RCA ref: 3062-003/1
15 October 2002

Bickham Coal Company Pty Limited
PO BOX 377
LOCHINVAR NSW 2321

Attention: Mr David Foster

WATER CHEMISTRY ANALYSIS
BULK SAMPLE OVERBURDEN
BICKHAM COAL

1 INTRODUCTION

Presented in this report are the findings of analysis of overburden material to be excavated and reused as part of the Bickham Coal Company, Bulk Sample Project. The aim of the investigation was to determine the potential for leachate or salinity mobilisation from the overburden material.

The investigation was undertaken at the request of Mr Ian Pankhurst on behalf of the Bickham Coal Company.

Information provided by the client for preparation of this assessment was as follows:

- Perrens Consultants, Flooding & Surface Water Assessment For The Proposed Bulk Sample Development Application, Proposed Bickham Coal Mine, September 2002, Draft, Ref 1;
- Perrens Consultants, Excel spreadsheet of surface water chemical analysis from the 6/6/02 and 2/9/02, Ref 2;
- Dundon Consultants, Excel spreadsheet of groundwater analysis from bores at the Bickham Coal site, results, August 02, Ref 3;
- Allied Testing, Laboratory Report no. 5808, soil chemistry analysis of overburden material, Ref 4;

- Geological and Mining Assessment of the Proposed Bulk Sample for Bickham Coal Company, DRAFT, Ref 5.

- Allied Testing Report No 5708, 30th July 2002. Water quality analysis of one surface water sample collected from within the clay void, Ref 8.

2 BACKGROUND

A Development Application is being prepared for the proposed bulk sample extraction of approximately 25,000 ROM tonnes of coal. This bulk sample will entail the removal of some 331,000 cubic metres of overburden. Overburden is to be transported to a Flint Clay Quarry located on the site where overburden will be used to fill the existing void and rehabilitate the area. As part of this process a flooding and surface water assessment was prepared to support the development application for the extraction of coal from the proposed bulk sample. A baseline groundwater quality assessment was also undertaken.

The migration in water of contaminants from the overburden dump to the Pages River could result from:

- Surface water runoff from the overburden area transporting suspended and dissolved contaminants;

- Groundwater flow through the overburden dump area transporting dissolved contaminants;

- Surface water migration through the void to groundwater and migration to the Pages River transporting dissolved contaminants.

The likelihood and significance of surface water contact with overburden was discussed in Perrens Report, Ref 1. Their report outline the measures proposed to divert surface water around the overburden dump thereby reducing the volume of water in contact with the overburden material. At completion of rehabilitation, the diversion drains will be removed and the drainage line restored. Perrens report indicated that the drainage line is dry for most of the year and therefore the surface water runoff from the final landform is expected to be minimal. On this basis it is expected that surface water contact with overburden during the project and after rehabilitation will be minimal.

Hydrostatic groundwater levels were determined for one standpipe (56B) located within close proximity of the flint clay void area. The standing water level at this location was determined to be 438m. The base of the flint clay void adjacent this location has RLs of 455m to 460m indicating that groundwater is located greater than 17m below the base of the void. The flint clay void therefore does not intersect the groundwater table. Seepage from intermittent perched water tables may result during rainfall events leading to the accumulation of surface water within the void area.

3 CHEMICAL ANALYSIS

Analytes identified to be of concern include pH, Conductivity, Heavy Metals (Boron, Cobalt, Copper, Lead, Manganese, Molybdenum and Zinc) and sulphate. Other analytes of concern for the receiving Pages River, would include nutrients and suspended solids. However, these contaminants are unlikely to leach from emplaced overburden and are therefore not included in this study.

Chemical analysis undertaken of the overburden material, groundwater and surface water has been summarised in Tables 1 - 3 attached. In addition, leachable concentrations of Heavy Metals were determined using a distilled water leach solution to simulate field conditions (ie rainwater leaching through the overburden). These results are presented in Table 4.

4 CRITERIA

The chemical analysis undertaken of the overburden samples have been compared against four relevant site criteria as follows.

1. The ANZECC, Guidelines for Fresh and Marine Water Quality, 2000 Ref 6. These guidelines are considered relevant as they provide guidance for the protection of fresh and marine waters and are derived from ecological assessments of benthic species, aquatic plants and fish. The guidelines are most commonly used in the absence of site-specific river water quality data and are therefore applied to Heavy Metals in leachate as no river data was available. The guideline adopted for the Pages River is the 95% protection limit which is applicable to Rivers in rural areas.

2. Acid Sulphate Soil Manual, Ref 7, has been utilised to determine the potential for acid generation from the overburden material.

3. The groundwater chemistry identified at the site, Dundon, Ref 3. The groundwater chemistry at the site has been used as site specific data to determine the impact of leachate from the overburden stockpile on the groundwater system;

4. The surface water quality identified in the Pages River, Perrens, Ref 1. This data has been used as site specific data for Conductivity and pH in the River. Additionally, analysis of Heavy Metals was undertaken on two samples collected in the Pages River, upstream and downstream of the impact area.

A summary of the data and the relevant criteria is presented in Table 5.

5 DISCUSSION

Analysis undertaken of the overburden has identified an average pH of 6.1 pH units. This pH is lower than the average pH 7.9 observed in the Pages River. The lower pH is not considered significant as pH in soils normally ranges between pH 4 and pH 8. In addition, the low pH was evaluated in distilled water, with a pH of 7 and therefore, rainwater passing through the material is likely to have a higher pH and will therefore negate the low pH to some extent. In addition, the contribution of runoff from the site is expected to be minimal in comparison to the volume of the Pages River and therefore the impact of the lower pH is likely to be insignificant.

The pH of the aquifer at the site was identified to have a wider pH range than the overburden leachate and a slightly alkaline average. Any overburden leachate reaching the aquifer would therefore be expected to slightly neutralise the underlying aquifer. Note that leachate would be expected to be minimal in comparison to the volume of the aquifer and therefore is unlikely to have an impact.

Conductivity in the overburden samples was identified to be very low and significantly lower than both the Pages River and the underlying aquifer. On this basis, salt mobilisation to the Pages River and the aquifer would be considered unlikely.

Overburden samples were analysed for Total Sulphur and results were compared to the Acid Sulphate Management Guidelines. The analysis has indicated that the Total Sulphur percentage identified is below the action criteria for acid sulphate soils and therefore acid generation from the overburden samples is not expected.

Heavy Metals were compared against the ANZECC guidelines for Freshwaters and also against baseline concentrations identified in the Pages River. The guidelines indicate that metals identified in overburden leachate samples are below the relevant guidelines with the exception of Copper and Lead. Of these, Lead was identified to be above the baseline lead concentration identified in the Pages River.

The Heavy Metals analysed were also compared against the heavy metal concentrations identified in groundwater at the site. The concentrations in leachate were identified to be below the existing groundwater concentrations for those analytes tested. On this basis it would be expected that any leachate from the overburden material would not impact on the heavy metal concentrations in the underlying aquifer.

The assessment of overburden leachate undertaken has identified that the concentrations of contaminants in leachate are unlikely to impact on the receiving waters of the Pages River or on the aquifer at the site. The assessment is based on the concentrations of contaminants identified in the leachate being low and comparable to concentrations already existing in receiving waters and the volume of leachate being low in comparison to the volume of the receiving waters.

6 MONITORING

Proposed surface water monitoring of the Pages River has been outlined in the report by Perrens, Ref 1. Water quality monitoring of the Pages River has commenced upstream and downstream of the proposed open cut mine on the Pages River for the purpose of establishing baseline surface water quality prior to commencement of the project.

Monitoring is also proposed at the overburden dump site during the rehabilitation of the void. It is proposed that water quality monitoring is undertaken on discharge from the sedimentation basin to the drainage line and 50m upstream and downstream of the confluence of this drainage line with the Pages River. Monitoring is only proposed during a discharge event from the sedimentation dam. Surface water samples are to be analysed for following water quality parameters Total nitrogen, Total phosphorous, Suspended solids, Turbidity and Salinity (EC).

The proposed monitoring program has been reviewed in terms of assessing the contaminants of concern identified in this report. The monitoring locations and frequency of sample collection are considered to be adequate to assess any impact from the overburden area. It is recommended that analysis of samples for field pH and Total Heavy Metals (B, Co, Cu, Mn, Mo, Pb, Zn) be undertaken in conjunction with the analyte list outlined by Perrens above. Analysis for all analytes should ensure that samples are collected and preserved appropriately prior to analysis and that analysis is undertaken to detection levels that are below the ANZECC 2000 water quality guidelines.

The findings of surface water analysis for Heavy Metals should be reviewed in a monthly review process and compared against baseline water quality and ANZECC guidelines. Monitoring should be continued until revegetation of the overburden dump is complete.

For further information on the above please do not hesitate to contact the undersigned.

Yours faithfully,
ROBERT CARR & ASSOCIATES PTY LTD

Fiona Robinson
Senior Environmental Engineer

Phillip Hitchcock
Manager Environmental Services

ATTACHMENTS

Tables 1 - 5

REFERENCES

[1] Perrens Consultants, Flooding & Surface Water Assessment For The Proposed Bulk Sample Development Application, Proposed Bickham Coal Mine, September 2002, Draft.

[2] Perrens Consultants, Excel spreadsheet of surface water chemical analysis from the 6/6/02 and 2/9/02.

[3] Dundon Consultants, Excel spreadsheet of groundwater analysis from bores at the Bickham Coal site, results, August 02.

[4] Allied Testing, Laboratory Report no. 5808, soil chemistry analysis of overburden material.

[5] Mining Exploration Geology Services, Geological and Mining Assessment of the Proposed Bulk Sample for Bickham Coal Company, DRAFT.

[6] ANZECC 2000, Australian and New Zealand Guidelines for Fresh and Marine Water Quality, 2000.

[7] Acid Sulphate Soil Management Advisory Committee, Acid Sulphate Assessment Guidelines, 1998.

[8] Allied Testing Report No 5708, 30th July 2002. Water quality analysis of one surface water sample collected from within the clay void.