



Bickham Water Resources Assessment

STATUS UPDATE

AUGUST 2006

This is a statement on the progress of the Bickham water studies. Analysis of sampling is currently being undertaken. The report is still being compiled.

Groundwater Related Investigations

Additional monitoring bores drilled at sites west of the New England Hwy have been subjected to pumping tests to establish the groundwater hydraulic properties.

Baseline Monitoring

The baseline monitoring program continues, and consists of:

- Monthly measurement of groundwater levels in all monitoring bores.
- Three-monthly sampling of all monitoring bores and laboratory chemical analysis of water samples.
- Monthly sampling at 7 sites on the Pages River and at 2 sites on the tributary at the northern boundary of the Bickham property, and laboratory analysis of water samples.
- Three-monthly measurements of salinity and pH at 200m intervals along Pages River through the project area.
- Monthly inspection and sampling of all sediment traps downstream of areas rehabilitated after completion of the bulk sample project.

Water Quality Profiling

Continuous water quality profiling along the Pages River from upstream of Splitters Creek to downstream of the Bickham project area. This survey was conducted by continuous recording probes trailed behind a canoe, measuring salinity, pH, redox potential, dissolved oxygen, dissolved CO₂, to look for changes in quality parameters that might indicate inflows of groundwater to the river. Notable inflows leading to increased salinity in the river were detected at the confluence of Splitters Creek (inflow of more saline surface flow from Splitters Creek) and upstream of the gorge above the Bickham project area (seepage from more saline groundwater from alluvial floodplain). No significant inflow was detected within the river adjacent to the Bickham project site.

Tracer Studies

Water samples have been collected from all monitoring bores close to the Pages River and from the river itself at 200m intervals through the project area, and have been air-freighted to CSIRO lab in Adelaide for testing for radon gas. Under certain geological conditions, radon concentration can be an indicator of the comparative age of waters due to the relatively short half-life of radon gas. Water flowing in a stream will rapidly lose any radon by escape of the gas and by radioactive decay. By comparison, water recently derived from rock is more likely to contain radon at elevated concentrations. Should the sampling in Pages River detect a significant increase in radon concentration at some point it may indicate an inflow of groundwater. Other natural or introduced tracers may also be used in future depending on the results of the initial testing for radon.

Pumping Tests on Bores Close to Pages River

Bore OH78 (closest to the Pages River) has been test-pumped, and showed no recharge effects that would indicate interception of either the Pages River or groundwater in the alluvium associated with the river. Tests are to be carried out on other bores near the river.

Automatic Water Level Recorders

Automatic water level recorders have been installed in three bores located near the former mine adit close to the Pages River east of the proposed Bickham open cut and in the Pages River nearby. The data loggers have been programmed to record water levels at 10 minute intervals. This monitoring is intended to detect similarities and/or differences in the recharge response patterns between the river and the groundwater. This monitoring has been ongoing for several months, and will continue until the completion of the water resource studies.

Geological Mapping

The geological model of the area has been updated with the results of additional boreholes installed by Bickham. A revised geological map has been prepared. Further geological mapping is currently in progress, to provide more detail in the area of outcrop/subcrop of the G coal seam in the vicinity of Pages River east of the proposed open cut.

The geological mapping also includes identification and characterisation of all faults, fractures and joints in the vicinity of the proposed open cut, to identify any potential high permeability pathways that could link the open cut to Pages River.

Groundwater Modelling

Development of a groundwater flow model which will be used to predict potential impacts of the proposed project on the local and regional groundwater resources and on the Pages River has been completed. Calibration of the model is expected to commence in the next week or so, and once calibrated, the model will be used to simulate the progressive development of the mine, backfilling of the pit with overburden, and the post-project period.

Barrier Zone Between the Open Cut and Pages River

A geotechnical study has been carried out on the potential for blasting related fracturing to cause an increase in permeability of the buffer zone between the proposed open cut and Pages River. An additional study has investigated the stability of the low wall between the open cut and the Pages River.

Surface Water Investigations

Baseline Monitoring

Pages River water quality and ecology at has been assessed at:

- Five sites (spring and autumn x 2),
- All dams on Bickham property,
- Dam on adjacent property,
- Four other sites in Kingdon Ponds

Terrestrial Ecology and Groundwater Dependent Ecosystems

Investigations have been carried out in accordance with the requirements of NSW State Groundwater Dependent Ecosystem Policy and have identified:

- Six distinct vegetation communities on the Bickham site, none likely to be groundwater dependent ecosystems;
- Riparian vegetation within the study area has high level of weed invasion;
- Several groundwater fed springs identified, little evidence of native vegetation being dependent on them;
- Vegetation in Cameron's Gorge unlikely to match any groundwater dependent ecosystems;
- Only potential groundwater dependent ecosystems are river baseflow dependent communities.

Fluvial Geomorphology

- An initial geomorphological survey of the site has been carried out.
- The bed and banks of the Pages River adjoining the site have been inspected and photographed.
- Areas which will require management to manage impacts on adjoining natural systems have been identified and assessed;
 - River flat upstream of the gorge where one of the two main overburden dumps will be located.
 - Upper Kingdon Ponds catchment in which the second overburden dump will be located.
- Survey of the micro-topography of the river flat will be carried out to define the natural drainage and adapt it to the best possible disposal of overburden drainage.
- Investigations of soil profile on the river flats are planned.
- Survey of the Pages River adjacent to the site has been obtained for hydraulic modelling to identify flow regime for flows up to 100 year annual exceedance probability and to assess the effect of the overburden dumps on flood levels and flow velocities.

Design of the Water Management System

- Further refinement of the overburden dump design has been undertaken to create natural slopes that minimise erosion potential and are characteristic of the Bickham area;
- Drainage lines and sediment dam locations at the base of overburden dumps have been determined;
- Preliminary design of sediment dams has been completed;
- Preliminary sizing of the pollution control dam adjacent to the coal stockpile area has been undertaken;
- Preliminary location and sizing of the main mine water dam has been undertaken. Objective is to ensure that the dam is of sufficient capacity to ensure zero discharge to Pages River.

Water Balance Analysis

- Climatic data collection and analysis completed;
- Assessment of water requirements for dust suppression completed;
- Runoff characteristic of spoil dumps defined on the basis of measured runoff from other mines.
- Water balance model nearing completion. Awaiting estimates of groundwater inflow before finalising the model. The model will be used to:
 - Verify the adequacy of the mine water management systems to ensure no discharge to the Pages River during any stage of mine development;
 - Determine the long term water levels and water quality in the final void.