosidae	20	9	11		2	114	35	13	48
		Philopotamidae	9	19	80		169	27	15	3	30
		Hydroptilidae	115	77	302	84	217	41		1070	4
		Hydropyschidae	223	1	48	288	246	156	83	7	321
		Ecnomidae	48	35	44	1	12	50	1		20
		Leptoceridae	14		1	30	74	231			35
		Helicopsychidae	141	1	30			23			34
		Glossomatidae	30	11	14			71	54		3
		Calamoceratidae	39					73			1
		Conoescucidae	82		64	1	22	291			27
		Tasimiidae	2		1			24			62
		Calocid/Helicophidae		2				308	26		25
	Insecta	Unidentified	203	23	60	57	11	483	21	27	169

reference sites, all except Hydropsychidae had lower abundance at the mine drainage site than at reference sites. In contrast, of the ten taxa that contributed most to the separation between the site immediately downstream of the sewage inflow (HHD) and the reference sites, six (Ancylidae, Nemertea, non-Ancylidae gastropods, Simuliidae, Hydroptilidae, Corbiculidae) had higher abundance in the presence

Table 3 Results for linear comparisons of biotic indices for total family richness, EPT family richness and total abundance

	Total family richness			EPT family richness			Total abundance		
Comparison (linear contrast)	Mean highest at	F	p	Mean highest at	F	p	Mean highest at	F	p
Reference sites vs. HHD	Reference sites	19.3	***	Reference sites	95.82	***	HHD	4.80	*
Reference sites vs. GDD	Reference sites	75.2	***	Reference sites	73.60	***	Reference sites	7.22	*
Reference sites vs. GHU		4.3	ns		1.7	ns	GHU	17.2	**
GDD vs. GBK	GBK	14.6	**	GBK	14.4	*	GBK	0.4	ns
HHD vs. HHG	HHG	4.9	*	HHG	28.9	***	HHD	3.9	ns

Comparisons are between unpolluted sites with selected polluted sites, and comparison of recovery downstream of each of the point source outflows. See Fig. 1 for catchment map with sites

EPT Ephemeroptera, Plecoptera and Trichoptera combined

*$p<0.05$; **$p<0.001$; ***$p<0.0001$, ns = not significant

of sewage than at the reference sites, while the other four common taxa (Leptophlebiidae, Baetidae, Elmidae, Scirtidae) were in higher abundance at the reference sites than in the presence of the highest influence of organic pollution (Table 5).

The affinity of each common taxon to each pollution type was compared, based on the SIMPER results (Table 6). Leptophlebiidae was the only family that had a highly negative response to both types of pollution. Elmidae (larvae), Baetidae and Psephenidae had highly negative responses to zinc pollution and moderately negative responses to organic pollution (Table 6). In contrast, the response of Ancylidae was highly positive to organic pollution and highly negative in the presence of zinc pollution. Other taxa that demonstrated a negative response to zinc pollution and a positive response to organic pollution were the Chironomidae and Simuliidae. Hydropsychidae was the only common taxon that showed a negative response to organic pollution and a positive response to zinc pollution (Table 6).

3.2 Physical and Chemical Indicators

The effects of the two waste discharges on the water chemistry of local streams (Table 7; Fig. 4) were clearly apparent, although distinctly different. TP ($F_{9,50}=8.05$, $p<0.001$; Table 8) and TN ($F_{9,50}=9.10$, $p<0.001$; Table 8) both varied highly significantly among sites. Linear contrasts revealed that both were higher immediately below the STP (HHD) (TP, 506.8 μg/L and TN, 14,316.7 μg/L) compared to the reference sites (TP, 3.8–5.0 μg/L and TN, 55.0–101.7 μg/L). Five kilometres below the STP (HHG), there was some reduction (TP, 189.2 μg/L, TN, 7,533.3 μg/L; Fig. 4).

Mean total zinc levels also varied significantly among sites ($F_{9,44}=74.72$, $p<0.001$; Table 8), and linear contrasts revealed that total zinc was significantly higher (594.7 μg/L) in Dalpura Ck, the tributary containing the coal-mine outflow, compared to reference sites (4.2–6.2 μg/L). With further distance downstream of Dalpura Ck, the level gradually dropped, although at the most downstream site sampled (GHU), levels remained elevated (70.7 μg/L; Fig. 4).

Given that water hardness was classified as 'soft' (ANZECC 2000), the recommended 'trigger level' for protecting aquatic ecosystems for New South Wales upland streams for total zinc levels (5 μg/L) were violated at all sites sampled downstream of the coal mine (see Tables 7 and 8).

4 Discussion

Treated sewage from Blackheath STP and mine drainage, from the disused Canyon Colliery, resulted in different and distinct pollution-related changes to macroinvertebrate communities and water chemistry of surface waters in the upper reaches of the Grose River system. Comparison of the water quality and ecological effects of the two pollution gradients in this study was enhanced by the lack of other human impacts, apart from the waste discharges, in an otherwise predominantly naturally vegetated (c. 95%) upland catchment within a largely protected National Park reserve (NPWS 2001).

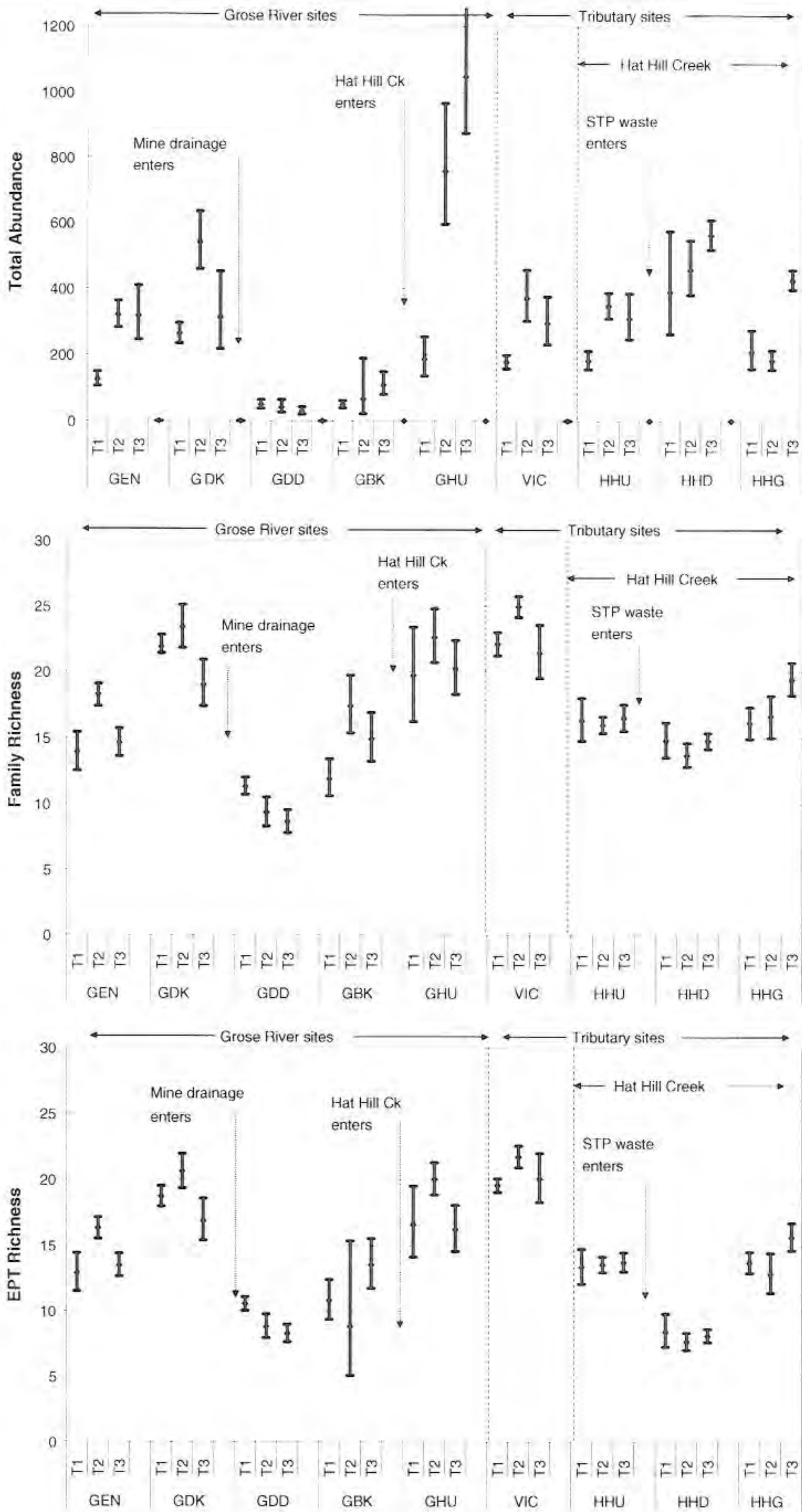


Fig. 2 Back-transformed mean macroinvertebrate (*top*) total abundance, (*middle*) taxon richness and (*lowest*) EPT richness collected from sites in the upper Grose River and its tributaries, on each of the three sampling occasions (T1, T2 and T3) ±standard error from five replicates at each site

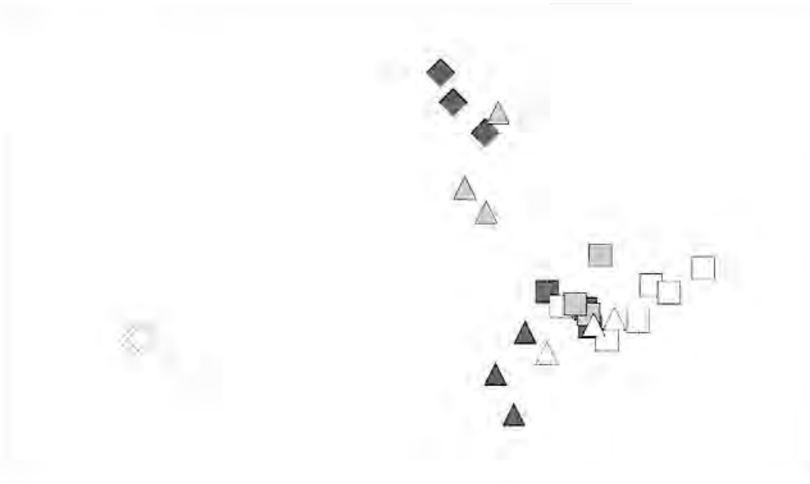


Fig. 3 NMDS ordination of macroinvertebrate data. Stress = 0.2. *Each symbol* represents a centroid of five macroinvertebrate samples from the Grose River and its tributaries, from each of three sampling occasions (four from GBK on second occasion). Reference sites are *squares*: *black* VIC, *light grey* GEN, *white* GDK, *dark grey* HHU. Sites immediately below waste discharges are *diamonds*: *black* GDD (coal-mine drainage), *white* HHD (sewage). Sites further downstream of waste discharges are triangles: *white* HHG, *dark grey* GBK, *black* GHU (site abbreviations given in Table 1)

Table 4 Summary results for two-way ANOSIM

Source of variation	Comparison	R-statistic	p (%)
Site	Global R	0.772	0.1
	Reference sites vs. point source of zinc pollution (GDD)	0.930	0.1
	Reference sites vs. second site below point source zinc pollution site (GBK)	0.770	0.1
	Reference sites vs. site of combined pollution (GHU)	0.611	0.1
	Reference sites vs. point source of organic pollution (HHD)	0.927	0.1
	Reference sites vs. second site below organic pollution inflow (HHG)	0.323	0.1
	Comparison of within stream recovery from zinc pollution (GDD vs. GBK)	0.297	0.9
	Point source of zinc pollution (GDD) vs. site of combined pollution (GHU)	0.927	0.1
	Comparison of two pollution types at outflows (GDD vs. HHD)	0.988	0.1
	Point source of zinc (GDD) vs. downstream organic pollution (HHG)	0.984	0.1
	Downstream zinc (GBK) vs. site of combined pollution (GHU)	0.800	0.1
	Downstream zinc (GBK) vs. point source organic pollution (HHD)	0.960	0.1
	Downstream zinc (GBK) vs. downstream organic pollution (HHG)	0.923	0.1
	Combined pollution site (GHU) vs. point source organic pollution (HHD)	0.944	0.1
	Site of combined pollution (GHU) vs. downstream organic pollution (HHG)	0.887	0.1
	Point source organic (HHD) vs. downstream organic pollution (HHG)	0.980	0.1
Time	Global R	0.126	0.1
	Sampling time 1 vs. 2	0.192	0.1
	Sampling time 1 vs. 3	0.162	0.2
	Sampling time 2 vs. 3	0.014	27.2

Values of ANOSIM statistic (R) and significance (p) for pairwise differences between reference sites (GEN, GDK, VIC, HHU grouped) and pairwise differences between time of sampling and sample site (see Fig. 1 for catchment map with sites)

Table 5 Results of SIMPER breakdown, the most influential macroinvertebrates contributing to the different communities at the reference sites compared to those at the site sampled below each pollution source

Taxon	Reference sites	HHD	Contribution (%)	Cumulative (%)
Reference sites compared to site of organic pollution outflow (HHD)				
Ancylidae	2.45	165.07	8.10	8.10
Nemertea	0	49.13	6.22	14.32
Leptophlebiidae	33.48	0	5.83	20.15
(non-Ancylidae) Gastropoda	0.03	18.07	5.11	25.27
Simuliidae	8.45	49.73	4.38	29.65
Baetidae	30.23	0.40	4.35	34.00
Elmidae (larvae)	27.98	5.00	3.82	37.82
Hydroptilidae	8.23	71.33	3.75	41.57
Corbiculidae	0.00	7.07	3.41	44.97
Scirtidae	5.00	0.00	3.17	48.14
Reference sites compared to site of mine drainage (GDD)				
Leptophlebiidae	33.48	0	7.70	7.70
Elmidae (larvae)	27.98	0.27	6.85	14.55
Baetidae	30.23	0.20	5.97	20.51
Oligochaeta	33.87	0.40	5.89	26.40
Gripopteryigidae	41.62	6.27	4.23	30.63
Psephenidae	7.45	0	4.09	34.72
Hydropsychidae	5.92	19.20	3.90	38.62
Chironomidae	62.63	9.80	3.60	42.21
Scirtidae	5.00	0.40	3.37	45.58
Hydroptilidae	8.23	5.60	3.31	48.89

Table 6 Change in abundance[a] due to pollution (zinc or organic) in the upland streams of the Grose River catchment, Greater Blue Mountains World Heritage Area

Family	Coal-mine (zinc) pollution	Sewage pollution
Leptophlebiidae	×××	×××
Elmidae (larvae)	×××	××
Baetidae	×××	××
Ancylidae	×××	√√√
(Class) Oligochaeta	××	×
Chironomidae	××	√
Gripopteryigidae	××	××
Hydropsychidae	√	××
Psephenidae	×××	××
Simuliidae	××	√√

√ 200% to 500% abundance; √√ 500% to 1,000%; √√√ >1,000%; × 20% to 50%; ×× 1% to 20%; ××× <1% or ND (not detected)

[a] Abundance relates to comparison of abundance below each pollution point source to average from reference sites.

We found that biological indices (macroinvertebrate abundance, family richness and EPT family richness) responded differently to the two waste discharges in this study. Family richness declined to a greater degree downstream from the coal-mine drainage compared to only a modest reduction below the STP (Fig. 2). A similar difference in taxonomic richness to dual disturbance gradients was observed by Metzeling et al. (2006) who reported that family richness performed poorly against a salinity gradient but better against a habitat simplification gradient. EPT richness was the only one of the indices that responded with a reduction of similar magnitude below both the mine and STP discharge. In comparison, macroinvertebrate abundance declined below the mine but increased immediately below the STP. Measuring abundance is often not included in many pollution studies, perhaps partly due to the popularity of rapid assessment methodologies that use non-quantitative techniques (e.g. Chessman 1995). Our findings illustrate how abundance data can be a very important ecological attribute in pollution studies. Abundance of individual families in this study helped reveal differences in community structure at

Table 7 Summary of physicochemical data indicating mean and range (in brackets) for each water physical and chemical variable, according to site

Site	Water temperature (°C)	pH	Electrical conductivity (µS/cm)	Total nitrogen (µg/L)	Total phosphorus (µg/L)	Total zinc (µg/L)	Hardness (mg/L: CaCO3)
Reference sites							
GEN	11.4 (8.9–13.7)	6.1 (6.00–6.33)	39.3 (38–41)	55 (25–100)	3.8 (3–6)	4.2 (2.5–5.0)	5.2 (5–5.5)
GDK	11.6 (8.7–14.7)	7.4 (7.28–7.45)	82.7 (70–92)	68.3 (50–90)	4.2 (3–6)	4.2 (2.5–5.0)	23.1 (20–26)
VIC	11.4 (9.5–13.0)	7.0 (6.92–7.23)	47	70.9 (25–130)	4.7 (3–8)	4.2 (2.5–5.0)	8.5 (8–9)
HHU	10.1 (9.5–11.2)	6.0 (5.84–6.20)	31.3 (29–33)	101.7 (90–110)	5.0 (3–8)	6.2 (5–10.0)	3.2 (3–3.5)
Mine drainage (zinc) polluted sites							
DAL	12.8 (11.3–15.3)	7.06 (6.94–7.18)	133.9 (131–139)	25	4.5 (3–8)	594.7 (545–650)	49.2 (47.5–51)
GDD	12.4 (10.2–15.1)	7.2 (7.01–7.35)	151.1 (140–160)	25	4.3 (3–7)	388 (297–440)	53.8 (50.5–57)
GBK	12.5 (11.4–13.6)	7.3 (7.15–7.53)	143.3 (130–150)	33.3 (25–50)	4.5 (3–7)	261.3 (212–300)	49.8 (44.5–55)
STP (organic) polluted sites							
HHD	11.2 (11.0–13.8)	7.2 (6.76–7.44)	327.0 (132–462)	14,316.7 (4,400–21,200)	506.8 (204–820)	12.5 (5–20.0)	38.4 (37–39.5)
HHG	12.4 (10.5–12.1)	7.24 (7.18–7.27)	230.8 (201–265)	7,533.3 (6,700–9,000)	189.2 (180–198)	5	23.2 (20–26.5)
Combined pollution site							
GHU	12.3 (10.0–14.9)	7.6 (7.43–7.80)	141.5 (123–157)	1,680 (1,540–1,950)	40.5 (34–45)	70.7 (60–80)	32.2 (29–35.5)

See Fig. 1 for map of sites

polluted and unpolluted sites, further details of which are discussed further below.

A group of six taxa were particularly abundant and strongly influenced the organically polluted macroinvertebrate community, below Blackheath STP: Ancylidae, non-Ancylidae gastropods, Nemertea, Simuliidae, Hydroptilidae and Corbiculidae. This group of biota collectively increased their abundance, in the presence of sewage effluent, more than three times that found at unpolluted reference sites. However, in contrast, the macroinvertebrate community below the coal mine was depauperate, with only one influential taxa, Hydropsychidae, being more abundant here than at unpolluted sites. Hydropsychidae was much less abundant below the STP.

Our finding that Hydropsychidae was tolerant of mine drainage contrasts with findings from some Australian metal pollution studies. For example,

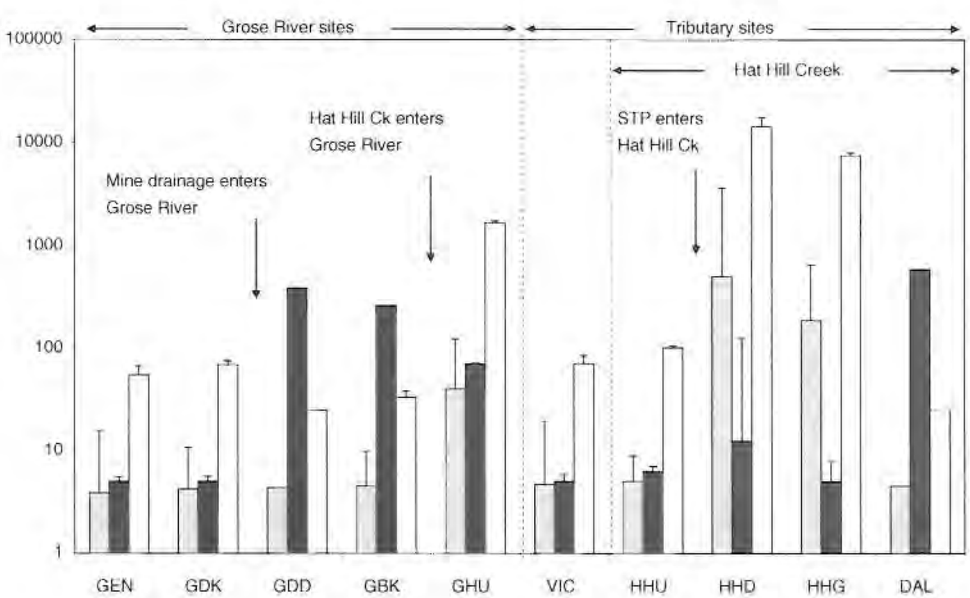


Fig. 4 Mean total phosphorus (*grey bar*), mean total zinc (*black bar*) and mean total nitrogen (*white bar*), in µg/L, collected from duplicate samples, at each site, on three sampling occasions April to June 2003 (plus one standard error). Grose River sites are grouped to the *left* and tributary sites to the *right*. *Arrows* and text indicate the location that mine drainage and Hat Hill Ck enters the Grose River and where STP effluent flows into Hat Hill Creek

Table 8 Results for linear comparisons of chemical data (zinc, total phosphorus and total nitrogen), compared to differences between reference sites and both zinc and organic pollution

Comparison (linear contrast)	Zinc			Total phosphorus			Total nitrogen		
	Mean higher at	*F*	*p*	Mean higher at	*F*	*p*	Mean higher at	*F*	*p*
Reference sites vs. HHD		0.1	NS	HHD	56.6	***	HHD	58.7	***
Reference sites vs. GDD	GDD	445.6	***		0.0	NS		0.1	NS
Reference sites vs. GHU	GHU	13.9	**		0.3	NS		0.7	NS
GDD vs. GBK	GDD	31.0	***		0.0	NS		0.1	NS
HHD vs HHG		0.1	NS	HHD	14.1	**	HHD	8.3	*

Comparisons are between unpolluted sites with selected polluted sites, and comparison of recovery downstream of each of the point source outflows. Specifically, comparisons are between: 1. unpolluted sites and site immediately downstream of organic pollution outflow (HHD); 2. unpolluted reference sites and zinc pollution point source (GDD); 3. unpolluted sites with most downstream site sampled within the catchment were residues of both zinc and organic pollution combined (GHU); 4. zinc pollution point source (GDD) and downstream (GBK); and 5. organic pollution outflow site (HHD) and further downstream of organic pollution (HHG). See Fig. 1 for catchment map with sites

ns not significant

$^*p<0.05$; $^{**}p<0.001$; $^{***}p<0.0001$

Norris (1986) reported that Hydropsychidae responded negatively to metal-pollution in the Molongolo River and Mackey (1988) also made the same observation in the River Dee. Metal-pollution tolerance of Hydropsychidae was also observed in Daylight Creek (NSW) where they were the second most abundant taxa at a highly copper- and zinc-polluted site (Napier 1992), and in the South Esk River (Tasmania), they were abundant at all but one metal-polluted site (Norris et al. 1982). Tolerance of Hydropsychidae to mine pollution has been documented in other parts of the world; for example, they were recorded in New Zealand metal-polluted waterways (Hickey and Clements 1998), an English zinc contaminated river (Armitage 1980) and in acid mine drainage (AMD)-affected waters in Kentucky (Short et al. 1990).

The mayfly family Leptophlebiidae emerged as the most sensitive family in this study with equal and absolute intolerance of both the mine drainage and sewage. No individual specimen was collected at either the mine-polluted site or the STP-polluted site. Our results reinforce the reputation of Leptophlebiidae as one of the most pollution-sensitive macroinvertebrate families worldwide. They have been reported as being completely missing from other heavily acid mine drainage-affected reaches of rivers and streams such as the River Dee in Queensland (Mackey 1988), Bob's Creek in Kentucky (Short et al. 1990) and the River Vascão in Portugal (Gerhadt et al. 2004). Some pollution tolerance has been reported with AMD-affected streams in New Zealand (Winterbourn 1998) containing Leptophlebiidae tolerant of highly acidic waters (pH 3.5). Leptophlebiidae are also frequently reported to be very sensitive to organic pollution with several researchers reporting their complete absence at the most affected sites (Cosser 1988; Whitehurst and Lindsey 1990; Wright et al. 1995).

Four animals that strongly contributed to community structure at the polluted sites exhibited opposite affinities towards each of the two waste-types. Hydropsychidae was discussed above. The other three taxa were highly abundant in the organic pollution below the STP (Ancylidae, Chironomidae and Simuliidae) and were absent or at very low abundances, below the mine drainage. The gastropod Ancylidae had the most strongly diverging relationship to the waste sources. It was more than 1,000% more abundant in the presence of sewage effluent than at the unpolluted reference sites, yet it displayed intolerance of mine pollution. This differential tolerance is supported by the metal (SIGNAL-MET 8/10) and organic pollution (SIGNAL-SEW 2/10) grades in Chessman and McEvoy (1998). Ancylidae have also been found to be intolerant of mine drainage in Spain (Marqués et al. 2003) and were reported as being tolerant of sewage pollution in NSW (Wright 1994; Wright et al. 1995) and nutrient enrichment in the Eresma River in Central Spain (Camargo et al. 2004), although they were absent from the most sewage-polluted sites on the River Adur (Whitehurst and Lindsey 1990), possibly due to other human influences in the disturbed Adur catchment.

The biological and chemical changes resulting from pollution has been illustrated by the classic model developed by Hynes (1960) with a steady increase of 'pollution fauna' below the waste discharge then a gradual and progressive reduction with further distance below the point-source and a corresponding inverse relationship with pollution sensitive animals. We found some evidence of recovery below each waste source compared to sites located in the zone of highest contamination. Considerable recovery was evident further downstream below the STP discharge in Hat Hill Creek, yet a lower degree of recovery was observed in the Grose River below the coal mine, until the sewage-enriched waters combined with the Grose River.

This study constitutes some of the first Australian evidence that coal mining can result in freshwater ecosystem damage due to heavy-metal contamination. Such cases may appear to be unusual in Australia, but this is not the case internationally, where coal mining has been more frequently associated with AMD and elevated heavy metal levels in the USA (e.g. Herlihy et al. 1990), Europe (e.g. Armitage 1980; Malmqvist and Hoffsten 1999; Johnson 2003) and New Zealand (Winterbourn 1998).

This study builds upon previous northern hemisphere studies that also used macroinvertebrates to measure sewage and mine drainage impacts. They were carried out on the Nent River system in England where they contended with contaminated runoff from urban and agricultural landuses as well as mine and sewage impacts (Armitage 1980; Armitage and Blackburn 1985). Although strong changes in macroinvertebrate community structure were detected in the Nent River, there were difficulties clearly differentiating the specific sewage and mining impacts due to overlapping contamination from multiple sources of mine pollution. Our current study was able to limit the confounding effects of multiple overlapping sources of pollution and disturbance due to it being situated in a small catchment that was predominantly naturally vegetated.

5 Conclusions

Comparison of ecological effects of two different types of pollution (organic and inorganic) in a small catchment with otherwise unpolluted waterways flowing upstream of the two waste discharges provided an unusual opportunity to observe the relationship of macroinvertebrates to the different waste sources. The ecological effects of each of the two waste sources (STP and mine drainage) were clearly apparent from observed changes to the taxonomic assemblages of stream macroinvertebrates. We found that multivariate analysis of quantitative family level data allowed detailed assessment of the pollution impacts. Three biotic indices family richness, total abundance and EPT richness were also valuable for comparing effects of the two wastes. EPT richness was particularly sensitive at detecting biological impairment from both pollution sources.

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EXHIBIT 5

Ma15ccn10mc.r1

Submitted by: **Councilor Valerie Abbott**
Recommended by: **Councilor Valerie Abbott**

RESOLUTION NO. 366-11

WHEREAS, the Council of the City of Birmingham believes that clean, safe, reasonably-priced drinking water and the environmental health of the Black Warrior River basin are both essential to the quality of life of residents of the Birmingham area and the State of Alabama; and

WHEREAS, we believe that the Shepherd Bend Mine would be detrimental to the quality of drinking water in Birmingham and the surrounding area, and to the health of the Black Warrior River itself. This damage would result from the discharge of waste water from coal mining into the Black Warrior's Mulberry Fork, only 800 feet from the drinking water intake for over 200,000 customers of the Birmingham Water Works Board; and

WHEREAS, despite widespread opposition, in October 2010 the Alabama Surface Mining Commission issued a permit to Shepherd Bend, LLC for the mining of 286 acres adjacent to the river. The BWWB is appealing this permit and has offered detailed information as to how the wastewater discharges from the mine will introduce both toxic pollutants and sediment into the water. These pollutants can result in increased treatment costs (typically passed on to customers), decreased water quality, and possible health risks, as well a degradation of the river. The BWWB also stated that a mine this close to a major water intake would be "incompatible and unprecedented"; and

WHEREAS, Shepherd Bend, LLC has leases necessary to start mining an initial 34 acres. If they choose to mine beyond that first small increment, they will have to obtain leases from other property owners, including the University of Alabama System, a major owner of both land and mineral rights at Shepherd Bend. As a practical matter, without the consent and full participation of the UA System, it may not be cost effective to mine Shepherd Bend at all; and

WHEREAS, the Council of the City of Birmingham strongly believes that the damage which would be done to drinking water, the harm to fish and wildlife, and the tons of sediment dumped into the river and the adjacent wetlands are all excellent reasons to not to allow this project to go forward; and

NOW, THEREFORE, BE IT RESOLVED by the Council of the City of Birmingham, with Mayor William A. Bell, Sr. concurring, that we implore the University of Alabama System to neither sell nor lease their significant land and mineral holdings to allow coal mining at Shepherd Bend.

ADOPTED this Fifteenth day of March, Two Thousand and Eleven.

Adopted by the Council of the City of Birmingham March 15, 2011 and Approved by the Mayor March 22, 2011

Official Seal Birmingham, Alabama

A CERTIFIED COPY
Lee Frazier, Acting City Clerk
Birmingham, Al
Lee Frazier

EXHIBIT 6

City of Birmingham

RESOLUTION

WHEREAS, the Council of the City of Birmingham believes that clean, safe, reasonably-priced drinking water and the environmental health of the Black Warrior River Watershed are both essential to the quality of life for residents of the greater Birmingham area and the State of Alabama; and

WHEREAS, a new coal mine is being proposed along Mulberry Fork of the Black Warrior River near Dovertown and Cordova, upstream from one of greater Birmingham's drinking water intakes that provide water for 200,000 residents daily. Reed Minerals No. 5 Mine is scheduled to cover 506 acres, and the mine proposes to discharge wastewater out of 23 points into Mulberry Fork and its tributaries; and

WHEREAS, this is the second proposed coal mine near the drinking water supply in recent years, following the Shepherd Bend Mine proposal, which is 3 miles downstream from the Reed Mine site. On March 15, 2011, the Birmingham City Council unanimously adopted Resolution No. 366-11, which "implored the University of Alabama System to neither sell nor lease their significant land and mineral holdings to allow coal mining at Shepherd Bend"; and

WHEREAS, similar to the Shepherd Bend Mine proposal, according to the Birmingham Water Works Board (BWWB), Reed No. 5 Mine has "the potential to adversely impact the Birmingham drinking water" and it would significantly pollute Mulberry Fork, which has a use classification designation as a Public Water Supply. The BWWB Mulberry Fork drinking water intake is approximately 5.5 miles downstream from the proposed Reed No. 5 Mine site; and

WHEREAS, if the mine leads to greater demands on drinking water treatment operations including increased treatment costs, these costs will be paid for by consumers, not the mining company; and

WHEREAS, previous public comment letters submitted by the BWWB and Black Warrior Riverkeeper incorporate extensive data about the possible impacts of coal mining on local streams and the Mulberry Fork public water supply. Those materials conclusively demonstrate that permitting coal mine operations upstream from a public drinking water supply simply cannot and should not happen; and

WHEREAS, Reed No. 5 Mine joins a cluster of three other large coal mines on Mulberry Fork that were reclaimed or are currently in reclamation. After active coal mining has ceased, coal mine reclamation in many cases does not stop pollution from flowing off mine sites into the rivers. The cumulative impacts of these three mines, and many more upstream, on the river and the drinking water supply have not yet been evaluated; and

WHEREAS, until September 10, 2012, the Alabama Surface Mining Commission (ASMC) is accepting permit comments in reference to Reed No. 5 Mine, ASMC Permit No. P-3957, via surface mail to: ASMC, PO Box 2390, Jasper, AL 35502-2390 or via E-mail to Dr. Randall Johnson, **Randall.Johnson@asmc.alabama.gov**.

NOW, THEREFORE, BE IT RESOLVED by the Council of the City of Birmingham, with Mayor William A. Bell, Sr., concurring, that we implore the Alabama Surface Mining Commission to deny the permit for the proposed Reed Mine No. 5.

ADOPTED this Fourth day of September, Two Thousand and Twelve.

PRESIDENT OF THE CITY COUNCIL

Valerie A. Abbott
COUNCILMEMBER

Johnathan F. Austin
COUNCILMEMBER

Steven W. Hoyt
COUNCILMEMBER

Maxine Herring Parker
COUNCILMEMBER

Kimberly S. Rafferty
COUNCILMEMBER

Jay Roberson
COUNCILMEMBER

COUNCILMEMBER

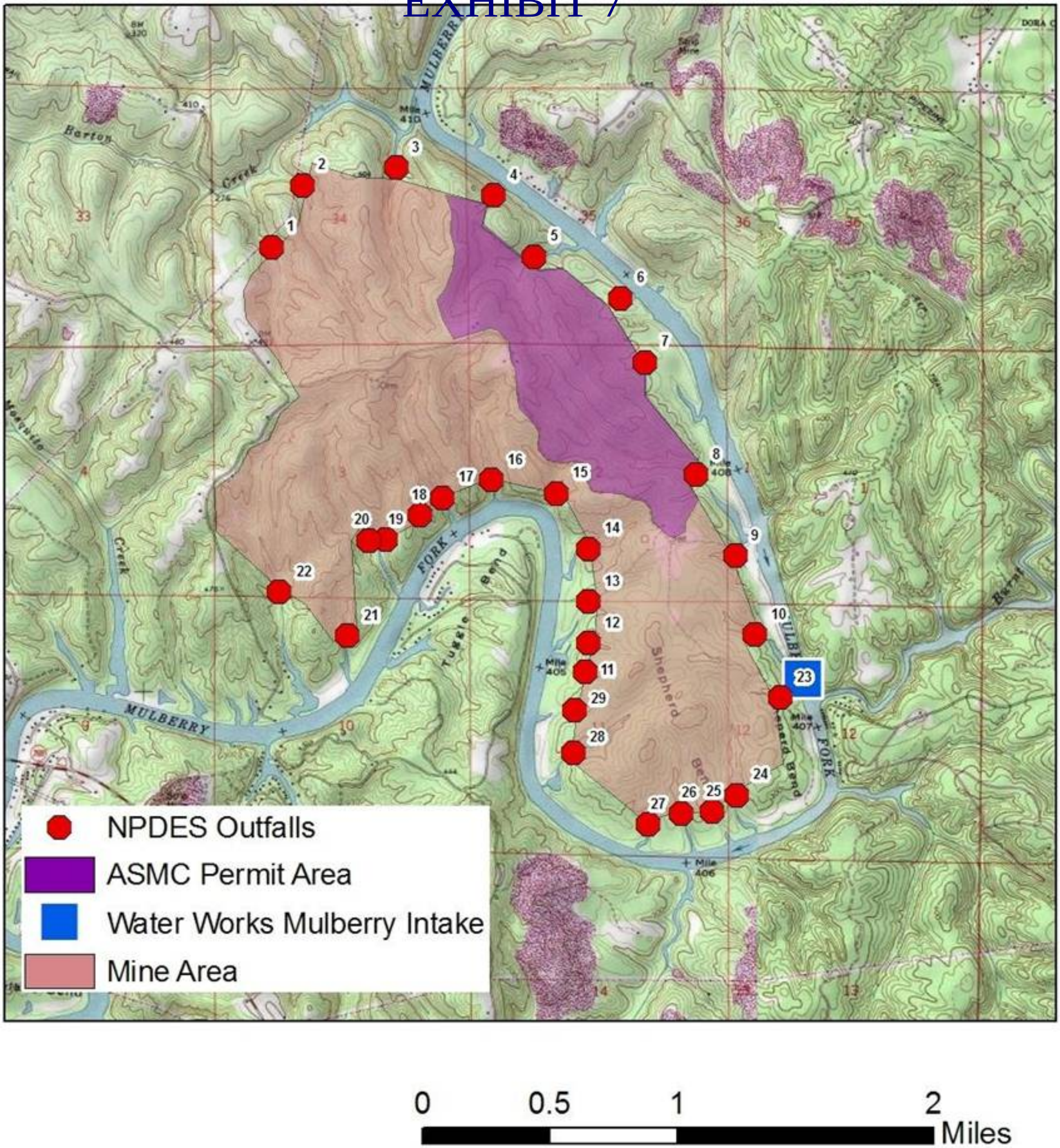
Carole C. Smitherman
COUNCILMEMBER

William A. Bell, Sr.
MAYOR

ATTEST:

CITY CLERK

EXHIBIT 7



MULBERRY
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FORK
Tuggle Bend
Shepherd Bend
MULBERRY
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Mile 407
Mile 406
Mile 405
NPDES Outfalls
ASMC Permit Area
Water Works Mulberry Intake
Mine Area
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1
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Miles

EXHIBIT 8

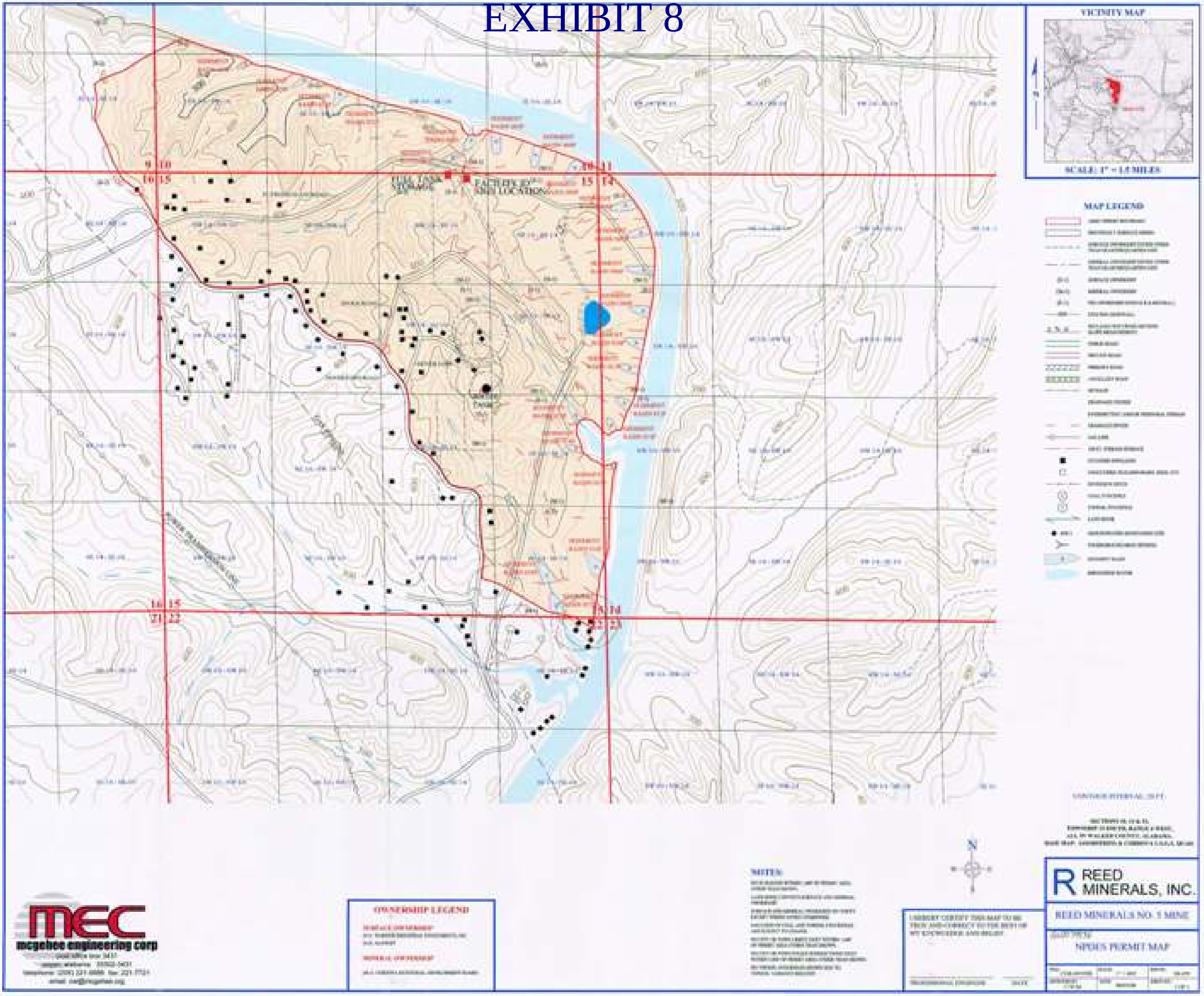
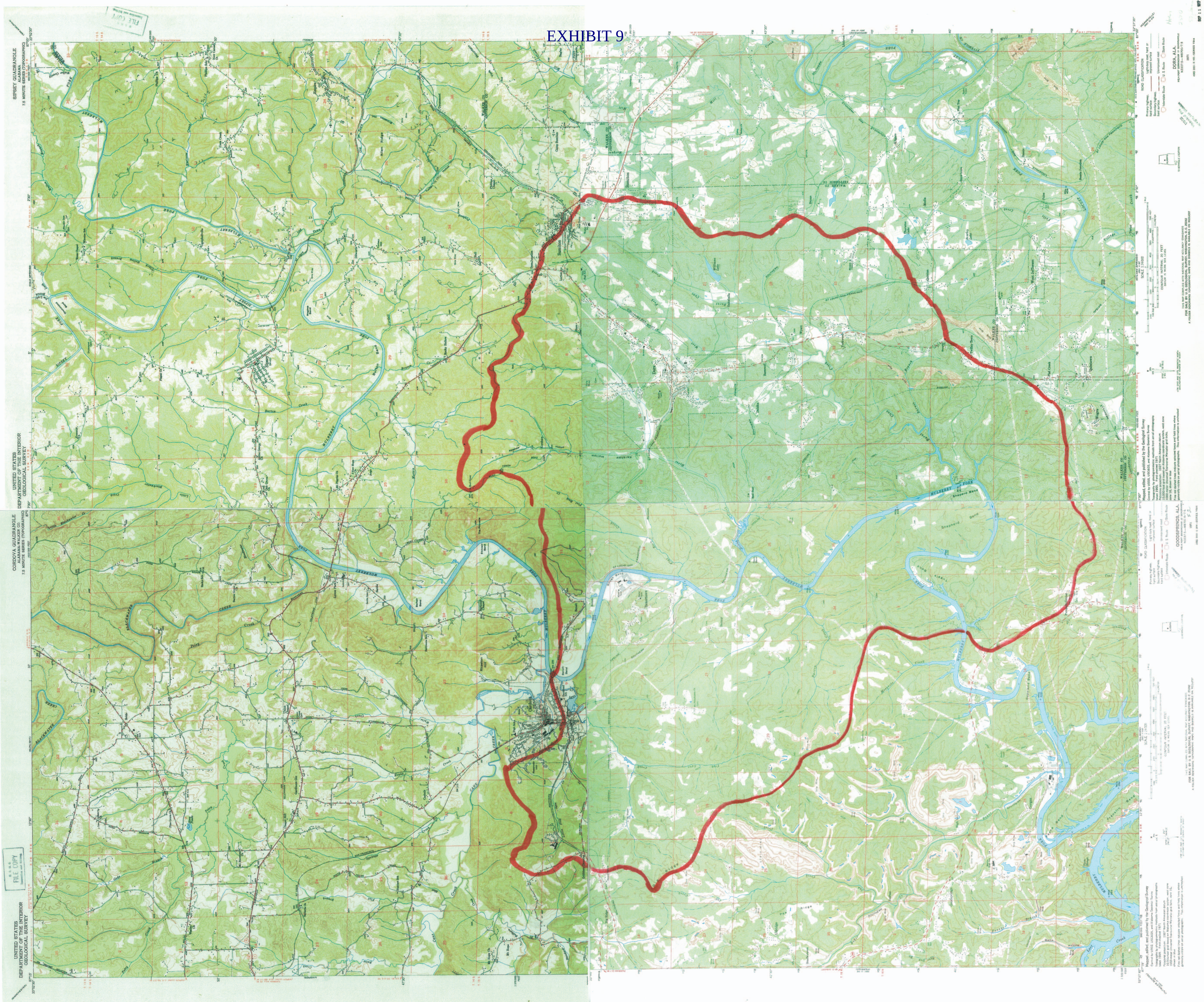

VICINITY MAP
SCALE: 1" = 1.5 MILES
MAP LEGEND
FUEL TANK STORAGE
NOTES:
OWNERSHIP LEGEND
MEC
mcgehee engineering corp
REED MINERALS, INC.
REED MINERALS NO. 5 MINE
NPDES PERMIT MAP

EXHIBIT 9


SIPSEY QUADRANGLE
CORDOVA QUADRANGLE
UNITED STATES DEPARTMENT OF THE INTERIOR GEOLOGICAL SURVEY
FILE COPY

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 4
SAM NUNN
ATLANTA FEDERAL CENTER
61 FORSYTH STREET
ATLANTA GEORGIA 30303-8960

OCT 01 2010

Ms. Glenda Dean
Chief, Water Division
Alabama Department of Environmental
Management
1400 Coliseum Boulevard
P.O. Box 301463
Montgomery, Alabama 36130-1463

Subject: Draft Permit Review

Dear Mr. McIndoe:

On September 1, 2010, the following draft National Pollutant Discharge Elimination System (NPDES) draft permits and fact sheets were publicly noticed by the Alabama Department of Environmental Management (ADEM) on its website.

	Applicant	NPDES Permit No.
1)	Tuscaloosa Resources - Licking Creek Mine	AL0073164
2)	M & B Excavating - Thompson South Mine	AL0077241
3)	Oak Grove Resources - Oak Grove Mine	AL0026875
4)	Twin Pines - Toby Mine	AL0076236
5)	Kodiak Mining - Coke Mine #1	AL0078221
6)	Twin Pines - Yeshic Mine	AL0079464
7)	United Land Corporation - United Land Loadout	AL0075558
8)	Triple B Minerals - Kellerman Barge Loadout	AL0076759
9)	Pickens Coal Barge Loadout	AL0043524
10)	Glen Allen Rail Loadout	AL0080101

In accordance with Section IV(B)(3) of the ADEM/Environmental Protection Agency (EPA) Memorandum of Agreement (MOA) and 40 Code of Federal Regulations (C.F.R.) § 123.44(a), I am taking this opportunity to provide you with our concerns and the specific areas that we believe must be addressed to ensure the final permits are consistent with the requirements of the Clean Water Act (CWA) and its implementing regulations.

EPA's concerns with the draft permits are focused on the need for sufficient information to determine whether there is a reasonable potential that the proposed discharges will cause or contribute to violations of state water quality standards (WQS) and, where needed, develop effluent limits and requirements, to ensure compliance with WQS, as required by 40 C.F.R. § 122.4(a), (d) and (i) and 40 C.F.R. § 122.44(d). General concerns are described in detail below, and specific comments are enclosed.

A. Evidence that Coal Mines Threaten Water Quality

Table 2-7 on page 33 of ADEM's 2010 Integrated Water Quality Monitoring and Assessment Report (305(b) Report) lists the size of rivers and streams impacted by various sources. By grouping together the surface mining and surface mining-abandoned categories of the 19 sources, coal mining activities ranks as the second largest source that impairs the most stream miles at 14.5 percent. "Atmospheric deposition" ranks first at 19.2 percent.

Recent studies have shown that there is a direct correlation between stream impairment and discharge of total dissolved solids (TDS)/specific conductivity (SC) due to coal mining and coal processing.[1] Much of this body of developing information regarding the extent to which coal mines are causing, or could cause, impairments to waters in areas of active coal mining has recently become available.

B. Sufficient Information to Ensure Compliance with State WQS

Despite the amount of data Alabama has collected for CWA Section 303(d) listing purposes, there is a scarcity of information available to EPA specifically pertaining to in-stream water quality in coal mining areas of Alabama. Available information regarding Alabama's progress towards collecting and reporting in-stream water quality suggests that much work remains to be done in assessing waters in areas of active coal mining in Alabama. EPA suggests an effective vehicle to gather data for developing permit limits that assure compliance with WQS would be for ADEM to include in-stream monitoring requirements in coal mine permits.

The major Standard Industrial Classification (SIC) codes associated with coal mining are 1221 and 1222. According to EPA's Integrated Compliance Information System (ICIS),[2] there are approximately 126 permits in Alabama with these SIC codes. The following table was generated based on ICIS data and information in ADEM's 2010 305(b) report:

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[1] A 2003 published study, "Field and Laboratory Assessment of a Coal Processing Effluent in the Leading Creek Watershed, Meigs County, Ohio" by Kennedy, et al. linked elevated specific conductance levels in the effluent to impaired, sensitive aquatic fauna. A 2004 Kentucky Department for Environmental Protection, Division of Water, Water Quality Branch study, "Effects of Surface Mining and Residential Land Use on Headwater Stream Biotic Integrity in the Eastern Kentucky Coalfield Region" (http://www.water.ky.gov/NR/rdonlyres/ED76CE4E-F46A-4509-8937-1A5DA40F3838/0/coal_mining1.pdf) found that the wholesale loss of mayflies at mined sites indicated that these organisms are especially sensitive to coal mine drainage. Dissolved solids emanating from hollowfills are a primary cause of biological impairment because of their severe impact to mayflies (a key component of headwater stream communities) and other sensitive taxa. A 2005 published study, "Evaluation of Ionic Contribution to the Toxicity of a Coal-Mine Effluent Using Ceriodaphnia dubia" by Kennedy, et al. linked impairment of aquatic life to elevated TDS levels. Finally, a 2008 published study, "Downstream effects of mountaintop coal mining: comparing biological conditions using family- and genus-level macroinvertebrate bioassessment tools" by Pond, et al. found evidence indicating that mining activities have subtle to severe impacts on aquatic life and the biological conditions of a stream.

[2] www.epa.gov/echo, July, 2010

Table 1 - Number of Coal mines in Alabama and Associated Water Quality Monitoring Stations

County	SIC code 1221 or 1222	Number of active trend WQ monitoring stations*	Number of Ecoregional WQ ref. stations*
Walker	46	0	0
Jefferson	27	17	0
Tuscaloosa	18	2	0
Marion	11	1	1
Shelby	5	2	1
Winston	4	0	1
Jackson	6	1	1
Cullman	3	1	2
Bibb	2	1	2
Fayette	1	0	0
Franklin	1	0	0
Barbour	1	1	1
St. Clair	1	0	1

* ref: Figure 2-3 (Representation of AL's active trend station network) and Table 2-1 (AL Ecoregional Reference stations) of ADEM's 2010 305(b) report

Most coal mines discharge to rivers and streams, and according to ADEM's 2010 305(b) report, approximately 77 percent of Alabama's rivers and streams have not been assessed for water quality purposes. As shown above, except for Jefferson, counties with coal mines lack a sufficient number active trend or reference water quality monitoring stations. Additionally, Alabama has no data in EPA's Storage and Retrieval system (i.e., STORET), a repository for ambient water quality, biological, and physical data used by state environmental agencies, EPA and other federal agencies, universities and private citizens.

One way ADEM currently supplements collecting water quality data near selected industrial facilities is through its Industrial River Monitoring Program. The Industrial River Monitoring Program is a water quality monitoring program consisting of 20 facilities that discharge to various rivers across the state. Facilities volunteer to perform in-stream monitoring in order to assist ADEM in assessing impacts from their discharges on the respective receiving streams. Participating facilities have monitoring requirements included in their NPDES permits. For example, the NPDES permit for Degussa Corporation requires the facility to monitor for downstream dissolved oxygen concentrations and also contains a requirement to do sediment and benthic studies, and Sloss Industries' permit requires bi-weekly stream monitoring for turbidity, total cyanide, available cyanide, hardness and pH. A similar approach is warranted for assessing coal mining impacts on Alabama waters.

In addition, to assure compliance with the foregoing water quality protection conditions, appropriate compliance monitoring requirements are necessary, especially in light of information described above showing TDS and SC to be suspected causes of impairments due to coal mining in eastern coal mining areas,[3] it is essential that the permittee perform some basic effluent and

[3] Relevant Alabama water quality standards include the following: "State waters shall be free from substances attributable to sewage, industrial wastes or other wastes that will settle to form bottom deposits which are unsightly, putrescent or interfere directly or indirectly with any classified water use." ADEM Administrative Code R 335-6-10-.06(a) and "State waters shall be free from substances attributable to sewage, industrial wastes or other wastes in concentrations or combinations which are toxic or harmful to human, animal or aquatic life to the extent commensurate with the designated usage of such waters." ADEM Administrative Code R 335-6-10-.06(c).

stream monitoring that will enable ADEM to identify discharges which may cause or contribute to violations of WQS, and take appropriate action.

C. Comments for Draft Coal Mine Permits

1. Coal mine effluents are complex due to the combination of SC/TDS levels and metals. EPA believes coal mine permits should require the permittee to perform either acute or chronic Whole Effluent Toxicity (WET) tests on the representative outfall, depending on the duration of the discharge. The results of WET monitoring will be used to determine the effectiveness of the Best Management Practices (BMPs) and compliance with WET limits included in the permit. In cases where Discharge Monitoring Reports (DMRs) indicate a sedimentation pond with a discharge lasting more than four consecutive days, chronic WET tests should be performed using *Ceriodaphnia dubia* and *Pimephales promelas* and using a dilution series that includes 100 percent effluent and the in-stream waste concentration. The end points should be reported as the inhibition concentration that affects 25 percent of the test organisms compared to the control (IC_{25}). Sampling should be performed quarterly. Any WET failures during the permit term should result in a requirement to do a toxicity reduction evaluation. In cases where the effluent discharge may be short in duration, it may be necessary to collect a high volume effluent sample and properly preserve it for use in the static-renewal test. Please refer to Section 8.5.4 on page 32 of EPA's document entitled, "Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms" (October 2002). Alternatively, the operator can use an acute WET test using either *Daphnia magna* or *D. pulex* and *Pimaphales promelas*. Any WET failure during the permit term should result in reopening the permit to include a requirement to do a toxicity reduction evaluation. All results should be reported to the Permit Issuing Authority as part of the DMR.

2. ADEM includes a reasonable potential analysis (RPA) in the fact sheet for several metals in some coal mine permits. However, an RPA should be performed for every facility, and either the fact sheet/rationale or the RPA spreadsheet should include the 7Q10 of each receiving water body (RWB) so that we can verify ADEM's calculations. It appears RPAs are being done using 7Q10 values for RWBs other than the ones the applicants plan to discharge to. Also, the RPA should include background data for several total recoverable metals (antimony, arsenic, beryllium, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, thallium, and zinc), total phenols, total cyanide, SC, and TDS levels in the receiving stream and downstream water bodies. ADEM should not assume background levels of zero when information is available that indicates otherwise. Water quality data may be obtained from a CWA Section 404 permit (if applicable), from the Alabama Surface Mining Commission (ASMC) permit application (if applicable), or from the ASCM surface water monitoring reports for existing coal mines. When appropriate, ADEM should use information from these sources as background conditions in the RPA. At a minimum, we recommend ADEM document the data sources that are used.

3. EPA recommends ADEM revise all the draft permits to include in-stream monitoring requirements contained in the enclosed monitoring plan. This data would be used to supplement in-stream information water quality from CWA 404 or ASMC permit applications for future RPAs.

4. For existing coal mine operations that have had a discharge during the term of the permit, data submitted in permit application renewals should be obtained from representative outfalls at that site. Also, data used to develop permit limits should not be more that three years old. Refer to page 2C-2 of EPA's Form 2C which states, "Data from samples taken in the past may be used, provided that all data requirements are met; sampling was done no more than three years before submission; . . ."

5. Part I, Section D (Schedule of Compliance) should specify a date by which the permittee should submit the BMP plan to ADEM. We recommend 120 days.

6. Part IV - Special Requirements, Section B.3: The phrase "stormwater discharged" in the second paragraph should be replaced with the phrase "any water discharged." This will clarify that the Total Maximum Daily Load (TMDL) does not just apply to stormwater.

7. Part IV.C.1 - The permit should define the term "persuasive evidence." As is, this term creates obstacles regarding enforceability.

8. The pH exemption needs to be revised to clarify that permittees are required to ensure that the pH WQS (6 - 8.5 Standard Units) will not be violated during low flow conditions. Proper documentation should include results of in-stream monitoring immediately downstream of each outfall with a discharge.

9. NPDES regulations require owners/operators to properly operate and maintain all treatment facilities used to achieve compliance with NPDES permit conditions (40 CFR 122.41(e)). Accordingly, we recommend ADEM use the enclosed Model Permit Language sheet, which addresses the structural integrity of all impoundments, for all coal mine permits. Additionally, to ensure ponds are maintained properly, the permits should require the permittees to submit to ADEM an annual certification that each pond/impoundment has a storage volume above the level of sediment (i.e., free board) to retain the 10-year, 24-hour storm event.

10. ADEM's form entitled, "Coal Mining and/or Preparation Plant Application Metals, Cyanide, and Total Phenols Outfall Data," is for all intents and purposes a substitute for EPA's Form 2C; a footnote at the bottom of the form refers to EPA's Forms 2C and 2D. Page 2C-2 of EPA's Form 2C states that grab samples can only be used for "effluents from holding ponds, or other impoundments, with a retention period of greater than 24 hours." However, unlike EPA's Form 2C, ADEM's form allows applicants the option of submitting analyses from either <u>the contents of a pond</u> or from the discharge of a pond. In most cases, applicants are submitting results from one grab sample taken from water within the pond. Therefore, permit applications should be re-submitted such that the reported lab results are from effluent samples. Based on EPA's review of some of the coal mine DMRs, in many cases the mine actually had a discharge but still used results from another site. Also, the permit should be modified to clarify application form requirements, including requiring verification that the ponds have a retention period greater than 24 hours.

11. The permit should require daily monitoring for effluent flow in order to more accurately determine the frequency of discharge.

The foregoing data submission and monitoring requirements would enable ADEM to make determinations of whether the permittee may cause or contribute to violations of WQS, as required by the CWA, and to take necessary and appropriate actions to prevent or mitigate potential violations. In the future, EPA may send interim objection letters for draft permits for coal mines, and coal mine related operations such as loadout facilities, that do not address the aforementioned concerns.

We commit to working with you on an expedited basis to resolve the issues in a manner that ensures the proposed permit modifications will be consistent with the requirements of the CWA. We look forward to working with you to achieve that objective. If you have any questions, please call me at (404) 562-9459 or have your staff contact Mark Nuhfer of the Municipal and Industrial NPDES Permit Section, at (404) 562-9390.

Sincerely,

James D. Giattina
Director
Water Protection Division

Enclosures

cc: See Addressee List

Addressee List

E.A. Drummond, President
Triple B Minerals, LLC
Kellerman Barge Loadout Facility
P.O. Box 1362
Jasper, AL 35504

Charles Stewart
Manager and President
Kodiak Mining Company, LLC
3500 35th Avenue North
Birmingham, AL 35207

Joe E. Powell, President
Pickens Coal, Inc.
P.O. Box 661135
Birmingham, AL 35266

Jerry Wood, President
Glen Allen Loadout Facility
P.O. Box 378
Brilliant, AL 35548

Stephan Williams
Oak Grove Resources, LLC
8800 Oak Grove Mine Road
Adger, AL 35006

George Barber, President
Twin Pines Coal Company
74 Industrial Parkway
Jasper, AL 35501

Eugene Morton, President
M & B Excavating Company
1001 Heflin Avenue
Birmingham, AL 35214

Jan Kizziah
Vice-President - Operations
Tuscaloosa Resources, Inc.
3500 35th Avenue
Birmingham, AL 35207

Miles Dearden, President
United Land Corporation
3500 35th Avenue North
Birmingham, AL 35207

Specific Comments

1. AL0073164, Tuscaloosa Resources - Licking Creek Mine in Shelby County

   a. This permit is for an existing mine with four outfalls to RWBs that are classified as Fish and Wildlife (F&W). They are Lick Creek, unnamed tributary to Piney Woods Creek, and an unnamed tributary to the Cahaba River. Operations at the site include surface and underground mining and coal preparations and reclamation. Representative samples used in the application were taken from outfall 035E at the Tacoa Minerals Mine (AL0061786) on February 2, 2007. The permit application for AL0073164 was signed on April 4, 2010, and received by ADEM some time thereafter. Since the data was received more than three years from the date it was sampled, more recent data must be submitted. Refer to page 2C-2 of EPA's Form 2C which states, "Data from samples taken in the past may be used, provided that all data requirements are met; sampling was done no more than three years before submission; . . ."

   b. The mine is upstream of a RWB designated as an Outstanding Alabama Water. Therefore, we recommend in-stream monitoring downstream of the mine be performed for metals and TDS/SC in order to ensure that the discharges do not cause or contribute to downstream WQS violations.

2. AL0077241, M & B Excavating - Thompson South Mine to be located in Bibb County

   a. This facility is a proposed mine for future surface and underground mining operations. Sixteen outfalls discharge to RWBs classified as F&W, and they are unnamed tributaries to Caffee Creek and to Pratt Creek. The fact sheet/permit rationale states that ADEM is currently developing a TMDL for siltation for the Upper Cahaba Watershed, which includes the Thompson Mine. Calculations were done by ADEM to determine if the new outfalls will contribute to the impairment of the Upper Cahaba Watershed. However, the calculations were only done for 8 of the 16 proposed outfalls; explain why. Also, the calculations indicate that a Total Suspended Solids (TSS) limit of 35 mg/l from the 8 outfalls translates to a TSS loading of less than the target load for ecoregion 67, which is 24.7 tons per square kilometer-year (km^2-yr). Provide a reference for the target load of 24.7 tons per km^2-yr. Whenever the permit is revised to include TMDL limits, the fact sheet should include data/calculations that demonstrate that the TSS permit limits were developed to ensure that the TMDL will be met at all times (i.e., all mining activities and various precipitation events, not just during dry weather events).

   b. The samples used for the permit application was taken on February 2, 2007, and received by ADEM's NPDES Enforcement Section on July 9, 2010. Since the data was received more than three years from the date it was sampled, more recent data must be submitted. Refer to page 2C-2 of EPA's

Form 2C which states, "Data from samples taken in the past may be used, provided that all data requirements are met; sampling was done no more than three years before submission; . . ."

c. The "2C" effluent information was obtained from a pond that discharges from outfall 015E at the Hope Coal Company (AL0076295). According to the permit application for the Hope Coal Mine, it has surface mining operations but no underground mining operations. Therefore, the effluent concentrations may not be representative for use by the M & B for its Thompson Mine. Have the applicant submit effluent data reflective of operations at the Thompson Mine site. Also, verify that the 7Q10 reported on the "2C" for AL0077241 (0.765 cfs) is that for a RWB at the Thompson Mine site and that the correct 7Q10 was used in the RPA calculations.

3. AL0026875, Oak Grove Resources - Oak Grove Mine

   a. This is an existing underground mine with 32 outfalls to RWBs classified as F&W or Agricultural and Industrial. The RWBs are unnamed tributary to Raccoon Branch, Raccoon Branch, Lick Branch, Valley Creek, unnamed tributary to Valley Creek, and Rock Creek. Per the permit application and DMRs, outfall 001 discharges sanitary wastewater. However, the permit application contains no effluent information on this discharge nor are there limits in the permit addressing this type of wastewater. Likewise, the permit should contain appropriate limits for the "Clean Water Tank" discharge to outfall 009.

   b. The effluent concentration data ("2C") indicates that samples are representative of those taken from a pond at the Chevron North River Mine (AL0030546, outfall 018E) on August 8, 2007. The 7Q10 indicated on the "2C" for AL0026875 is 0.132 cfs, and this 7Q10 was used in the RPA. EPA obtained the permit application effluent data for AL0030546, and Chevron also reported in its application data for samples taken from outfall 018E on August 8, 2007. The reported 7Q10 value was 0.132 cfs, which is the same as that reported for the Oak Grove Mine. It appears that an RPA done for the Oak Grove Mine was done using the 7Q10 value for a RWB at the Chevron Mine; please clarify. Notwithstanding this, the values for samples for pond effluent at outfall 18E at the Chevron Mine, which were also taken on August 8, 2007, do not match those submitted on the permit application for the Oak Grove Mine; please explain.

   c. Alabama's 2008 CWA Section 303(d) list indicates that segment AL0316112-0101-101 (Valley Creek) is listed for mercury. Verify that the Oak Grove Mine does not discharge neither directly, nor upstream, of this segment.

4. AL0076236, Twin Pine - Toby Mine located in Shelby County

a. This is an existing mine with surface mining activities. There are 23 outfalls to RWB classified as F&W. They are Jesse Creek, unnamed tributary to Jesse Creek, unnamed tributary to the Cahaba River, Lick Creek, Piney Woods Creek, and unnamed tributary to Piney Woods Creek. The application states that the 7Q10 is 0.765 cfs and that the hardness is 110 mg/l as $CaCO_3$. Is this information for the Toby Mine (AL0076236) or for the representative outfall from AL0076295?

b. The applicant certifies (page 11 of 15) that a comprehensive Pollution Abatement/Prevention (PAP) plan and an Spill Prevention and Countermeasure Control (SPCC) plan have been prepared. Explain if the PAP plan is the same as the BMP plan required in the permit. Also, forward to us a copy of the facility's PAP and SPCC plans.

c. Clarify the 7Q10 was used in the reasonable potential calculations - zero or 0.765 cfs.

d. The fact sheet should explain why WET requirements only apply to outfalls 003 and 004; both go to an unnamed tributary to the Cahaba River.

e. The effluent samples reported on the "2C" for the Toby Mine were taken from the pond for outfall 015E at the Hope Coal Mine (AL0076295). EPA obtained the permit application for AL0076295, and it indicates that reported values on that application were based on metals concentrations in a pond from yet another coal mine, the Tacoa Minerals Mine (AL0061786). The Toby and Hope Coal Mines both have surface mining operations, but they have no underground operations. Since the Tacoa Mine has surface and underground mining operations, its pond concentrations should not be used to represent that at the Toby Mine or at the Hope Coal Mine.

5. AL0078221: Kodiak Mining - Coke Mine #1 located in Shelby County

a. This is a new mine that will have surface and underground mining operations and a coal preparation plant. There are 13 proposed outfalls to the following RWBs: Jesse Creek, Lick Creek, Savage Creek, and an unnamed tributary to the Cahaba River. All RWBs are classified as F&W. The fact sheet/permit rationale states that ADEM is currently developing a TMDL for siltation for the Upper Cahaba Watershed, which includes the Coke #1 Mine. Calculations for all 13 proposed outfalls were done by ADEM to determine if the new outfalls will contribute to the impairment of the Upper Cahaba Watershed. Also, the calculations indicate that a TSS limit of 35 mg/l from the 8 outfalls translates to a TSS loading of less than the target load for ecoregion 67, which is 24.7 tons per km^2-year. Provide a reference for the target load of 24.7 tons per km^2-year. Whenever the permit is revised to include a TMDL limit, the fact sheet should include data/calculations that demonstrate that the TSS permit limits were developed to ensure that the TMDL will be met at all times (i.e., all mining activities and various precipitation events, not just during dry weather events).

b. The fact sheet/rationale should indicate the 7Q10 value for a RWB at the facility so that we can perform an independent RPA.

c. Samples used for the application were obtained from a pond at outfall 015E at the Hope Coal Mine (AL0076295) on February 7, 2007. The application for Kodiak's Coke #1 Mine was signed on July 2, 2010. Since the data was received more than three years from the date it was sampled, more recent data must be submitted. Please refer to page 2C-2 of EPA's Form 2C which states, "Data from samples taken in the past may be used, provided that all data requirements are met; sampling was done no more than three years before submission; . . ."

6. AL0079464, Twin Pines - Yeshic Mine located in Shelby County

a. The facility is an existing surface mine with 18 outfalls to the following RWBs, which are all classified as F&W: Murray Creek, unnamed tributary to Murray Creek, and Clark Creek. The fact sheet states that ADEM is currently developing a TMDL for siltation for the Upper Cahaba Watershed, which includes the Yeshic Mine. Calculations were done by ADEM to determine if the new outfalls will contribute to the impairment of the Upper Cahaba Watershed. The calculations were only done for 9 of the 18 outfalls; please explain why. Also, the calculations indicate that a TSS limit of 35 mg/l from each of the 9 outfalls translates to a TSS loading of less than the target load for ecoregion 67, which is 24.7 tons per km^2-year. Please provide a reference for the target load of 24.7 tons per km^2-year. Whenever the permit is revised to include a TMDL limit, the fact sheet should include data/calculations that demonstrate that the TSS permit limits were developed to ensure that the TMDL will be met at all times (i.e., all mining activities and various precipitation events, not just during dry weather events).

b. The fact sheet/rationale should document the 7Q10 value for the RWB used in the RPA.

7. AL0075558, United Land Corporation - United Land Loadout Facility

a. This is a reissuance of an existing coal barge loading facility with one outfall to the Black Warrior River (F&W) at mile marker 353. The SIC Code in the application is reported as being 1221, and the following are listed as operations at the site: mineral storing, mineral loading, mineral crushing and screening, mineral transportation, preparation plant waste recovery, excavation, grading, clearing and grubbing, reclamation of disturbed areas, and pre-mining logging or land clearing. Based on this information, it appears that there are no active mining operations at the site, but there is a coal preparation plant; please clarify. There is no ASMC permit for this facility.

However, there are two United States Corps of Engineer permits: AL02-00696-L and ALG02-00697-L.

b. The effluent limitation table in Part I.A of the permit contains limits for active mining and post-mining operations. If there is no active mining at the site, please delete the reference to active mining in order to avoid confusion. Also, the fact sheet/permit rationale should be revised to reflect the actual activities at the site.

c. The permit application was not signed nor dated. Therefore, it should be deemed to be incomplete.

8. AL0076759, Triple B Minerals - Kellerman Barge Loadout Facility located in Tuscaloosa County

   a. This is a reissuance of an existing coal barge loading facility with one outfall to the Holt Reservoir (F&W). The application states that the SIC Code is 1241 (Coal mining services), and the following are listed as operations at the site: mineral storing, mineral loading, mineral transportation, on-site construction, excavation, grading, clearing and grubbing, and reclamation of disturbed areas. Based on this information, it appears that there are no active mining operations at the site. Also, according to the permit application, there is no ASMC permit for this facility. Confirm there are no mining activities on site.

   b. The effluent limitation table in Part I.A of the permit contains limits for active mining and post-mining operations. If there is no active mining at the site, please delete the reference to active mining in order to avoid confusion. Also, the fact sheet/permit rationale should be revised to reflect the actual activities at the site.

9. AL0043524, Pickens Coal Barge Loadout

   a. This is a reissuance of an existing coal barge loading facility with coal preparation operations with two outfalls to the Black Warrior River (classified as F&W). The application states that the SIC Code is 1221 (coal mining services), and the following are listed as operations at the site: mineral storing, mineral dry processing, mineral loading, mineral transportation, preparation plant waste recovery, on-site construction, excavation, grading, clearing and grubbing, reclamation of disturbed areas, and pre-mining logging or land clearing.

   b. The Form 2C was not signed nor dated. Therefore, it should be deemed to be incomplete.

   c. The effluent limitations table in Part I.A of the permit contains limits for active mining and post-mining operations. If there is no active mining at the site, delete the reference to active mining in order to avoid confusion. Also, the fact sheet/permit rationale should be revised to reflect the actual activities at the site.

10. AL0080101, Glen Allen Rail Loadout Facility to be located in Marion County

    This is a new coal barge loadout facility with one outfall to Studhorse Creek (F&W). The SIC Code in the application is reported as being 4013 (Railroad Loadout), and the following are listed as operations at the site: mineral storing, mineral loading, mineral crushing and screening, mineral transportation, on-site construction, and reclamation of disturbed areas. The effluent limitation table in Part I.A of the permit contains limits for active mining and post-mining operations. If there is no active mining at the site, delete the reference to active mining in order to avoid confusion. Also, the fact sheet/permit rationale should be revised to reflect the actual activities at the site.

MONITORING PLAN

The purpose of this Monitoring Plan is to set forth requirements for in-stream biological and chemical monitoring before (i.e., baseline), during and after active mining activities as well as chemical and WET effluent monitoring requirements, in order to evaluate BMP effectiveness and downstream water quality effects as mining proceeds.

In-stream Chemical Monitoring

The permittee should perform in-stream monitoring for the parameters listed below in Table 1. Additionally, in accordance with 40 Code of Federal Regulations (C.F.R.) § 122.44(c) (5), the following in-stream monitoring should be conducted:

Table 1. List of Parameters To Be Sampled*

Parameter	EPA Test Method
Stream Flow, cubic feet per second	
Specific conductance (SC), uS/cm	
Total Dissolved Solids (TDS), mg/l	160.1
Turbidity, Nephelometric Turbidity Units (NTU)	
Sulfates, mg/l	300.0
Chlorides, mg/l	300.0
Bicarbonate Alkalinity, mg/l	
Total Recoverable Antimony, ug/l	200.8
Total Recoverable Arsenic, ug/l	200.8
Total Recoverable Beryllium, ug/l	200.8
Total Recoverable Cadmium, ug/l	200.8
Total Recoverable Chromium, ug/l	200.8
Total Recoverable Copper, ug/l	200.8
Total Recoverable Iron, ug/l	200.8
Total Recoverable Lead, ug/l	200.8
Total Recoverable Manganese, ug/l	200.8
Total Recoverable Mercury, ug/l	1631E or 245.7
Total Recoverable Dissolved Nickel, ug/l	200.8
Total Recoverable Dissolved Selenium, ug/l	200.8
Total Recoverable Dissolved Silver, ug/l	200.8
Total Recoverable Dissolved Thallium, ug/L	200.8
Total Recoverable Zinc, ug/l	200.8
Hardness, mg/l (as $CaCO_3$)	SM 2340B
pH, Standard Units	
Total Calcium, ug/l	200.7
Total Magnesium, ug/l	200.7
Total Sodium, ug/l	
Total Potassium, ug/l	

*Specific conductance is a measurement of the sum of various ionic components in water that have the ability to conduct electricity. Due to differences in site-specific geology, the specific individual constituents comprising a SC (or TDS) concentration can vary. Relatively high levels of SC/TDS may impair the ability for some organisms to osmoregulate. Based on best professional judgment, the analyses for these parameters will be useful in determining the specific ionic species that may be the major constituent(s) in the conductivity level at the site.

a. <u>Sample Type</u>
Grab samples should be taken whenever possible.

b. <u>Sample Frequency</u>
The sampling frequency should be twice per month, at least five days apart, until reclamation is completed and the final bond is released. The amount of precipitation for the previous 24 hour period should be noted.

c. <u>Sampling Sites and Representative Outfall</u>
The plan should include the latitude and longitude for the following sampling locations:

i. One sampling point located upstream of the sediment pond.

ii. One in-stream monitoring site located immediately below the toe of the sedimentation pond outfall used for effluent monitoring requirements in this NPDES permit.

iii. One sampling point located *the further* of 200 meters (656 feet) downstream of a NPDES-permitted sedimentation pond outfall or the furthest downstream location that is upstream of any intervening tributaries. The sampling point should be downstream of riprap and other disturbance and located within a relatively natural and intact riparian zone.

iv. One sampling point located downstream of the first intervening tributary.

v. One sampling point located upstream of the first intervening tributary.

d. <u>Conditions for Taking Samples</u>
Samples should be collected during low- or base-flow conditions (e.g., not during, or within 24 hours after, a precipitation event).

e. <u>New/Proposed Mines</u>
For new/proposed mines, in-stream samples should be taken at a point upstream of the proposed outfall and at a point near a representative proposed outfall which is

up-gradient of any other confluence/stream segment and below the proposed representative outfall.

f. Test Methods
All analyses should be done using EPA methods in 40 C.F.R. § 136; specific low-level methods for metals are indicated in Table 1.

g. Reporting
The permittee should submit the laboratory report showing the analytical results and the latitude and longitude of the sampling locations, to ADEM as part of the Discharge Monitoring Report (DMR).

In-stream Biological monitoring

The permittee should implement an annual benthic macroinvertebrate study plan during critical low-flow conditions using approved state protocols for benthic macroinvertebrate sampling.

a. Concurrent in-stream monitoring
In-stream samples for SC, TDS, pH, temperature and dissolved oxygen should be taken at the same locations along with benthic samples.

b. Methods
The permittee should implement an annual benthic macroinvertebrate study plan using approved state-protocols for benthic macroinvertebrates sampling.

c. Sampling Locations
Use the same locations as shown above for in-stream chemical monitoring.

d. Sampling Time
Sampling should be avoided during periods of excessive precipitation and scouring floods. In cases where a large flow rate of the receiving water does not lend itself to a benthic assessment (i.e, only has non-wadeable sites), the permittee should perform a bioassessment using fish. Both fish and benthic macroinvertebrate studies should be performed for receiving waterbodies that are conducive to fish assessments. Results from sampling either of the two assemblages may be used to determine if the waterbody is impaired.

e. Reporting
The permittee should submit the results of the study to ADEM no later than 30 days following the permitee's receipt of the final report.

Effluent Monitoring

The permittee should perform effluent monitoring on the selected outfall that is representative of the effluent being discharged under worst case conditions (i.e, "representative outfall"). Therefore, the selected representative outfall should discharge to the receiving waterbody with the lowest 7-day consecutive flowrate with a 10-year frequency (i.e., 7Q10) on the mine site area which is currently undergoing the most mining disturbance, based on data/information submitted in the permit application.

a. Parameters and Test Methods
All analyses should be done using EPA methods in 40 C.F.R. §136. Recommended low-level methods for metals are indicated in Table 1.

b. Sampling Location
The sampling should be conducted at the representative outfall.

c. Sampling Frequency
The sampling frequency should be twice per month, at least five days apart, and the inches of precipitation measured during at the sampling location should be recorded and reported as part of the sampling report.

d. Sample Type
Grab samples should be used.

e. Reporting
All results should be reported to ADEM as part of the DMR.

Model Permit Language

A. Impoundment Design, Construction, Operation, and Maintenance

(1) All impoundments used to hold or treat wastewater and other associated wastes shall be designed, constructed, operated, and maintained to prevent the discharge of pollutants to waters of the United States, except as authorized under this permit.

(2) Design, construction, operation, and maintenance of any impoundment shall be in accordance with all relevant State and Federal regulations and shall be certified by a qualified, State-registered professional engineer and permitted and inspected by the appropriate agency prior to use. When practicable, piezometers or other instrumentation shall be installed as a means to aid monitoring of impoundment integrity.

B. Impoundment Integrity Inspections

(1) All impoundments shall be inspected at least monthly by qualified personnel with knowledge and training in impoundment integrity. The term qualified personnel means personnel having successfully completed the Mine Safety and Health Administration Qualification for Impoundment Inspection course in addition to the Annual Retraining for Impoundment Qualification, or equivalent courses. In addition, impoundments shall be inspected annually by a qualified, State-registered professional engineer. Additional inspections by qualified personnel shall be done within 7 days after large or extended rain events (i.e., 10-year, 24 hour precipitation event).

(2) Inspections shall, at a minimum, include observations of dams, dikes and toe areas for erosion, cracks or bulges, seepage, wet or soft soil, changes in geometry, the depth and elevation of the impounded water, sediment or slurry, freeboard, changes in vegetation such as overly lush, dead or unnaturally tilted vegetation, and any other changes which may indicate a potential compromise to impoundment integrity. The findings of each inspection shall be documented in a written inspection report.

(3) *Remediation Measures.* Within 24 hours of discovering changes that indicate a potential compromise to the structural integrity of the impoundment, the permittee shall begin procedures to remediate the problem. Changes such as significant increases in seepage or seepage carrying sediment may be signs of imminent impoundment failure and should be addressed immediately.

Other issues which may have long term impacts on integrity, such as trees growing on the impoundment or vegetation blocking spillways, shall be cleared within thirty days of first observation.

C. Reporting and Recordkeeping Requirements for Impoundments

(1) Within 5 days of discovering any changes in the impoundment that indicate a potential compromise to the structural integrity, the permittee must notify the NPDES Permitting Authority in writing describing the findings of the inspection, corrective measures taken, and expected outcomes. Failure to do so will be a violation of this permit.

(2) The permittee shall submit an annual report to the NPDES Permitting Authority summarizing findings of all monitoring activities, inspections, and remediation measures pertaining to the structural integrity, design, construction, and operation and maintenance of all impoundments.

(3) The permittee shall maintain records of all impoundment inspection and maintenance activities, including corrective actions made in response to inspections and all other activities undertaken to repair or maintain the impoundment. All records shall be kept on site and made available to State or Federal inspectors upon request.

(4) All pertinent impoundment permits, design, construction, operation, and maintenance information, including but not limited to: plans, geotechnical and structural integrity studies, copies of permits, associated certifications by qualified, State-registered professional engineer, and regulatory approvals, shall be kept on site and made available to State or Federal inspectors upon request.

D. Permit Re-opener Requirement

The Director may re-open this permit to incorporate more stringent requirements or any applicable standards pertaining to the operation and maintenance of coal combustion waste impoundments.

EXHIBIT 11

Expert Report of Robert Angus

I. <u>Qualifications and Experience</u>

1. My name is Robert Angus. I am a professor in the Biology Department at the University of Alabama at Birmingham. I hold a Bachelor's Degree in Zoology from the University of Wisconsin and a Ph.D. in Zoology from the University of Connecticut. A C.V. detailing my education, employment history, research, and representative publications is attached as Exhibit A to this report.

2. I have over thirty years of experience in researching the ecological health of aquatic systems, including rivers and creeks in the Black Warrior River drainage in Alabama. Specifically, my research has focused on the effects of toxic substances and silt from coal mining, industrial activities, urban runoff and treated wastewater on the biological health of aquatic ecosystems.

3. I am familiar with the discharge-related provisions of the federal Clean Water Act and the related regulations and guidelines. I am also familiar with the Alabama's National Pollutant Discharge Elimination System ("NPDES") program and its accompanying regulations and guidelines, including Alabama's narrative water quality standards.

4. I understand that Alabama has both numeric and narrative water quality standards that are intended to support water uses for Fish and Wildlife and Public Water Supply. In particular, I know that Alabama's standards include a provision that forbids sediment discharges from collecting on river bottoms.

5. I understand that mining sites must have a Pollution Abatement/Prevention Plan ("PAP Plan") associated with them to comply with state regulations and guidance, and that this plan details the ways in which sediment and other pollutants will be kept out of a receiving river or stream.

6. My publications for the last 10 years are as follows:

McClintock, J.B., Angus, R.A., Ho, C., Amsler, C.D., Baker, B.J. 2008. Intraspecific agonistic arm-fencing behavior in the Antarctic keystone sea star *Odontaster validus* influences prey acquisition. Marine Ecology Progress Series 371: 297–300.

Viamonte, L.D., Marion, K.R., Hofer, S.C., Angus, R.A. 2007. Five Mile Creek bioassessment study: baseline evaluation of stream health using fish communities. Journal of the Alabama Academy of Science 78:231-247.

McClintock, J.B., Angus, R.A., McClintock, F.E. 2007. Abundance, diversity and fidelity of macroinvertebrates sheltering beneath rocks during tidal emersion in an intertidal cobble field: Does the Intermediate Disturbance Hypothesis hold for less exposed shores with smaller rocks? Journal of Experimental Marine Biology and Ecology 352:351-360.

Gavand, M.R., McClintock, J.B., Amsler, C.D., Peters, R.W., Angus, R.A. 2007. Effects of sonication and advanced chemical oxidants on the unicellular green alga *Dunaliella tertiolecta* and cysts, larvae and adults of the brine shrimp *Artemia salina*: a prospective treatment to eradicate invasive organisms from ballast water. Marine Pollution Bulletin 54(11):1777-1788.

Stanko, J.P., Angus, RA. 2007. In vivo assessment of the capacity of androstenedione to masculinize female mosquitofish (*Gambusia affinis*) exposed through dietary and static renewal methods. Environmental Toxicology and Chemistry 26(5):920-926.

Estes, E.C.J., Katholi, C.R., Angus, R.A. 2006. Elevated fluctuating asymmetry in eastern mosquitofish (*Gambusia holbrooki*) from a river receiving paper mill effluent. Environmental Toxicology and Chemistry 25(4):1026-1033.

Angus, R.A., Stanko, J.P., Jenkins, R.L., Watson, R.D. 2005. Effects of 17α-ethynylestradiol on sexual development of male western mosquitofish (*Gambusia affinis*). Comparative Biochemistry and Physiology, Part C 140:330-339.

Stanko, J.P., Angus, R.A. 2005. Paper manufacture and its impact on the aquatic environment. Reviews of Environmental Contamination and Toxicology 185:67-92.

Jenkins, R.L., Wilson, E.M., Angus, R.A., Howell, W.M., Kirk, M., Moore, R, Nance, M., Brown, A. 2004. Production of androgens by microbial transformation of progesterone in vitro: a model for androgen production in rivers receiving paper mill effluent. Environmental Health Perspectives 112: 1508-1511.

Blackwell, E.A., Angus, R.A., Cline, G.R., Marion, K.R. 2003. Natural growth rates of *Ambystoma maculatum* in Alabama. Journal of Herpetology 37: 608-612.

Jenkins, R.L., Wilson, E.M., Angus, R.A., Howell, W.M., Kirk, M. 2003. Androstenedione and progesterone in the sediment of a river receiving paper mill effluent. Toxicological Sciences 73:53-59.

Angus, R.A., Weaver, S.A., Grizzle, J., Watson, R.D. 2002. Reproductive characteristics of male mosquitofish (*Gambusia affinis*) inhabiting a small southeastern U.S. river receiving treated domestic sewage effluent. Environmental Toxicology and Chemistry 21:1404-1409.

Angus R.A., McNatt H., Howell W.M. and Peoples S.D. 2001. Gonopodium development in normal and 11-ketotestosterone-treated mosquitofish (*Gambusia affinis*): a quantitative study using computer image analysis. General and Comparative Endocrinology 123:222-234.

Jenkins, R., Angus, R.A., McNatt, H., Howell, W.M., Kemppainen, J.A., Kirk, M., and Wilson, E.M. 2001. Identification of androstenedione in a river containing paper mill effluent. Environmental Toxicology and Chemistry 20:1325-1331.

Tolar, J.F., Mehollin, A.R., Watson, R.D., and Angus, R.A. 2001. Mosquitofish (*Gambusia affinis*) vitellogenin: identification, purification, and immunoassay. Comparative Biochemistry and Physiology Part C 128:237-245.

Onorato, D., R.A. Angus, and K.R. Marion. 2000. Historical changes in the ichthyofaunal assemblages of the upper Cahaba River in Alabama associated with extensive urban development in the watershed. Journal of Freshwater Ecology 15:47-63.

Angus, R.A., B. Dass, and P.D. Blanchard. 1999. Quantification of the expression of a temperature-sensitive pigment allele in sailfin mollies (*Poecilia latipinna*) by image analysis. Pigment Cell Research 12(2):126-130.

7. In the previous three years, I have not testified as an expert in a trial or by deposition in any litigation.

II. <u>Areas of Investigation/Opinions</u>

I have been asked to investigate and form opinions on the following issues related to ADEM's issuance of an NPDES permit ("the permit") for the Shepherd Bend mine in Walker County, Alabama:

- The exemptions from discharge limits in the permit, and whether the exemptions from discharge limits in the permit are protective of water quality and assure compliance with water quality standards;
- The failure to set discharge limits for certain pollutants present in mining discharges and the impact of this failure on water quality standards; and
- The specific impacts of this permitted discharge on fish and wildlife in the Mulberry Fork of the Black Warrior River.

III. <u>Facts Relied Upon</u>

I have considered the following information about the Shepherd Bend mine site in forming my opinions. The information I considered has included facts that I would ordinarily consider and rely upon in reaching opinions about a site.

1. I have reviewed ADEM's water use classifications for the Mulberry Fork and its tributaries; the permit application; the draft permit; comments of the Birmingham Water Works Board, Black Warrior Riverkeeper, and United States Fish and Wildlife Service on the draft permit; the final permit; and the expert report of Warner Golden.

2. Based upon my review of these documents, I have learned the following facts:

    a. On October 10, 2007, Shepherd Bend submitted its application for a NPDES permit from ADEM to authorize the discharge of water from its mining operations into the Mulberry Fork of the Black Warrior River and certain tributaries.

    b. In November of 2007, ADEM released a draft permit which proposed the authorization of Shepherd Bend's discharges at the site.

c. In December of 2007, Black Warrior Riverkeeper and the Birmingham Water Works Board submitted comments on the draft permit. Both entities raised concerns regarding the proximity of the mining operation to its drinking water intake valve and other water quality impacts.

d. The United States Fish and Wildlife Service commented on the Shepherd Bend project in December 2007 and March 2008. Although the agency concluded that no endangered species exist at the site, it made several specific recommendations to minimize harm to aquatic species, including a numeric turbidity limit of 10 nephelometric turbidity units ("NTUs") in the permit and the maintenance of riparian buffers.

e. On July 21, 2008, ADEM issued a final permit to Shepherd Bend. The final permit became effective on August 1, 2008.

f. Shepherd Bend did not submit a Pollution Abatement/Prevention Plan ("PAP plan") to ADEM during the permitting process. The PAP plan is a site-specific, detailed document which explains the measures that a mining operation will employ to minimize its impacts on water quality. Pursuant to ADEM regulations, PAP plans typically include an explanation of the design of sediment ponds at the site and diagrams of this design for all ponds, plans to minimize impacts from mining on nearby streams, plans to minimize sediment and other pollutants' release from haul roads, and plans to minimize the effect of non-point source pollution from the mining operation. The PAP plan is an essential element of any NPDES permit for a mining facility. Without a PAP plan, there is no meaningful way to determine the total impact of the discharges from the site on the water quality of the receiving waters.

g. The Shepherd Bend site is 1,773 acres.

h. Shepherd Bend will have 29 outfalls at the site, and will potentially release a variety of pollutants including iron, manganese, aluminum, arsenic, cadmium, copper, lead, selenium, zinc, total dissolved solids ("TDS") and total suspended solids ("TSS").

i. The Mulberry Fork of the Black Warrior River, where 11 of the 29 outfalls will release their discharges, is classified for "Public Water Supply" and "Fish and Wildlife" uses pursuant to Alabama's water quality criteria.

j. The remaining 18 outfalls all discharge into tributaries of the Mulberry Fork which are designated for "Public Water Supply" and/or "Fish and Wildlife" uses.

k. A "Fish and Wildlife" designation means that the water is suitable for fishing, propagation of fish, aquatic life, and wildlife.

l. The permit exempts iron, manganese, and TSS from discharge limitations during the vast majority of precipitation events, as explained further below.

m. The permit does not set any discharge limitations for aluminum, TDS, sulfates, or chlorides or any of the other heavy metals commonly associated with mine runoff (e.g. arsenic, copper, cadmium, lead, zinc, selenium).

n. Since the permit does not limit the levels of toxic substances that may be discharged from the mining site, it fails to adopt the recommendations from the Fish and Wildlife Service to protect fish and wildlife in the Mulberry Fork and its tributaries.

o. The river is already suffering from abuse. Portions of the Mulberry Fork are currently listed as "impaired" (i.e. on the 303(d) list), which means that they are already sufficiently impacted by human inputs that they are unable to support their designated uses.

IV. **Opinions**

Based on information contained in the permit application, draft permit, and final permit, the report of Warner Golden, and my experience, education, and training in evaluating pollutant discharges and their effects on aquatic ecosystem health, I have formed the following opinions.

A. **Exemptions in the Permit and Violations of Water Quality Standards**

1. The permit includes daily average and daily maximum discharge limitations for iron, manganese, and TSS, but exempts discharges of these pollutants during most precipitation events, as explained in further detail below in paragraphs 2 and 3.

2. For any precipitation event greater than a 2-year, 24-hour precipitation event, the permit exempts discharges of iron from any discharge limitation.

3. For all precipitation events, the permit exempts discharges of manganese and TSS from any discharge limitation.

4. Precipitation events carry the most potential for harm to aquatic life in the receiving waters from a mine site. The stormwater leaving the site carries heavy metals and other toxic pollutants from mining activities. Furthermore, the sediment leaving a site will settle onto stream bottoms, filling in crevices and depriving fish, insects, mussels and other aquatic organisms of habitat needed for daily living and/or spawning. For example, the larval forms of many aquatic insects require spaces between cobble on stream bottoms to hide from predators. Some fish need similar spaces in which to deposit their eggs. In heavily sedimented streams, such species become extirpated from the system. Sediment clouding the water reduces primary productivity (photosynthesis) and alters the types of plants that can grow in the system. Turbidity interferes with fish sight; it reduces their visual feeding efficiency and interferes with reproductive behavior of species that rely on visual cues.

5. The site will discharge approximately 3,187 tons of sediment during 10-year, 24-hour precipitation events, according to the accompanying report of Warner Golden. While it is not possible to precisely extrapolate the amount of sediment released in smaller precipitation events from the amount released in the 10 year, 24 hour precipitation event, the amount of sediment would be significant because of the steep slopes associated with the Shepherd Bend mine. The sheer volume and velocity of runoff from a site as large as the Shepherd Bend mine site will result in scouring in the receiving waters, which further degrades habitat and harms fish and wildlife. Whatever sediments are not moved downstream during the storm event will remain to smother the bottom habitat of the stream and fill in the interstices in the gravel. Also, by filling in pools, sedimentation reduces the habitat heterogeneity (i.e. riffles, runs and pools – both deep and shallow) characteristic of an undisturbed stream.

6. The exemption of discharges of TSS during all precipitation events, including even small precipitation events, will cause a violation of the water quality standards for the receiving waters because the discharges are not effectively treated or controlled.

B. <u>Failure to Set Limits for Total Dissolved Solids, Sulfates, Chlorides, and Aluminum</u>

1. The permit fails to set any discharge limits for total dissolved solids (TDS), sulfates, chlorides, aluminum and other metals, all of which are known to be present in significant levels in typical discharges from coal-mining operations.

2. Failure to include discharge limits on these pollutants will cause a violation of the water quality standards for the receiving waters because the discharges are not effectively treated or controlled (because there are no limits for the pollutants), and will harm aquatic life in the Mulberry Fork and its tributaries.

3. Specifically, heavy metals are toxic to aquatic organisms. Depending on the concentration in the receiving water, they may be acutely toxic (cause death within a short period of time) or may cause chronic toxicity – impairing growth, behavior and reproduction. Excessive sediment loads are highly destructive to aquatic ecosystems. They scour the stream during storm events and, by settling out when flow slows, they bury the system. This fills in the spaces between rocks where invertebrates live and many fish spawn. Instead, the bottom becomes an anaerobic layer of smelly "muck." Any toxic substances, such as heavy metals that are in the sediments tend to become re-distributed into the water column the next time they are disturbed, such as by a rain event. Chronic turbidity also modifies the primary productivity of the system, alters the kinds of plants that can live in the system and impairs any activities of the fish or invertebrates that rely on sight.

IV. Conclusion

In summary, ADEM could not possibly have determined that discharges from the Shepherd Bend mine would not impair water quality or cause a violation of water quality standards without reviewing a complete PAP plan for the site. Moreover, ADEM's exemption of iron, manganese, and TSS from almost all precipitation events, and failure to include limits on TDS, sulfate, chlorides, aluminum and other heavy metals at all, will cause a violation of Alabama's water quality standards because of its harm to fish and wildlife in the Mulberry Fork and its tributaries.

This 10th day of March, 2009.

Robert Angus

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Robert Angus, Ph.D.

EXHIBIT A

Curriculum Vitae Robert A. Angus

Address:	Biology Department University of Alabama at Birmingham Birmingham, AL 35294-1170
Phone:	(205) 934-4799
Fax:	(205) 975-6097
e-mail:	raangus@uab.edu

Education

B.S.	1968. (Zoology) University of Wisconsin, Madison, Wisconsin
Ph.D.	1977 (Zoology) University of Connecticut, Storrs, Connecticut. Doctoral Dissertation: Origin and distribution of multiple clones in unisexual fishes.

Academic Position

Professor, Department of Biology, University of Alabama at Birmingham

Employment

1998-	Professor of Biology, University of Alabama at Birmingham
1984-1998	Associate Professor of Biology, University of Alabama at Birmingham
1978-84	Assistant Professor of Biology, University of Alabama at Birmingham
1977-78	Postdoctoral Research in fish population genetics, University of Connecticut.
1972-77	University of Connecticut teaching assistantships in introductory biology, comparative vertebrate anatomy and ecology

Memberships

American Association for the Advancement of Science, American Fisheries Society, Alabama Fisheries Association, Alabama Academy of Science, Sigma Xi, Society of Environmental Toxicology and Chemistry

Editorial Boards

Associate Editor, The Journal of Heredity (1983 - 2001)
Editor, Alabama Fisheries Association Newsletter (1995 - present)

Reviewer of Manuscripts/Grant Proposals

American Midland Naturalist, American Naturalist, Archives of Environmental Contamination and Toxicology, Auburn University Environmental Institute, Biology of Reproduction, Bulletin of Marine Science, Cooperative Institute for Coastal and Estuarine Environmental Technology, Copeia, Environmental Science & Technology, Environmental Toxicology and Chemistry, Evolution, Fishery Bulletin, General and Comparative Endocrinology, Genetics, Gulf of Mexico Science, Journal of Alabama Academy of Science, Journal of the American Water Resources Association, Journal of Heredity, Maryland Sea

Grant, Mechanisms in Development, National Institutes of Health, National Science Foundation, North American Journal of Fisheries Management, Pakistan Journal of Scientific and Industrial Research, Southwestern Naturalist, U.S. Environmental Protection Agency, Waveland Press, West Publishing Company

Research Interests

Aquatic toxicology, especially fishes.

Publications (Peer-reviewed)

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2. Angus, R.A. and K. R. Marion. 1993. Producing a quality recreational fishery in the Bear Creek Reservoirs of Northwest Alabama: Assessment of current physical and biological conditions. Submitted to Tennessee Valley Authority. 83 pp.

3. Bohac, C.E., R.A. Angus, and K.R. Marion. 1993. Evaluation of conditions and improvement options for Upper Bear Creek Reservoir. TVA Technical Report Series TVA/WR - 93/6, TVA, Chattanooga, TN. 135 pp.

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39. Angus, R.A., and W.P. Thomas. 1987. Tyrosinase activity in hypermelanistic and wild-type sailfin mollies. J. Ala. Acad. Sci. 58:64.

40. Angus, R.A. 1987. Genetic and biochemical studies of pigment variants in Poeciliid fishes. ASB Bull. 34:98.

41. Tarbox, N.T., and R.A. Angus. 1986. Phenol resistance in mosquitofish (*Gambusia affinis*): a study of physiological mechanisms. J. Ala. Acad. Sci. 57:113.

42. Cline, G.B., C.W. Hardwick, Jr., and R.A. Angus. 1986. Isozymic similarities and differences among three populations of stone crabs, *Menippe mercenaria*, from near shore waters of the Gulf of Mexico. J. Ala. Acad. Sci. 57:131.

43. Angus, R.A. 1985. Fluctuating asymmetry in pure vs. intergrade mosquitofish populations. ASB Bulletin 32:60.

44. Angus, R.A. 1982. A temperature-sensitive melanistic mutation discovered in a natural population of sailfin mollies (*Poecilia latipinna*). ASB Bulletin 29:51.

<u>Graduate Students</u>

James Diggs. Ph.D. anticipated 2011. Dissertation title: Genetic variation within and between populations of glade-specific species in the genus *Dalea*.

Bryan Arwood. M.S. anticipated 2010. Thesis title: Evaluation of advanced oxidants as a treatment for enhancing the breakdown of steroids in wastewater.

Patricia Jackson. M.S. anticipated 2010. Thesis title: A survey of endocrine disrupting compounds in surface waters in the vicinity of Birmingham, Alabama.

Samiksha-Ashok Raut. Ph.D. anticitpated 2009. Dissertation title: Effects of endocrine disruptors on biomarkers of reproductive function in the western mosquitofish, *Gambusia affinis*.

Paul D. Melvin, III. Ph.D. 2007. Dissertation title: Sperm production and vitellogenesis as biomarkers of endocrine disruption in the male western mosquitofish, *Gambusia affinis*.

Louis D. Viamonte. M.S. 2007. Thesis title: Five Mile Creek bioassessment study: Baseline evaluation of stream health using fish communities.

Kevin J. Morse. Ph.D. 2005. Dissertation title: The effects of urbanization on the health of fish and benthic macroinvertebrate communities in the Upper Cahaba River watershed.

Jason P. Stanko. Ph.D. 2005. Dissertation title: Reproductive and developmental effects of bioactive constituents of pulp mill effluent on female mosquitofish, *Gambusia affinis*.

Eleanor J. Estes. M.S. 2004. Thesis title: Fluctuating asymmetry in eastern mosquitofish (*Gambusia holbrooki*): a comparison of populations inhabiting polluted and nonpolluted rivers.

Jaideep V. Honavar. M.S. 2003. Thesis title: Assessment of ichthyofaunal assemblages as indicators of sedimentation in the upper Cahaba River and its tributaries.

Peggy M. Kyzer. M.S. 2003. Thesis title: The effects of urban development on freshwater ecosystems: A literature review.

Heather B. McNatt. M.S. 2002. Thesis title: Effects of Paper Mill Effluent on a Population of Eastern Mosquitofish, *Gambusia holbrooki*.

Joseph F. Tolar. M.S. 1999. Thesis title: Mosquitofishes as sensitive indicators of environmental estrogens.

Paul D. Blanchard. Ph.D. 1991. Dissertation title: Pigment cell studies in sailfin mollies.

J. Mark Brubaker. M.S. 1983. Thesis title: A study of fluctuating asymmetry in mosquitofish populations in polluted and nonpolluted environments using a new scale staining technique.

Teaching

<u>Lecture/Lab Courses</u>

BY212 Human Genetics (taught once or twice/year since 1978)
BY245/345 Fundamentals of Scientific Investigation (taught once/year since 1993)
BY312 Genetics (taught once or twice/year since 1978)
BY313 Genetics Laboratory (taught four times)
BY501 Advanced Biology for Teachers (taught once or twice/year since 1987)
BY555 Principles of Scientific Investigation (taught once/year since 1994)

<u>Non-Lecture Courses</u>

BY 397 Advanced Directed Readings
BY398 Undergraduate Research
BY399 Honors Research
BY499 Seminar in Biology (Genetics)
BY695 Special Topics in Biology
BY696 Special Topics in Biology II

Other Teaching

BY109 Human Population Pressures and the Environment (Guest lectures on water resources)
MGE 700 Human Genetics (Guest lecture on population genetics)
ENH 663 Biological Processes and Pollutant Impacts in Water (Guest lecture on methods of sampling freshwater fish populations)
CJ572 Biological Methods in Forensic Sciences (Guest lecture on probability and statistics)
UAB Special Studies - MCAT Review Course (Lectures on quantitative methods and genetics)
UAB Summer HPOPP (Health Professions OPPortunity) Enrichment Program (Lectures on human genetics)
UAB Biology Update Workshop for High School Teachers (Lecture on recent advances in molecular Genetics)
UAB Biomedical Methods Course for Birmingham High School Teachers (Lectures on computer programming in BASIC)
Talladega College - Biomedical Methods (Guest lecture on electrophoretic methods in biology)
Samford University ENVM503 - Quantitative Methods for Environmental Decision Makers (Statistics)

EXHIBIT 12

Expert Report of Warner Golden

I. Qualifications and Experience

1. I am Warner Golden, P.E., a Senior Engineer and Partner with NewFields, an environmental consulting firm headquartered in Atlanta, Georgia with an office in Birmingham, Alabama. I hold a Bachelor's Degree in Engineering from the Georgia Institute of Technology. I am a Professional Engineer licensed in the states of Alabama, Georgia, and Mississippi, a member of the American Society of Civil Engineers, and a member of the Air and Waste Management Association of Alabama. A C.V. detailing my education, employment history, research, and representative publications is attached as Exhibit A to this report.

2. I have over twenty years experience in civil engineering and environmental projects and specialized expertise in surface water and contamination assessment projects. I also have experience in various environmental remediation projects involving the remediation of water pollution.

3. I am familiar with the discharge-related provisions of the federal Clean Water Act and the related regulations and guidelines. I am also familiar with Alabama's National Pollutant Discharge Elimination System ("NPDES") program and its accompanying regulations and guidelines, including Alabama's narrative water quality standards.

4. I have worked on various projects involving NPDES permits and discharges over the last twenty years, and am familiar with the design of pollution abatement and/or prevention plans ("PAP plans"). I assisted in the preparation and design of such plans for several pulp and paper mills in Mississippi and for a facility in Eufaula, Alabama. I am familiar with Alabama Department of Environmental Management's ("ADEM") "Guidelines for Minimizing the Effects of Surface Mining and Surface Effects of Underground Mining on Water Quality" (hereinafter "PAP Plan Guidelines"), which include sections designed to help control sedimentation and harm from haul roads at mining sites such as the Shepherd Bend mine.

5. As a result of my work with NPDES permits, the development of PAP plans, and other wastewater modeling work I have conducted, I am familiar with design features and best management practices necessary to minimize the discharge of harmful pollutants into water. I am also familiar with the critical importance of such design features and best management practices in minimizing harm to the environment.

6. My publications for the last 10 years are as follows:

"Risk Management as a Land Use Issue: Case Study Application of GIS Analysis for Determining Remediation Requirements for Future Land Use Options and Implementation," Golden, W. and Odle, B., 2007 Soil and Groundwater Technology Association Annual Meeting Rotherham, United Kingdom

"Real Time Basin Wide Conductivity Monitoring," Golden, W and Hall, W. L., 1991 Coalbed Methane Symposium, Tuscaloosa, Alabama

7. In the previous three years, I have not testified as an expert in a trial or by deposition in any litigation.

II. **Areas of Investigation/Opinions**

I have been asked to investigate and form opinions on the following issues related to ADEM's issuance of an NPDES permit ("the permit") for the Shepherd Bend mine in Walker County, Alabama:

- The importance and essential nature of a complete PAP plan in assessing a surface mining operation's impacts on water quality;

- Whether the limited SEDCAD analyses for ponds 8 and 10 submitted by Shepherd Bend with its permit application comply with ADEM's PAP Plan Guidelines;

- The exemptions from discharge limits in the permit, and whether the exemptions from discharge limits in the permit are protective of water quality and assure compliance with water quality standards; and

- The failure to set discharge limits for certain pollutants present in mining discharges and the impact of this failure on water quality standards.

III. **Facts Relied Upon**

I have considered the following information about the Shepherd Bend mine site in forming my opinions. The information I considered has included facts that I would ordinarily consider and rely on in reaching opinions about a site.

1. I have reviewed the permit application, the draft permit, comments of the Birmingham Water Works Board and the Black Warrior Riverkeeper on the draft permit, and the final permit.

2. Based upon my review of these documents, I have learned the following facts:

    a. On October 10, 2007, Shepherd Bend submitted its application for a NPDES permit from ADEM to authorize the discharge of water from its mining operations into the Mulberry Fork of the Black Warrior River and certain tributaries.

    b. Shepherd Bend plans to release discharges from its mining operations within 800 feet of the Mulberry Raw Water Pump Station, a drinking water intake maintained by the Birmingham Water Works Board. The Mulberry Raw Water Pump Station is a source of drinking water for the Birmingham water system.

    c. In November of 2007, ADEM released a draft permit which proposed the authorization of Shepherd Bend's discharges at the site.

d. In December of 2007, Black Warrior Riverkeeper and the Birmingham Water Works Board submitted comments on the draft permit. Both entities raised concerns regarding the proximity of the mining operation to its drinking water intake valve and other water quality impacts.

e. On July 21, 2008, ADEM issued a final permit to Shepherd Bend. The final permit became effective on August 1, 2008. ADEM attached its response to the Birmingham Water Works Board and Black Warrior Riverkeeper comments on the draft permit to this final permit.

f. Shepherd Bend did not submit a PAP plan to ADEM during the permitting process.

g. The Shepherd Bend site is 1,773 acres.

h. Shepherd Bend will have 29 outfalls at the site, and will release a variety of pollutants including iron, manganese, aluminum, sulfates, chlorides, total dissolved solids ("TDS"), and total suspended solids ("TSS") and will result in changes to the pH of the receiving waters.

i. The Mulberry Fork of the Black Warrior River, where 11 of the 29 outfalls will release their discharges upstream of the Mulberry Raw Water Pump Station, is classified for "Public Water Supply" and "Fish and Wildlife" uses pursuant to Alabama's water quality criteria. These 11 outfalls discharging into the Mulberry Fork drain approximately 886 acres, 50%, of the site.

j. The remaining 18 outfalls all discharge into the Mulberry Fork or its tributaries downstream of the Mulberry Raw Water Pump Station which are also designated for "Public Water Supply" and/or "Fish and Wildlife" uses.

k. The permit contains general discharge limitations for iron, manganese, and TSS. However, the permit drops these limits during the vast majority of precipitation events, as explained further below.

l. The permit does not set any discharge limitations for aluminum, total dissolved solids, sulfates, or chlorides.

IV. <u>Opinions</u>

Based on information contained in the permit application, draft permit, and final permit, and my experience, education, and training in reviewing NPDES permits and designing measures to minimize discharges that degrade water quality, I have formed the following opinions.

A. <u>PAP Plan/Violation of Water Quality Standard with Sediment Discharges from Pond Eight</u>

i. ***No PAP - Importance of a PAP Plan***

1. The PAP plan is an essential element of any NPDES permit for a mining facility. Without a PAP plan, there is no meaningful way to determine the total impact of the discharges from the site on the water quality of the receiving waters.

2. The PAP plan is a site-specific, detailed document which explains the measures that a mining operation will employ to minimize its impacts on water quality resulting from precipitation driven runoff. Pursuant to ADEM regulations and good engineering practices, PAP plans typically include an explanation of the design of sediment ponds at the site and diagrams of this design for all ponds, plans to minimize impacts from mining on nearby streams, plans to minimize sediment and other pollutants' release from haul roads, and plans to minimize the effect of non-point source pollution from the mining operation.

3. Based on information in the permit application, ADEM did not review any PAP plan before granting the permit to Shepherd Bend because Shepherd Bend did not provide a PAP plan to ADEM.

ii. Pond Design for Pond 8, Violations of Water Quality Standards

4. Pond design and orientation, one element of a PAP plan, has a major impact on how much sediment is discharged from a site such as the Shepherd Bend mine. This is particularly true at the Shepherd Bend site given the steep slopes present at the site.

5. Instead of submitting a PAP plan to ADEM, Shepherd Bend appears to have only submitted a SEDCAD analysis for its sediment ponds at Basins 8 and 10, two of the twenty-nine basins on the site. The SEDCAD analysis provides a hydrologic routing of the 10 year, 24 hour precipitation event through the theoretical sediment pond and provides an estimate of sediment collected in the pond and the amount allowed to pass through the pond. There is no indication that the sediment ponds at Basins 8 and 10 have actually been designed properly, as there are no plans and specifications for construction included in the SEDCAD analyses.

6. Without design plans and specifications for the sediments ponds at Basins 8 and 10, it is impossible to verify that these sediment ponds comply with ADEM's PAP Plan Guidelines because there is insufficient detail. ADEM could not possibly make a determination that the designs are adequate to provide for protection of water quality without details of the pond design for all sediment ponds including layout on topographic map, orientation of inflow and outfalls to check for short circuiting, pond size to verify retention time and sediment capture, dam width and side slopes to verify slope stability, outlet structure size and orientation, outlet works erosion protection to prevent the downstream toe of the dam, and slope protection measures, etc.

7. Notwithstanding the incompleteness of the information provided, the SEDCAD analysis for the sediment pond at Basin 8 reveals that the release of sediment from this pond alone will cause or contribute to a violation of Alabama's water quality standards.

8. First, the SEDCAD analysis assumes that the sediment ponds will capture 90% of the sediment from the site and prevent it from being released. This is high for a sediment pond and could be difficult to achieve in practice, especially as the retention time for the pond is reduced as sediment builds up over time.

9. Moreover, according to Shepherd Bend's SEDCAD analysis for pond 8, during the 10 year, 24 hour precipitation event, 3,142 tons of sediment will be washed from the 183 acres of open mine into the sediment pond for basin 8. Sediment pond 8 will then discharge approximately 329 tons of this sediment into downstream wetlands and the Mulberry Fork. This is the equivalent of more than 16 dump trucks of sediment. Notably, Shepherd Bend did not provide a SEDCAD analysis for precipitation events less than the 10 year, 24 hour precipitation event. While it is not possible to precisely extrapolate the amount of sediment released in smaller precipitation events from the amount released in the 10 year, 24 hour precipitation event, the amount of sediment would be significant because of the steep slopes associated with the Shepherd Bend mine.

10. Assuming the ratio of sediment discharged per disturbed mine area for pond 8 applied to the entire 1,773 acre site, the entire site will discharge approximately 3,187 tons of sediment into downstream wetlands and the Mulberry Fork. This is the equivalent of 160 dump trucks of sediment resulting from one storm event.

11. The release of this amount of sediment from pond 8, just one of the 29 proposed ponds, violates Alabama's water quality standards. The SEDCAD analysis indicated the peak sediment concentration (TSS) in the discharge will be 11,165 mg/l. Mass balance calculation indicates the average TSS of the discharge will be approximately 5,000 mg/l. This large amount of TSS violates Alabama's water quality standard providing that state waters must be free from wastes that will settle to form bottom deposits and interfere with classified water uses such as Public Water Supply and Fish and Wildlife uses.

12. The SEDCAD analysis for pond 10 is deficient in the same way as the analysis for pond 8, and also demonstrates that discharges at this pond alone would violate Alabama's water quality standards.

13. ADEM could not have determined that a PAP plan for the site was adequate to provide for the protection of water quality because no PAP plan was submitted with the permit application, and because the two pond designs provided do not comply with ADEM's PAP Plans Guidelines and will cause a violation of Alabama's water quality standards.

B. Exemptions in the Permit and Violations of Water Quality Standards

1. The permit includes generally applicable daily average and daily maximum discharge limitations for iron, manganese, and TSS, but exempts discharges of these pollutants during most precipitation events.

2. For any precipitation event greater than a 2-year, 24-hour precipitation event, the permit exempts discharges of iron from any discharge limitation.

3. For all precipitation events, the permit exempts discharges of manganese and TSS from any discharge limitation.

4. The exemption of discharges of iron in most precipitation events will cause a violation of the water quality standards for the receiving waters because the discharges are not effectively treated or controlled. As noted in the Birmingham Water Works Board's ("BWWB") comments on the draft permit, the discharge limits set for iron are ten times higher than the secondary maximum contaminant loads for total iron concentrations under the Safe Drinking Water Act. These lenient discharge limits are not applicable in precipitation events greater than a 2-year, 24-hour precipitation event, thus in many precipitation events, discharges of iron will violate the water quality standards. As noted by the BWWB, the discharge limits and exemptions for iron are not protective of drinking water uses.

5. The exemption of discharges of manganese during all precipitation events, including even small precipitation events, will cause a violation of the water quality standards for the receiving waters because the discharges are not effectively treated or controlled. As noted in the Birmingham Water Work's Board's ("BWWB") comments on the draft permit, the discharge limits set for manganese are forty times higher than the secondary maximum contaminant loads for total manganese concentrations under the Safe Drinking Water Act. These lenient discharge limits are not applicable in precipitation events, thus in many precipitation events, discharges of manganese will violate the water quality standards. As noted by the BWWB, the discharge limits and exemptions for manganese are not protective of drinking water uses.

6. The exemption of discharges of TSS during all precipitation events, including even small precipitation events, will cause a violation of the water quality standards for the receiving waters because the discharges are not effectively treated or controlled.

C. Errors in ADEM's Bases for the Discharge Limits

1. The permit sets general discharge limits for iron, manganese, TSS, pH, and flow (most of which do not apply during most precipitation events, as discussed below).

2. According to its Response to Comments, ADEM used mass balance calculations "to determine expected contaminant levels under critical conditions." On the basis of these calculations, ADEM determined that the discharge limits in the permit would be protective of water quality for both precipitation-driven and non-precipitation-driven discharges. However,

due to a misapplication of discharge limits in these calculations, ADEM's conclusion is flawed and incorrect.

3. Specifically, ADEM applied the final permit's <u>general</u> discharge limits – i.e., the limits from which the vast majority of precipitation-driven discharges are exempted – to Shepherd Bend's expected precipitation-driven discharges, as presented in the permit application. On the basis of this calculation, ADEM determined that the TSS concentrations at the Mulberry Intake would be at acceptable TSS concentrations of 35 and 70 mg/l.

4. In applying the general discharge limits to precipitation-driven discharges, ADEM improperly failed to consider that the precipitation-driven discharges would not be subject to the general discharge limits under the terms of the permit. Rather, the vast majority of precipitation events would be exempt from any discharge limits whatsoever. Accordingly, ADEM's application of the general discharge limits to precipitation-driven discharges to justify limits in the permit is not a valid analysis, as the 35 and 70 mg/l general discharge limits for TSS, as a matter of example, simply would not apply.

5. As a further matter, ADEM improperly failed to consider any non-precipitation discharges from Shepherd Bend in its analysis setting the general discharge limits. As noted above, ADEM considered <u>only</u> precipitation-driven discharges coming from the Shepherd Bend site, which artificially decreased the amount of discharges that ADEM considered in its analysis.

6. For example, under an appropriate analysis, ADEM should have used the average discharge of 5,000 mg/l TSS, as obtained from the pond 8 analysis, <u>in addition to</u> the precipitation-driven flows from the application. This mass balance calculation using the same remaining parameters used by ADEM results in a river concentration of 229 to 384 mg/l TSS at the Mulberry Raw Water Pump Station.

D. <u>Failure to Set Limits for Total Dissolved Solids, Sulfates, Chlorides, and Aluminum</u>

1. The permit fails to set any discharge limits for TDS, sulfates, chlorides, and aluminum, all of which are known to be present in significant levels in typical discharges from coal-mining operations.

2. Failure to include discharge limits on these pollutants will cause a violation of the water quality standards for the receiving waters because the discharges are not effectively treated or controlled (because there are no limits on them), and will render the water unsuitable as a source of drinking water.

IV. Conclusion

In summary, ADEM could not possibly have determined that discharges from the Shepherd Bend mine would not impair water quality or cause a violation of water quality standards without reviewing a complete PAP plan for the site. The SEDCAD analyses submitted to ADEM by Shepherd Bend do not comply with ADEM's PAP Plan Guidelines and would permit the release of large amounts of sediment into receiving waters. ADEM's exemption of iron, manganese, and TSS from almost all precipitation events, and failure to include limits on TDS, sulfate, chlorides and aluminum in any case, will also cause a violation of Alabama's water quality standards.

This 10th day of March, 2009.

Warner Golden, P.E.

EXHIBIT A

WARNER GOLDEN, P.E.
Senior Engineer

EXPERIENCE SUMMARY

Mr. Golden is a senior engineer and partner with NewFields Atlanta, Georgia. Mr. Golden has over 20 years of consulting experience on a wide range of civil engineering and environmental projects including environmental program management and cost management of residential remediation projects. His expertise is in surface water, soil and groundwater contamination assessment projects including permitting, work plan development, technical approach, cost management, and implementation methods. Mr. Golden also has experience in a variety of remediation projects including petro-chemical refineries, oil and gas production and distribution facilities, RCRA sites, superfund sites and wastewater treatment facilities throughout the U.S., the U.K. and the Caribbean.

EDUCATION AND TRAINING

B.S. in Civil Engineering, Georgia Institute of Technology, 1983

REGISTRATIONS AND PROFESSIONALAFFILIATIONS

Professional Engineer, State of Alabama, #17714
Professional Engineer, State of Georgia, #18082
Professional Engineer, State of Mississippi, #11155
Member American Society of Civil Engineers
Air and Waste Management Association of Alabama

WORK EXPERIENCE

NewFields, LLC, Birmingham AL, Senior Engineer, September 1997 – present
Dames & Moore, Atlanta, GA / Birmingham AL, Project Engineer, 1987 - 1997

REPRESENTATIVE PROJECT EXPERIENCE

Technical consultant for the London 2012 Olympics Delivery Authority including value engineering and review of soil and groundwater remediation plans for construction zone 5. The 2012 Olympics site includes redevelopment of large brownfields site along the River Lee. Work included development of a 3D model for subsurface conditions including groundwater, clays and Victorian era fill materials.

Program and cost management for Bayer Crop Science Factory Lane Site in New Jersey including cost estimating, financial controls, engineering support, and contracts management. The project involves sampling soil and groundwater, property management and groundwater treatment system operations.

Program and cost management including estimating and financial controls, engineering support, and contracts management for NewFields role as General Contractor at the Anniston Lead Site project in Anniston, Alabama. The project involves the sampling and remediation of several thousand residential properties in the area of Anniston as a result of historic industrial operations and lead contamination.

Designed and managed implementation for soil and groundwater remedial project at the Aberdeen Pesticides Dumps Site in Aberdeen, North Carolina. The five individual sites thoughout the county included the following project scope of work: demolition, excavation and thermal desorption of 130,000 tons of soil, groundwater monitoring, progress and expenditure tracking by site for PRP allocations. Developed and implemented financial controls for $45 million soils and $10 million groundwater remedial projects.

Technical consultant and project manager for a petrochemical refining facility of Commonwealth Oil Refining Corporation in Penuelas, Puerto Rico. Project tasks have included since 1999: civil design, RCRA compliance, remedial cost estimates and implementation oversight including Environmental Indicators, NPDES Permitting, RFI Work Plans, decommissioning and demolition studies of former refinery production units, solid waste management units, wastewater treatment facilities, groundwater product recovery, spent materials neutralization and disposal, lab packs, SPCC, SWPPP and FRP plans.

Cost estimating for development of environmental liability profiles for five Chevron petrochemical refining facilities around the U.S. including Port Arthur, Texas and Cincinnati, Ohio.

Cost estimates for environmental remediation and infrastructure demolition of former petrochemical refining facilities, Commonwealth Oil Refining Company, Inc., Penuelas, Puerto Rico.

Cost estimates for environmental remediation and review of remediation plans for Potlach wood treatment facilities throughout U.S.

Designed and managed implementation of removal action at former Tifton Chemicals chlorinated pesticide and metals formulation facility in Lakeland, Florida.

Designed and managed implementation of removal action at the former Valley Chemical pesticide formulation facility in Greenville, Mississippi.

Technical direction and cost estimation for design and implementation of removal action at the former Red Panther pesticide formulation facility in Clarksdale, Mississippi.

Design consulting services for remedial action at Central Chemical pesticide formulation facility in Pennsylvania.

Site design and consulting services for water management infrastructure at Coalbed Methane production well fields in west Alabama including well sites, wastewater treatment facilities, transmission pipelines, effluent discharge diffusers and monitoring station design, construction and operation. Clients included Arco, Taurus Exploration (Energen) and a cooperative organization of the 11 area producers.

Wastewater and effluent mixing zone and modeling assimilation studies for the petrochemical refinery facility of Refineria Isla in Willamstead, Curacao.

Wastewater effluent modeling and design for river discharge diffuser at Georgia Pacific Leaf River Pulp Operations in New Augusta, Mississippi.

NPDES permitting and SW Pollution Prevention Plan development for Georgia Pacific Leaf River Pulp Operations in New Augusta, Mississippi.

NPDES permitting and SWPPP development for International Paper pulp and paper mill in Mississippi.

Wastewater and effluent modeling for South Carolina Electric and Gas Company at the Canadys, Wateree and Williams Electric Generation Stations in South Carolina.

Wastewater and effluent modeling and NPDES permitting for U.S. Navy Southern Division for permanently moored nuclear submarine training facility in South Carolina.

Environmental liability profiles for Shell Chemical sites worldwide.

Compliance Audits nationwide for Tenneco facilities.

Compliance audits nationwide for Tamko Asphalt Products facilities.

Waste and wastewater pond investigation and closure cost estimating for Mead Coated Board in Eufaula ,Alabama.

NPDES and BMP development for Mead Coated Board in Eufaula,Alabama.

SW Pollution Prevention Plan development for Mead Coated Board in Eufaula, Alabama.

PUBLICATIONS

"Risk Management as a Land Use Issue: Case Study Application of GIS Analysis for Determining Remediation Requirements for Future Land Use Options and Implementation," Golden, W. and Odle, B., 2007 Soil and Groundwater Technology Association Annual Meeting Rotherham, United Kingdom

"Real Time Basin Wide Conductivity Monitoring," Golden, W and Hall, W. L., 1991 Coalbed Methane Symposium, Tuscaloosa, Alabama

EXHIBIT 13

BEFORE THE ALBAMA SURFACE MINING COMMISSION

	)
	)
	)
A Petition To Designate Lands Adjacent	)
To The Mulberry Fork	)
As Unsuitable For Coal Mining	)
	)
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<u>AFFIDAVIT</u>

1. My name is Nelson Brooke. I am a resident of Jefferson, County, Alabama, am over the age of 19, and am competent to give this affidavit. This affidavit is based on my belief and personal knowledge of the facts below.

2. I have been Riverkeeper for Black Warrior Riverkeeper, Inc., ("Riverkeeper") since 2004. Riverkeeper is a nonprofit membership corporation founded in 2001 with a mission to protect and restore the Black Warrior River and its tributaries. Riverkeeper has over two thousand members. I have also been a member of Riverkeeper since 2003.

3. Riverkeeper is dedicated to the preservation, protection and defense of the environment and actively supports effective implementation of environmental laws, including the Surface Mining Control and Reclamation Act of 1977 (SMCRA) (30 U.S.C. § 1201 et seq.) and the regulations of the Alabama Surface Mining Commission (ASMC), particularly as they relate to the activities within the Black Warrior River watershed.

4. Riverkeeper and its members, myself included, have a direct and beneficial interest in the continued protection, preservation, and enhancement of the environment throughout the

Black Warrior River watershed, and, more specifically, the Mulberry Fork public drinking water intake that the Birmingham Water Works Board uses to provide clean, safe and affordable drinking water for some 200,000 residents of the greater Birmingham area.

5. I am concerned that surface coal mining in the vicinity of the Mulberry Fork drinking water intake (including, but not limited to, the areas covered by the proposed Shepherd Bend and Reed No. 5 mines) will decrease the source quality of the public water supply at, around and above the Mulberry Fork. Surface coal mining in these areas (including, but not limited to, the areas covered by the proposed Shepherd Bend and Reed No. 5 mines) represents a threat to the environment and public health because of the contaminants that surface coal mining will introduce into the public water supply on the Mulberry Fork of the Black Warrior River.

6. I work at Black Warrior Riverkeeper, whose office is at 712 37th Street S, Birmingham, AL 35222. Our drinking water originates at the Mulberry Fork drinking water intake and supplies me and my coworkers with clean, safe, and affordable water for drinking, cooking, and other uses.

7. In the future, if surface coal mining is allowed at, around and upstream of the Mulberry Fork drinking water intake (including, but not limited to, the areas covered by the proposed Shepherd Bend and Reed No. 5 mines), I will use the water less because of fears about its quality. I am also concerned that my employer will pay more for drinking water in the future because of the increased treatment that may be required because of surface coal mining.

8. I am much more likely to drink water from the Mulberry intake in the future if it remains healthful and affordable through effective source drinking water protection.

9. The quality of the public water supply at the Mulberry Fork directly affects my health, environmental and aesthetic interests.

10. Riverkeeper represents these interests in filing the Petition to designate as "lands unsuitable for mining" the areas at, around and upstream of the Mulberry Fork drinking water intake (including, but not limited to, the areas covered by the proposed Shepherd Bend and Reed No. 5 mines).

11. The resolution of the Petition in favor of Riverkeeper will serve to protect my interests and redress my injuries.

Nelson Brooke

Signed this 7th day of September, 2012

STATE OF ALABAMA

COUNTY OF Jefferson

I hereby certify that Nelson Brooke, whose name is signed to the forgoing affidavit and who is known to me, acknowledged before me this day that, being informed of the contents of the affidavit, he executed the same voluntarily on this date.

Given under my hand this 7th day of September, 2012.

Notary Public

My Commission expires:

MY COMMISSION EXPIRES NOVEMBER 28, 2015

BEFORE THE ALBAMA SURFACE MINING COMMISSION

	)
	)
	)
A Petition To Designate Lands Adjacent	)
To The Mulberry Fork	)
As Unsuitable For Coal Mining	)
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AFFIDAVIT

1. My name is Frank Chitwood. I am a resident of Jefferson County, Alabama, am over the age of 19, and am competent to give this affidavit. This affidavit is based on my belief and personal knowledge of the facts below.

2. I have been an active member of Black Warrior Riverkeeper, Inc. ("Riverkeeper") since April of 2007. Riverkeeper is a nonprofit membership corporation founded in 2001 with a mission to protect and restore the Black Warrior River and its tributaries. Riverkeeper has over two thousand members.

3. Riverkeeper is dedicated to the preservation, protection and defense of the environment and actively supports effective implementation of environmental laws, including the Surface Mining Control and Reclamation Act of 1977 (SMCRA) (30 U.S.C. § 1201 et seq.) and the regulations of the Alabama Surface Mining Commission (ASMC), particularly as they relate to the activities within the Black Warrior River watershed.

4. Riverkeeper and its members, myself included, have a direct and beneficial interest in the continued protection, preservation, and enhancement of the environment throughout the

Black Warrior River watershed, and, more specifically, the Mulberry Fork public drinking water intake that the Birmingham Water Works Board uses to provide clean, safe and affordable drinking water for some 200,000 residents of the greater Birmingham area.

5. I am concerned that surface coal mining in the vicinity of the Mulberry Fork drinking water intake (including, but not limited to, the areas covered by the proposed Shepherd Bend and Reed No. 5 mines) will decrease the source quality of the public water supply at, around and above the Mulberry Fork. Surface coal mining in these areas (including, but not limited to, the areas covered by the proposed Shepherd Bend and Reed No. 5 mines) represents a threat to the environment and the public health because of the contaminants that surface coal mining will introduce into the public water supply on the Mulberry Fork of the Black Warrior River.

6. I live at 2725 Hanover Circle South, Birmingham, AL 35205. My drinking water originates at the Mulberry Fork drinking water intake and supplies me with clean, safe and affordable water for drinking, cooking, homebrewing, bathing, gardening, and other uses.

7. In the future, if surface coal mining is allowed at, around and upstream of the Mulberry Fork drinking water intake (including, but not limited to, the areas covered by the proposed Shepherd Bend and Reed No. 5 mines), I will use the water less because of fears about its quality. I am also concerned that I will pay more for drinking water in the future because of the increased treatment that may be required because of surface coal mining.

8. I am much more likely to drink water from the Mulberry intake in the future if it remains healthful and affordable through effective source drinking water protection.

9. The quality of the public water supply at the Mulberry Fork directly affects my health, environmental and aesthetic interests.

10. Riverkeeper represents these interests in filing the Petition to designate as "lands unsuitable for mining" the areas at, around and upstream of the Mulberry Fork drinking water intake (including, but not limited to, the areas covered by the proposed Shepherd Bend and Reed No. 5 mines).

11. The resolution of the Petition in favor of Riverkeeper will serve to protect my interests and redress my injuries.

Frank Chitwood

Frank Chitwood

Signed this 10th day of September, 2012

STATE OF ALABAMA

COUNTY OF Shelby

I hereby certify that Frank Chitwood, whose name is signed to the forgoing affidavit and who is known to me, acknowledged before me this day that, being informed of the contents of the affidavit, he executed the same voluntarily on this date.

Given under my hand this 10 day of September, 2012.

Jennifer Anderson Newton

Notary Public

My Commission expires:
8-30-2016

BEFORE THE ALBAMA SURFACE MINING COMMISSION

	)
	)
	)
A Petition To Designate Lands Adjacent	)
To The Mulberry Fork	)
As Unsuitable For Coal Mining	)
	)
	)
	)
	)

AFFIDAVIT

1. My name is Adam Johnston. I am a resident of Jefferson County, Alabama, am over the age of 19, and am competent to give this affidavit. This affidavit is based on my belief and personal knowledge of the facts below.

2. I have been an active member of Black Warrior Riverkeeper, Inc. ("Riverkeeper") since April of 2012. Riverkeeper is a nonprofit membership corporation founded in 2001 with a mission to protect and restore the Black Warrior River and its tributaries. Riverkeeper has over two thousand members.

3. Riverkeeper is dedicated to the preservation, protection and defense of the environment and actively supports effective implementation of environmental laws, including the Surface Mining Control and Reclamation Act of 1977 (SMCRA) (30 U.S.C. § 1201 et seq.) and the regulations of the Alabama Surface Mining Commission (ASMC), particularly as they relate to the activities within the Black Warrior River watershed.

4. Riverkeeper and its members, myself included, have a direct and beneficial interest in the continued protection, preservation, and enhancement of the environment throughout the

Black Warrior River watershed, and, more specifically, the Mulberry Fork public drinking water intake that the Birmingham Water Works Board uses to provide clean, safe and affordable drinking water for some 200,000 residents of the greater Birmingham area.

5. I am concerned that surface coal mining in the vicinity of the Mulberry Fork drinking water intake (including, but not limited to, the areas covered by the proposed Shepherd Bend and Reed No. 5 mines) will decrease the source quality of the public water supply at, around and above the Mulberry Fork. Surface coal mining in these areas (including, but not limited to, the areas covered by the proposed Shepherd Bend and Reed No. 5 mines) represents a threat to the environment and the public health because of the contaminants that surface coal mining will introduce into the public water supply on the Mulberry Fork of the Black Warrior River.

6. I work at the Alabama Rivers Alliance, whose office is at 2027 2nd Ave. N, Birmingham, AL 35203. Our drinking water originates at the Mulberry Fork drinking water intake and supplies me and my coworkers with clean, safe and affordable water for drinking, cooking, and other uses.

7. In the future, if surface coal mining is allowed at, around and upstream of the Mulberry Fork drinking water intake (including, but not limited to, the areas covered by the proposed Shepherd Bend and Reed No. 5 mines), I will use the water less because of fears about its quality. I am also concerned that my employer will pay more for drinking water in the future because of the increased treatment that may be required because of surface coal mining.

8. I am much more likely to drink water from the Mulberry intake in the future if it remains healthful and affordable through effective source drinking water protection.

9. The quality of the public water supply at the Mulberry Fork directly affects my health, environmental and aesthetic interests.

10. Riverkeeper represents these interests in filing the Petition to designate as "lands unsuitable for mining" the areas at, around and upstream of the Mulberry Fork drinking water intake (including, but not limited to, the areas covered by the proposed Shepherd Bend and Reed No. 5 mines).

11. The resolution of the Petition in favor of Riverkeeper will serve to protect my interests and redress my injuries.

Adam Johnston

Signed this 7th day of September, 2012

STATE OF ALABAMA

COUNTY OF Jefferson

I hereby certify that Adam Johnston, whose name is signed to the forgoing affidavit and who is known to me, acknowledged before me this day that, being informed of the contents of the affidavit, he executed the same voluntarily on this date.

Given under my hand this 7th day of September, 2012.

Notary Public

My Commission expires:

MY COMMISSION EXPIRES NOVEMBER 28, 2015

BELINDA HENDERSON COLEMAN
NOTARY
PUBLIC
ALABAMA STATE AT LARGE