



# **THE BICKHAM COAL PROJECT REPORT**

**3 May 2010**

The Bickham Coal Project Report© State of New South Wales through the NSW Planning Assessment Commission, 2010.

NSW Planning Assessment Commission  
301 George St Sydney NSW Australia  
ISBN 978-0-9806592-6-9

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## **EXECUTIVE SUMMARY**

### Overview

The Bickham Coal Project refers to the proposal by Bickham Coal Company Pty Limited (the proponent) to develop a new open-cut coal mine approximately 13 kilometres southeast of Murrurundi in the Upper Hunter Valley. The proposed mine would extract a total of 36 million tonnes of coal over 25 years.

The Minister for Planning referred the Bickham Coal project to the Planning Assessment Commission (the Commission) on 30 October 2009. The Minister directed the Commission to advise on the water-related risks of the project, whether these risks can be suitably managed to an acceptable level of performance (having regard to the recommendations in the *Strategic Assessment of Coal Mining in the Upper Hunter Valley*, Department of Planning 2005), and the adequacy of the Water Resource Assessment and the draft Water Management Plan.

The Minister also directed the Commission to advise on any other significant issues raised in submissions, whether the project should proceed to a merit assessment under Part 3A of the Environmental Planning and Assessment Act (EP&A Act), and, if so, to provide the Director-General of Planning with any requirements for preparation of an Environmental Assessment.

In January 2010, the Commission formed a view that it would be difficult to provide the requested advice without the conduct of public hearings. At the Commission's request the Minister varied the initial direction to include the conduct of public hearings. The Commission proceeded by way of examination of the Water Resource Assessment and the draft Water Management Plan, receipt of submissions, public hearings, examination of experts, meetings with government agencies, local government and industry groups, field inspections, and meetings of the Commission.

### Water-Related Aspects of the Project

The water-related aspects of the project are a major feature of the Commission's terms of reference because the proponent was required to prepare a Water Resource Assessment and a draft Water Management Plan were required as a preliminary step in the Part 3A process. These documents were placed on public exhibition and led to the public submissions. These two documents were not intended to provide a full Environmental Assessment and many issues that would be required to be addressed in an Environmental Assessment are not included in them.

The Department of Planning's specifications for the Water Resource Assessment and draft Water Management Plan encompass a wide range of water-related issues. Many of these have been dealt with adequately. The Commission has not commented on these, but instead focused on what it considers to be the real or potential residual risks of the project. This focus inevitably leads to a level of negativity about the quality of the studies and analytical approaches that may not reflect their overall quality. However, the Commission's task is to provide sound advice on the residual risks, not to provide an overall score for the quality of the proponent's work. The critical nature of many of the Commission's findings needs to be viewed in this context.

Guided by the Terms of Reference, the Commission identified the water-related risks of the project, assessed whether the proponent's Water Resource Assessment and draft Water Management Plan dealt with those risks adequately and assessed whether the management measures proposed were likely to control those risks to an acceptable level.

### Identification of Water-Related Risks

The water-related risks are divided along conventional lines into groundwater risks and surface water risks. In doing so, the Commission notes the considerable interdependence between them.

*Groundwater Risks* - The groundwater-related risks identified are:

- Hydrogeological field investigations and modelling;
- Lowering of the water table aquifer;
- Depressurisation of confined coal seam aquifers and other layers;
- Reduction in groundwater discharge to the Pages River or leakage from the Pages River to the pit;
- Reduction in groundwater discharge to Kingdon Ponds;
- Contribution of groundwater to mine water balance; and
- Post mining recovery.

*Surface Water Risks* - The surface water-related risks identified are divided into risks to flow and risks to quality:

#### *Risks to Flow*

- Reduced flow in the Pages River and Kingdon Ponds due to reduced runoff from the mine site as a result of excision of some parts of the mine catchment area and lower runoff from more permeable mine spoil catchments;
- A reduction in baseflow in the Pages River as a result of reduced groundwater gradients between the mine and the river; and
- Loss of streamflow through leakage from the Pages River to the mine pit.

#### *Risks to Quality*

- Changes to water quality due to removal of a specific flow component;
- Increased salinity in the Pages River and Kingdon Ponds due to higher salt load in mine area drainage compared with pre-mining levels;
- Increased turbidity in the Pages River and Kingdon Ponds; and
- Other contaminants reaching the Pages River and Kingdon Ponds as a result of accidents.

### Adequacy of the Water Resource Assessment and draft Water Management Plan

The Commission's focus in this part of the report is on the areas of residual risk identified above.

#### *Groundwater Risks*

- *Hydrogeological field investigations and modelling* - There remains significant uncertainty about geological structure and hydrogeological properties at this site and therefore there is considerable uncertainty about the accuracy of the proponent's model predictions. In an environment where water resources are stressed and the Pages River itself is over-allocated this residual uncertainty poses an unacceptable level of risk.
- *Lowering of the water table aquifer* - The proponent did not systematically assess the potential impacts of a lower water table on the project's closest neighbours and has not identified strategies to deal with some of the important impacts.
- *Depressurisation of confined coal seam aquifers and other layers* - The proponent has not sufficiently addressed the issue of depressurisation to the southeast of the mine and its possible influence on connection with the Pages River.
- *Reduction in groundwater discharge to the Pages River or leakage from the Pages River to the pit* - In considering the potential for leakage from the Pages River to the pit, the proponent has focused on the northern tip of the proposed mine and extrapolated from this area to the other sections of the mine. This is a fundamental

weakness and leaves considerable uncertainty as to whether the proponent's contention that there will be no leakage from the Pages River to the pit is credible. The Commission's assessment is that the contention is not credible and that water is likely to flow from the Pages River to the pit at some time during mining operations. Just how much water might be lost from the river can not be predicted by the Commission based on the information available. However, it should be noted that it is not possible to turn off leakage in the same way that it is possible to cease pumping from a river.

The reduction in groundwater discharge to the Pages River is acknowledged by the proponent although its potential significance is masked by the proponent's use of average flows as the benchmark. Average flows are meaningless in the context of the Pages River since the river rarely flows at or above its average. It is the dry weather flows that matter most and it is the loss of contribution from groundwater to those dry weather flows that is important.

- *Reduction in groundwater discharge to Kingdon Ponds* - While consideration of groundwater impacts on Kingdon Ponds appears to be adequate, assessment of the impact of the predicted reduction in groundwater flow on springs and groundwater dependent ecosystems (GDEs) on nearby properties is not adequate.
- *Contribution of groundwater to mine water balance* – Groundwater is a significant component of the mine water balance. The Commission considers that the modelling supporting the predictions for this component is adequate.
- *Post-mining recovery* - This takes place over a period of more than 100 years and for some impacts there may never be any form of recovery. The likely outcome is a mine pit lake at an elevation higher than the Pages River. Discharge from the lake via groundwater flow pathways could adversely affect the Pages River and/or Kingdon Ponds at times of low flow if the quality of the stored water becomes significantly poorer than water already in those catchments. Because of the multiple potential sources of water in this final void and their likely differences in quality, the consequences are uncertain.
- *Alternative groundwater supply to compensate neighbours for detrimental impacts* - The proponent has not estimated the quantity of water required to compensate neighbours for loss of groundwater. The feasibility of using an alternative water supply to compensate for impacts on GDEs has also not been fully investigated, nor has a specific source of alternate supply been identified or assessed for adequacy over the life of the mine and post-mining recovery period.

#### *Surface Water Risks*

- *Adequacy of the Water Resource Assessment* - The surface water component of the Water Resource Assessment contains an adequate description of the surface water resources within and in close proximity to the proposed Bickham mine. However, it does not present the information required to assess the broader risks to downstream users on the Pages River and Kingdon Ponds.
- *Adequacy of mine surface water balance and draft water management plan* - In response to questions from the Commission, the proponent reassessed the yield obtained from mine catchments in its modelling and indicated a 78% increase in yield from this source. In the Commission's view this is not necessarily the credible upper limit of yield from this source.

Also in response to questions from the Commission the proponent expanded both the range and scope of options for managing excess mine water. However, while these options could probably manage excess mine water if fully and successfully implemented, there is no firm commitment to implement them and there are many steps involved in design, approval, construction and operation for which there is currently insufficient detail for assessment.

The Commission is not convinced that the draft Water Management Plan adequately demonstrates that it has the capacity to achieve its required performance objectives in this area under all reasonably foreseeable water balance conditions.

- *Adequacy of assessment of risk of reduced flows* - As indicated above, the proponent has sought to compare potential reductions in flow due to the mine to average flows in the Pages River. The Commission rejects this approach. The real potential impacts will occur during periods of low flow and the proponent has not demonstrated that the impacts on downstream users will be negligible. The proponent has indicated that it would compensate the Pages River for any loss. However, measurement of the loss would be difficult and there is no guarantee of either long-term supply of suitable water or an acceptable management regime for compensation over the long term.
- *Adequacy of assessment of risk of increased salinity* - The proponent has not adequately assessed the issue of reduced baseflow contributions of low salinity water from 'South Bickham' causing an overall increase in salinity under low flow conditions downstream of the mine. Moreover, while there is no reason to suspect that waste materials from the proposed mine would be significantly elevated in salinity or other contaminants, the proponent's geochemical report provided to the Commission is insufficient to demonstrate this.
- *Adequacy of assessment of risk of increased turbidity* - The conceptual sediment and erosion control plan is based on guidelines currently used to control sediment and erosion in the NSW coal mining industry.
- *Adequacy of assessment of risk of accidental contamination* - The proposed Bickham Project could introduce contamination that may migrate into the Pages River or Kingdon Ponds as a result of accidents. A more comprehensive assessment of all possible contaminants on site and all the possible events that could lead to a 'pollution incident' is necessary.

#### Whether Water-Related Risks of the Project can be Suitably Managed

The Commission has confined its comments on this aspect to the previously identified water-related risks of the project. The Commission was specifically requested to have regard to the relevant recommendations in the *Strategic Assessment of Coal Mining Potential in the Upper Hunter Valley* published by the Department of Planning in 2005 and has complied with this request.

#### *Groundwater Risks*

- *Hydrological field investigations and modelling* – While the proponent's adopted approach is generally consistent with standard practices in the industry, the Commission is of the view that the sensitivity of this catchment required a greater level of robustness, particularly in the validation of assumptions and extrapolations that could substantially affect the accuracy of predictions.
- *Lowering of the water table aquifer* - The proposed mine would affect the regional water table within 'South Bickham' and neighbouring properties. Whilst the proponent has committed to compensating for such impacts, it has not demonstrated conclusively how it would do so. In fact there is little evidence available to convince the Commission that the proponent can guarantee delivery of the proposed solutions.
- *Depressurisation of confined coal seam aquifers and other layers* - The long term impacts of depressurisation are likely to be manageable.
- *Leakage from Pages River to the Pit* - Whilst it is technically possible to reduce leakage from the Pages River to the pit by physical intervention, it cannot be totally prevented. The use of physical barriers in this context is also a subject of considerable debate. The key issue in regard to leakage is the additional impact that any leakage would have on an already over-allocated catchment, particularly in times

of low flow. If loss from the river is both unacceptable and unable to be prevented, then the only management solutions are minimisation and compensation. Both of these have significant challenges to overcome that have not been resolved to the satisfaction of the Commission.

- *Reduction in groundwater discharge to Kingdon Ponds* - A lowering of the water table in the upper part of the catchment would lead to a slight reduction in baseflow in the upper part of the catchment. The impact of such a reduction in baseflow on the whole catchment would be small. However, it may be of significance to nearby properties. This significance and the possibilities for dealing with it have not been explored adequately.
- *Contribution of Groundwater to Mine Water Balance* - The estimates of rates of seepage appear to be reasonable and whether or not the contribution of groundwater to the mine could be managed relates more to the interaction between groundwater inflows in the years when they are greatest and the possibility that these years may correspond to wet years with significant rainfall and runoff.
- *Post-mining Recovery* - Most, but not all, groundwater impacts would ultimately recover within 100 years after the end of mining and groundwater levels and a groundwater flow pattern would ultimately be re-established. However, the rate at which this would occur cannot easily be controlled or managed. The final void at Bickham would have a minimal impact on flow, but there could be a risk to water quality in the Pages River and/or Kingdon Ponds.
- *Alternate groundwater supply to compensate neighbours for detrimental impacts* - There is no evidence that specific alternative water supplies have been identified with which to compensate neighbours and it is unlikely that these could mitigate all impacts. The duration of impact and hence the need for compensation substantially exceeds the period in which the mine will be operational. The proponent's recent commitments concerning post-mining management structures are yet to be tested.

#### *Surface Water Risks*

- *Managing excess mine water* - This issue is complicated by the inadequate assessment of the magnitude of the potential excess mine water in the original proposal and the resultant need to create a substantially expanded range and scope of management options during the Commission's inquiry.  
The expanded range of options and increased scale of irrigation have a theoretical capacity to manage mine water. However, there remain questions concerning commitment to implement, lack of information on design, construction and operational parameters, and the capacity of the proponent to deliver given that many aspects of licensing, approval and land tenure are outside the proponent's control.
- *Management of salinity* - If runoff and drainage from overburden areas are contaminated this could be a significant source of problems for the Pages River. The proposed sedimentation control structures are unlikely to have any significant effect on contaminants other than those adsorbed to sediments and there is currently insufficient information provided to conclude that all the overburden units in the full scale mine have been adequately tested. This issue could be resolved with further testing.
- *Management of sediment and turbidity* - The risk of elevated turbidity and sedimentation of receiving water is real and to some degree inevitable. The potential impacts would need to be dealt with under existing regulatory powers to achieve a negligible residual risk.
- *Management of accidental spill* - This is a real, but manageable, risk.
- *Management of baseflow reduction* - The proponent proposes to compensate the Pages River for any reductions in baseflow. Baseflow reductions are likely to be difficult to measure but could have significant effects on the frequency of no flows or low flows. There is considerable uncertainty about the ability to source the necessary

water over the full period that may be required and therefore the practicality of achieving effective compensation is questionable.

### Other Issues

The Commission considered a wide range of issues raised in both written and oral submissions. Several of these were assessed as requiring further comment by the Commission.

- *Equine Industry*  
The thoroughbred industry in the Upper Hunter Valley is a very significant contributor to the regional, state and national economies and a major source of employment. The structure of the industry makes it particularly vulnerable to threats based on image and the introduction of coal mining to the Upper Hunter Valley is strongly identified as such a threat. The available evidence supports the view that open-cut coal mining and a viable international-scale thoroughbred breeding enterprise are incompatible land-uses.
- *Health-Related Issues*  
Coal dust and airborne toxins were raised as key issues in submissions and, whilst the health impacts from Bickham itself would be localised, they could be of significant and legitimate concern to neighbours. If mining extended beyond Bickham the evidence presented to the Commission suggests that the current regulatory system is incapable of guaranteeing effective control over these emissions at all times and the mine-by-mine assessment and approval system for open-cut coal mines has to date not demonstrated a capacity to deal with the cumulative impact of emissions.
- *Employment*  
Based on careful review of submissions and information from the proponent and other sources the Commission's assessment is that:
  - (i) the potential employment benefits from the Bickham proposal are likely to be substantially less than claimed by the proponent in terms of the net increase in mining-related employment in the Hunter region;
  - (ii) relatively little of any additional employment would be drawn from the local area; and
  - (iii) the potential losses in employment from industries negatively affected by the mine could be substantial and of greater significance than any employment generated by the mine.
- *Murrurundi*  
Some people believe the town of Murrurundi is dying whilst others believe it is in transition from one phase of its history to a sustainable future. Evidence provided to the Commission indicated that new industries have been established in the town, but potential further investment in these industries is 'on hold' until such time as the Bickham project is determined. Evidence supporting the Bickham proposal on the basis that it could 'revive' Murrurundi was narrowly based around accommodation and hotel interests. It is evident to the Commission that Bickham on its own cannot support a significant mine-related service industry in such an isolated location.
- *Variations in Proposal and Community Consultation*  
Continuing changes in the mine parameters have resulted in confusion and distrust within the community. Community consultation on the proposal has gone through multiple iterations each of which has degenerated after a period of time.



- *Deferred Investment and ‘Closure’*

A number of submissions indicated that investment decisions were being deferred in industries that might be impacted by the introduction of coal mining to the Shire. Community frustration at the length of time taken to get to this stage (10 years) and the constant disruption caused by the continued existence of the threat posed by Bickham has been a source of uncertainty for business and the community. Responding to the many iterations of the proposal has also been a substantial economic impost on individuals and organisations.

- *Access to Emergency Services – Scone*

The Upper Hunter Shire Council raised concern about the risks associated with coal trains blocking both the level crossings in Scone that provide access for emergency services from one side of the town to the other. With all emergency services based on one side and half the town’s population on the other it is only a matter of time before one or more lives are lost because access is not available.

### Whether the Project Should be allowed to Proceed to full Merit Assessment Under Part 3A of the EP & A Act

The Commission considered at some length whether it should recommend that open-cut coal mining be prohibited in the Upper Hunter Valley Shire. Its conclusion is that there is strong evidence to support such a move, but that this evidence lacks the rigour of a comprehensive study of competing land uses backed by a robust cost-benefit analysis. Whilst *Coal Mining Potential in the Upper Hunter Valley – Strategic Assessment* prepared by the Department of Planning in 2005 (DoP 2005) goes some way toward providing such an assessment, it lacks key information on both the coal resources actually able to be mined by open-cut methods and the value of the competing industries. It also lacks a rigorous assessment of the nature and degree of incompatibility between the competing land uses. A comprehensive cost-benefit analysis was beyond both the informational and financial resources of that study.

The Commission concludes that there is sufficient residual concern generated by its assessment of the water-related risks to warrant that the Bickham project proposal not be recommended for further merit assessment under Part 3A.

The Commission further concludes that there is strong evidence from the non-water-related issues raised in submissions that the Bickham project proposal has had, and would continue to have, significant adverse effects on other industries and investments that would outweigh any advantages in proceeding to merit assessment under Part 3A.

The Commission notes that merit assessment under Part 3A is unlikely to be capable of assessing or resolving the broader competing land use issues. The Commission also notes the significant bias in the economic data presented in support of the mining proposal and rejects the employment claims made by the proponent as unable to be supported by the evidence presented.

### Requirements for inclusion in the Director-General’s Requirements

As the Commission does not recommend that the proposal proceed to a Part 3A Merit Assessment, no advice on the Director-General’s Requirements is provided.

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## GLOSSARY/ACRONYMS AND ABBREVIATIONS

Aquifer	A permeable body of rock or regolith that both stores and transmits groundwater
Aquitard	A sparingly permeable body of rock or regolith that tends to restrict the passage of groundwater between aquifers located above or below
Bickham Coal Project	The proposal described in the WRA and draft WMP
Commission, the	The one permanent and two casual members of the PAC constituted to provide advice on the Bickham Coal Project
DEC	Department of Environment and Conservation, now superseded by DECCW
DECCW	Department of Environment, Climate Change and Water, NSW
DII	Department of Industry and Investment, NSW
DIPNR	Department of Infrastructure, Planning and Natural Resources, now superseded by DoP (predominantly), DECCW and NOW
DMR	Department of Mineral Resources, superseded by DII
DoP	Department of Planning, NSW
DoP 2005	<i>Coal Mining Potential in the Upper Hunter Valley – Strategic Assessment</i> , prepared by DoP and dated December 2005
EA	Environmental Assessment
EL	Exploration Licence
EP & A Act	<i>Environmental Planning and Assessment Act 1979</i>
EP & A Reg	<i>Environmental Planning and Assessment Regulation 2000</i>
FTE	Full-time Equivalent
GDE	Groundwater-Dependent Ecosystem
Hydrogeological	Related to the distribution and movement of groundwater, and the geological properties of the associated aquifers and aquitards
LGA	Local Government Area
NOW	(NSW) Office of Water within DECCW
PAC	Planning Assessment Commission
Piezometer	A non-pumping well or borehole, generally of small diameter, used to measure the elevation of the water table or piezometric surface
PM <sub>10</sub>	Dust and other types of air pollutants with a diameter of 10 microns or less
PM <sub>2.5</sub>	Dust and other types of air pollutants with a diameter of 2.5 microns or less
PM <sub>1</sub>	Dust and other types of air pollutants with a diameter of 1 micron or less
Proponent	Bickham Coal Company Pty Limited
REF	Review of Environmental Factors
Response to Submissions	The proponent's responses to issues raised in submissions, dated January 2010
'South Bickham'	The name of the property owned by the proponent which includes the area of the proposed mine
ToR	Terms of Reference
WMP	Draft Water Management Plan, dated March 2009
WRA	Water Resource Assessment, dated March 2009

## CHAPTER 1: CONTENTS AND TERMS OF REFERENCE

### 1.1 ADEQUACY OF THE WATER RESOURCE ASSESSMENT AND DRAFT WATER MANAGEMENT PLAN FOR GROUNDWATER

On 30 October 2009, the Minister for Planning issued a direction to the Chairperson of the Planning Assessment Commission, namely:

1. *Request the Planning Assessment Commission (the Commission) to advise on:*
  - *the water-related risks of the Bickham Coal Project;*
  - *the adequacy of the Water Resource Assessment for the project and associated draft life-of-mine Water Management Plan;*
  - *whether the water-related risks of the project can be suitably managed to ensure an acceptable level of environmental performance, having regard to the relevant recommendations in the Strategic Assessment of Coal Mining Potential in the Upper Hunter Valley;*
  - *any other significant issues that are raised about the project in public submissions;*
  - *whether the project should be allowed to proceed to a full merit assessment under Part 3A of the EP&A Act; and, if so*
  - *any specific requirements that should be included in the Director-General's requirements for the environmental assessment of the project as a whole.*
2. *Direct, that for the purposes of carrying out the review, the Commission is to be constituted of at least 3 members, including Mr Lindsay Gilbert and Dr Lloyd Townley as casual members; and*
3. *Request the Commission to provide its final report to the Director-General during the first quarter of 2010.*

For ease of reference the dot points under (1) above are referred to as 1(a)-1(f) in this report.

Dr Neil Shepherd AM was appointed by the Chairperson of the Planning Assessment Commission to chair this Commission.

By the middle of January 2010, the Commission formed a view that it would be very difficult to reach fully informed conclusions from which to provide the requested advice without allowing the public a further opportunity to express its views via the conduct of public hearings.

To this end, the Commission Chair wrote to the Minister on 19 January 2010 requesting a variation to the initial direction. The Minister subsequently issued a variation to the initial direction to:

1. *Request the Commission to conduct public hearings as part of the review, in the Upper Hunter Valley area; and*
2. *Request the Commission to provide its final report (under Clause 268V of the Environmental Planning and Assessment Regulation 2000) by 30 April 2010.*

The Bickham Coal Project refers to the proposal by Bickham Coal Company Pty Limited to develop a new open-cut coal mine approximately 13 kilometres southeast of Murrurundi in

the Upper Hunter Valley (See Annexure 3.1). The proposed mine would extract a total of 36 million tonnes of coal over 25 years.

## **1.2 METHOD OF OPERATION**

### **1.2.1 Commission Meetings**

The Commission was briefed initially by the Department of Planning (DoP) and meetings were subsequently held with all government agencies that provided submissions to DoP during the public exhibition period (see Section 1.2.3 below). The proponent and its consultants briefed the Commission over a period of two days as part of the Field Inspections of the site and neighbouring properties (see Section 1.2.4 below). The Commission also met with officers of the Upper Hunter Shire Council and with a group representing equine interests coordinated by the Hunter Thoroughbred Breeders Association during the period of the public hearings. Over the course of the review the Panel met several times to discuss issues and prepare the report.

### **1.2.2 Public Hearings**

Public hearings were held on 17 and 18 March 2010 at the Upper Hunter Shire Council Chambers in Scone. Thirty-nine verbal submissions were made to the Commission at the hearings, comprising one from the proponent, two from Councils (Upper Hunter and Muswellbrook), 17 from special interest groups (including small businesses) and 19 from individuals.

### **1.2.3 Documentation**

The Commission reviewed a large amount of information before and after the public hearings. The principal sources of this information were:

- *Coal Mining Potential in the Upper Hunter Valley – Strategic Assessment* (DoP 2005);
- the proponent's Water Resource Assessment and Draft Water Management Plan;
- submissions made to DoP from the general public, special interest groups and government agencies during and after the public exhibition period of 21 October to 4 December 2009 (see Summary of Submissions, Annexure 2.1);
- the proponent's responses to these submissions;
- submissions from any source made to the Commission prior to and following the public hearings (see also Summary of Submissions, Annexure 2.2); and
- additional information provided by the proponent, special interest groups and key government agencies in response to questions from the Commission.

### **1.2.4 Field Inspections**

The Commission compiled an extensive list of sites and features it wished to inspect and requested the proponent to facilitate these inspections. Apart from Cameron's Gorge Nature Reserve, the proponent was able to arrange the required access. Cameron's Gorge Nature Reserve was inspected at a later date with the assistance of the Department of Environment, Climate Change and Water (DECCW). A summary of the field inspections is provided in Table 1.

**Table 1: Field Inspections Undertaken by Panel Members**

Date	Facilitator	Sites/Features Inspected
3/2/10	Bickham Coal Company & Consultants, owners of 'Murulla North' and 'Glengarry'	<ul style="list-style-type: none"> <li>• Neighbouring properties 'Murulla North' and 'Glengarry' focusing on key existing water sources predicted to be impacted including groundwater bores, seeps and soaks</li> <li>• Proposed irrigation areas at 'Glencoe' and 'South Bickham'</li> </ul>
4/2/10	Bickham Coal Company & Consultants	<ul style="list-style-type: none"> <li>• Bulk sample pit and waste rock dump</li> <li>• Proposed mine footprint including infrastructure areas and main on-site drainages</li> <li>• Piezometer and groundwater monitoring locations</li> <li>• Old underground mineworkings</li> <li>• Areas of G-seam 'outcropping' at Pages River</li> <li>• All on-site flow gauging and sampling locations</li> <li>• Pages River gauging station at Blandford</li> <li>• Kingdon Ponds gauging station 'Parkville'</li> <li>• 'Bickham Homestead' (for consultant briefing and presentation)</li> </ul>
19/3/10	DECCW	<ul style="list-style-type: none"> <li>• Cameron's Gorge Nature Reserve, focusing on Pages River and aquatic habitat.</li> </ul>

### 1.3 CONTEXTUAL MATTERS

#### 1.3.1 Prior to publication of DoP 2005

Although small-scale underground mining was carried out on the site in the early 1900s, the current proposal described as the Bickham Coal Project originated from the granting of an Exploration Licence (EL 5306) by the Minister for Mineral Resources in September 1999.

In 2002 the proponent sought approval to extract a 25,000 tonne 'bulk sample' of coal in order to test its qualities, from an area about 150m from the Pages River at the North-Eastern end of the site. Under Part 5 of the EP&A Act, the proponent was required to prepare a Review of Environmental Factors (REF) for these activities.

The REF was publicly exhibited in October/November 2002 and attracted substantial community concern. The REF was revised and re-exhibited during 2003 and again drew widespread community concern. The proponent then received approval for the bulk sample from the Minister for Mineral Resources in January 2004 and extracted the coal in late 2004/early 2005.

Acknowledging community concerns about the possible introduction of coal mining to this area of the Upper Hunter, the NSW Government initiated a strategic study into the implications of coal mining in the area. The report of this study, *Coal Mining Potential in the Upper Hunter Valley - Strategic Assessment*, December 2005, is referred to as DoP 2005 throughout this report.

#### 1.3.2 DoP 2005

From the outset the study was intended to be a collaborative project between multiple government departments. Accordingly, the assembled project group consisted of officers



from the then departments of DIPNR (covering planning and natural resources), DEC (covering environment), DMR (covering mineral resources) and the Upper Hunter Shire Council. It was also agreed at an early stage that, rather than considering only the area around Bickham, the study should encompass the entire Upper Hunter Shire Local Government Area (LGA).

The Terms of Reference for the study emphasised that the focus of detailed assessment by the project group was to be on the potential impacts to surface and groundwater resources. However, the Terms of Reference also required the study to provide a broader cost-benefit analysis of introducing mining to the Shire at any time over the next 15 years.

The study was not resourced to either acquire new information or to engage relevant expertise to conduct a comprehensive collection and evaluation of economic data. Consequently, whilst many of the issues that might affect land-use compatibility were identified in DoP 2005, a quantitative assessment of these competing uses was not attempted. However, DoP 2005 contained a number of observations and recommendations to guide the consideration of water-related aspects of any future coal mining proposals in the area. These are detailed and considered in Chapter 4.

### **1.3.3 Following publication of DoP 2005**

Aware that the proponent had confirmed the quality of the coal resource and intended to proceed with a full-scale project, DoP advised the proponent in January 2006 of the relevant requirements arising from DoP 2005.

In January 2008 the proponent submitted a Water Resource Assessment (WRA) and draft Water Management Plan (WMP) to DoP for the proposal, which was based on mining approximately 47 million tonnes of coal from a single open-cut pit extending to within 100m of the Pages River.

Following a detailed review of these documents and consultation with other key agencies and an independent groundwater expert, DoP advised the proponent that the water study was inadequate for public exhibition and that it had significant concerns about the merits of the proposal as a whole.

In March 2009 the proponent submitted a revised Water Resource Assessment and draft Water Management Plan to DoP based on a substantially modified proposal to extract a total of 36 million tonnes from two open-cut pits. A 25-year mine-life was proposed. These documents were placed on public exhibition for 6 weeks until 4 December 2009.

A total of 253 submissions were made during and after this period, including 145 from the general public, 104 from special interest groups (including owners and stakeholders in local agricultural industries and other businesses) and 4 from government agencies. These submissions were provided to the Commission.

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## **CHAPTER 2: WATER-RELATED RISKS OF THE BICKHAM COAL PROJECT (TERM OF REFERENCE 1(a))**

### **2.1. INTRODUCTION**

Term of Reference 1(a) requires the Commission to advise on ‘the water-related risks of the Bickham Coal Project’.

Water-related risks are usually divided into groundwater risks and surface water risks and the Commission has followed this convention. However, there is also a substantial interdependence between groundwater and surface water that needs to be kept in mind.

Perhaps the easiest way to describe this interdependence is in terms of rainfall falling on a catchment. Under natural conditions it can enter a stream in the catchment either directly as surface runoff over a short period of time or infiltrate the shallow groundwater aquifers and emerge as baseflow in the stream over a much longer period. (In dry times almost all stream flow is baseflow.) Some of the water can also enter the deeper aquifers via very slow hydrogeological processes and the availability of this water to the stream is limited.

Once open-cut mining occurs the relationships between surface water and groundwater can become much more complex. For example, under some circumstances surface water in a nearby stream can move through permeable ground layers into a mine pit which is below the level of that stream. The mine area can also reduce the availability of both runoff and shallow groundwater sources for the stream and there may also be changes in quality of any water entering the stream from the mining area. Impacts on the stream may vary with short term climate changes and also as the operations change during the life of the mine.

This Chapter essentially describes the risks. Chapter 3 then discusses whether the Water Resource Assessment and draft Water Management Plan have dealt with them adequately. Chapter 4 discusses whether the management options proposed by the proponent to deal with these risks are likely to produce acceptable outcomes.

### **2.2. RISKS RELATED TO GROUNDWATER**

#### **2.2.1. Introduction**

As in all technical fields, the science of groundwater or hydrogeology has its own concepts and terminology. The purpose of this introductory section is to explain some of the terminology involved in discussing the groundwater-related risks at Bickham.

The proponent has undertaken field investigations in the Bickham area since 2002. The investigations are described in detail in the Water Resource Assessment (WRA). The area near Bickham can be described as an alternating sequence of coal seams and interburden, with these layers acting as ‘aquifers’ and ‘aquitards’, respectively. The terms aquifer and aquitard are relative. An aquifer is a layer capable of carrying a significant amount of water, relative to flow in nearby layers, generally within and parallel to the layer itself. An aquitard has more resistance, i.e. lower ‘hydraulic conductivity’, especially in the direction at right angles to the layers. Aquitards impede or restrict flow between aquifers. Hydraulic conductivity varies from place to place, within and between hydrogeological units or strata. The fact that groundwater tends to move more easily in one direction than another is embedded in a concept known as ‘anisotropy’. Most geological strata tend to have higher hydraulic conductivity in the horizontal direction than in the vertical, an anisotropy ratio of 10

being commonly assumed. This effect applies within individual aquifers and aquitards, but at a larger scale, it is the distinction between horizontal hydraulic conductivity in aquifers and vertical hydraulic conductivity in aquitards that is of primary importance. The term ‘transmissivity’ is used to describe the product of horizontal hydraulic conductivity and layer thickness in an aquifer.

Over the period of development of a coal mine, groundwater is removed (i) within coal and waste rock, (ii) from the water table aquifer and (iii) from compressible storage within deeper confined aquifers and aquitards.

Developing an open-cut coal mine below the regional water table requires removal of water so that the floor of the pit can be accessed. Groundwater is removed with every tonne of coal and waste rock, since groundwater is present inside the pore space of soil and in fractures within rock. Some moisture is shipped in product to international markets, and performs an essential role reducing dust emissions during transport from mine to final destination.

Groundwater in the uppermost or ‘unconfined’ aquifer, at the level of the ‘water table’, seeps into the mine pit from beyond the pit walls. This causes the level of the water table to decline, as water drains from pores and fractures to supply this seepage. The zone within which the water table falls is called a ‘cone of depression’. The cone of depression expands until the rate of recharge within the cone of depression, or the rate of supply of water from a nearby river or stream, is equal to the rate of seepage into the pit. A cone of depression can expand for years or tens of years, to distances of hundreds of metres or kilometres, depending on the hydraulic characteristics of the layer that hosts the water table aquifer.

A deeper coal seam may function as a ‘confined’ aquifer. When such a seam is exposed at the floor or in the wall of a mine pit, groundwater will flow from the seam into the pit. There is a gradual decline in water pressure within the seam, and the water itself expands slightly to fill the available storage space within the seam. A ‘cone of depressurisation’ expands like a cone of depression at the water table, except that the seam remains saturated, full of groundwater from the floor to the roof of the seam. A cone of depressurisation generally expands faster and to greater radii than a cone of depression at the water table. A drop in pressure or ‘piezometric head’ (a combination of elevation and pressure) in confined aquifers can induce seepage from adjacent aquifers towards the depressurised aquifer, essentially vertically through the separating aquitards. The aquitards also depressurise, thereby releasing additional water from compressible storage.

As noted above, when rivers like the Pages River flow in the dry season, they are fed by groundwater, i.e. by water that once fell as rainfall, infiltrated into the ground and has been released perhaps years later as groundwater discharge to the surface water drainage system. A stream that receives groundwater discharge is often called a ‘gaining’ stream, in contrast to a ‘losing’ stream that contributes recharge to underlying groundwater. It is useful to distinguish between ‘seepage’ into a mine pit and ‘leakage’ from a nearby river or stream. If an initially gaining stream is affected by a nearby mine, the initial groundwater flow from landscape to stream can be reversed, the stream can ‘leak’ towards the pit, and a reach of streambed can become a ‘losing’ stream.

Government agencies such as the NSW Office of Water (NOW) distinguish between leakage towards mine pits from rivers, streams and their connected alluvium, and seepage into mine pits from deeper confined coal seams, often described as hard rock aquifers. The distinction is partly due to the fact that shallow groundwater can be important for water supply and environmental needs, e.g. for sustaining groundwater-dependent ecosystems (GDEs), whereas hard rock aquifers may not have any immediately identifiable beneficial use. There are also legal distinctions that affect the way access to different types of water is licensed.

Seepage of groundwater into a mine pit can become an important operational issue. If rates of groundwater inflow are large, significant pumping infrastructure is required to remove the water and this water may need to be stored, treated and used or discharged.

Bores, seeps, soaks, sumps, in-stream farm dams and groundwater dependent ecosystems (GDEs) can be affected by lowering of the water table.

If a cone of depression reaches a nearby river or stream, leakage from the river or stream may have adverse impacts on streamflow and stream levels, hence on downstream users, including environmental users. A cone of depressurisation can also affect a nearby river or stream, especially if confined coal seam aquifers dip from a river towards a nearby mine pit. In such a case, as at Bickham, depressurisation in a confined aquifer can radiate outwards until it reaches layers at or below a stream, and a pathway for leakage from river to pit is established.

Consider the groundwater hydrogeology of a ridge adjacent to a river, where the ridge is mined to a level below that of the river. Prior to mining, the water table near the surface and piezometric head in lower confined aquifers will slope from high levels near the crest of the ridge towards the river. Following mining to a depth below river level, the water table and piezometric head would be lower near the pit wall, so a groundwater mound would form between the pit and the river. That is, the water table and piezometric head would be higher between the river and the pit than at either end. Groundwater would seep in both directions, towards the river, as before, and towards the pit. Water table elevations in the uppermost aquifer and piezometric heads in deeper aquifers respond as a classical dissipating mound, with the crest of the mound lowering in time, and the highest point on the mound migrating towards the river. If the crest of the mound were to reach the river bank, the piezometric gradient would slope continuously from the river towards the pit and there would be direct connection between the river and the pit. However, the time for this to occur depends on the hydrogeological properties of all aquifers and aquitards. Groundwater seeps slowly, so the time scale could be years, or tens of years.

All the concepts described here are relevant to consideration of potential issues at the proposed Bickham mine.

In order to predict the movement of groundwater near the proposed mine and the potential impacts of mining on groundwater, the proponent has developed a numerical groundwater flow model. The model has been developed using commercial software known as MODFLOW-SURFACT. A numerical model is based on a conceptual hydrogeological model that incorporates geology and stratigraphy (layering), the hydrogeological properties of the various layers and structures, natural recharge processes and the nature of nearby rivers and streams prior to mining. A model is calibrated by adjusting coefficients called model parameters to match historical data.

If a model's calibration is shown by 'sensitivity analysis' to be robust, the model can be used to predict the impact of mining. A range of possible impacts can be predicted by adopting different combinations of parameter values, this process being known as 'uncertainty analysis'. Sometimes, as part of the modelling process, it is useful to choose unlikely combinations of parameter values that imply a worse impact than expected. This leads to 'conservative' predictions, in the sense that the most likely environmental impacts would not be as great.

The proponent's explanation of potential groundwater-related issues relies on field data and on the numerical model that has been developed based on those data. The Commission, in considering the same potential issues, relies on the same data and model. During the course of this assessment, the Commission has asked questions of the proponent, some of which have been answered after the proponent's consultants performed additional model

simulations. It is not the Commission's role to audit the proponent's model, nor to perform its own calculations using the model.

### **2.2.2. The spectrum of groundwater-related risks**

As a precursor to consideration of risks to the hydrogeological system, there is one risk that affects consideration of all others:

- Assessment of groundwater-related risks relies on the adequacy of field investigations and the development of modelling capabilities that allow predictions of potential environmental impacts. There is a risk where field investigations are not sufficient that a model based on those investigations is incapable of predicting potential impacts with a sufficient level of accuracy.

The following groundwater-related risks will also be described and discussed below:

- Mining would affect groundwater levels near the proposed mine pit, in both unconfined (water table) and confined aquifers.
- There could be impacts on the Pages River and Kingdon Ponds, through a reduction in groundwater discharge as a contribution to baseflow, or by reversal of the direction of groundwater flow in some locations, such that the Pages River could recharge adjacent aquifers.
- The volume of groundwater seeping into the pit each year would need to be managed as part of the mine water inventory, and even though the quality of seepage may initially be good, the potential impacts of groundwater quality on the quality of water in the mine water inventory would need to be managed.
- Following cessation of mining, nearby groundwater and surface water would initially flow into the pit, flooding backfill and leading to the creation of a mine pit lake. The lake would rise above the level of Pages River 40-50 years after the end of mining, and would eventually act as a source for groundwater flow towards the Pages River and Kingdon Ponds.
- If the proponent were to provide water to neighbouring properties during and after mining operations, to compensate them for loss of groundwater supply to bores, seeps, GDEs etc., there remains a question as to where the proponent could find an appropriate source of supply.

#### **2.2.2.1. Hydrogeological field investigations and modelling**

The state-of-the-art in hydrogeological impact assessment requires proponents of a project to predict the potential environmental impacts of their project. This generally requires the development of a numerical simulation model, being a commercial computer program combined with a large number of data files that describe the hydrogeological system and how the project would interact with that system.

The first stage in modelling requires collection of field data, followed by development of a conceptual hydrogeological model that describes how the system is believed to work. The next stage involves setting up a numerical model, and calibration of the model so that it matches observed field data. This stage generally includes sensitivity analysis to assess how the model calibration would change if model parameter values were different. Finally a model is used to make predictions into the future, sometimes with uncertainty analysis to

assess the impact of parameter uncertainty, and sometimes by also considering possible errors in the structure of the model itself.

The effort and accuracy required in field investigations and modelling depend on the likelihood and consequences of impacts on the hydrogeological system, i.e. the risk to the health of that system. Given that that Pages River and Kingdon Ponds are both considered to be seriously stressed catchments, the risks of even minor errors may be significant.

#### **2.2.2.2. Lowering of the water table aquifer**

Lowering of the water table would be an inevitable consequence of mining at Bickham. If mining were to extend to the floor of the G Seam at 220 mAHD, for example, the water table in the regional water table aquifer would fall. Outside the walls of the pit, the water table would not fall to 220 mAHD. Rather, a number of seepage faces could develop in coal seams where they are exposed in pit walls. Each seam could respond relatively independently, because the low vertical hydraulic conductivity in interburden layers between seams may ensure that piezometric heads in adjacent seams remain different. The regional water table in the uppermost aquifer would fall to a level controlled by a seepage face in the wall of the pit, or by lower seepage faces if the water table aquifer drains to lower aquifers before reaching the pit wall.

The proponent's groundwater model represents the mine plan using a number of 'drain nodes' at the elevation of the floor of the pit to specify the level to which the mine pits must be dewatered. The proponent predicts that the 1 m contour of drawdown in the cone of depression will extend ~1 km to the northwest of the mine, generally down dip from the mine, as well as ~1 km to the southwest, into the catchment of Kingdon Ponds. The cone of depression is predicted to extend a very short distance to the northeast and southeast of the pit, because the uppermost coal seams do not extend beyond the wall of the pit. The base of the regional water table aquifer reaches the surface along the ridge to the southeast of the proposed mine, open to direct recharge by rainfall-induced infiltration. The extent of lowering of the water table is a risk that needs to be understood. Any fall in the water table may have an adverse impact on:

- A number of shallow bores in neighbouring properties
- A number of seeps and soaks in neighbouring properties, used by cattle as watering holes
- A number of GDEs, on neighbouring properties and potentially on 'South Bickham' as well.

#### **2.2.2.3 Depressurisation of confined coal seam aquifers and other layers**

Seepage from coal seam aquifers into the pit would cause a cone of depressurisation in each coal seam aquifer. The proponent's model suggests that the 1 m contour of drawdown in coal seam aquifers will extend ~3 km to the northwest, and 1 km to the north and southwest.

The deepest seam that Bickham proposes to mine is the G Seam, represented as layer 6 in the model. This layer does not extend far beyond the southeast wall of the proposed pit, so no drawdown is predicted in the G Seam to the southeast. The G Seam outcrops at and subcrops the Pages River to the northeast of the proposed pit. If depressurisation occurs between the pit and the river in this area, there is a risk that the river starts to act as a source of recharge to groundwater.

Depressurisation occurs in aquifers but also in interburden layers that act as aquitards above and below coal seams. To the southeast of the pit the uppermost layer in the model is layer 7, representing weathered regolith, perhaps a weathered remnant of the basal Koogah Formation or 'G Bottoms'. This overlies layer 8, representing Werrie Basalt. Mining G Seam to 220 mAHD in the middle of the proposed pit would reduce the heads in layers 7 and 8, and cause a cone of depressurisation in these layers to radiate outwards, including to the southeast towards the Pages River. In the region near the river, the weathered regolith becomes an unconfined water table aquifer, so the rate of propagation of depressurisation would slow, but the possibility of impacts being felt at the river remains.

If the cone of depressurisation in aquifers or aquitards were to reach the Pages River, this could lead to leakage directly from the river or stream towards the mine. The extent of depressurisation is therefore a risk that needs to be evaluated.

#### **2.2.2.4 Reduction in groundwater discharge to Pages River or leakage from Pages River to the pit**

Under natural conditions groundwater discharge to Pages River is a contribution to baseflow. During mining, groundwater discharge will decline. The proponent has consistently stated that analysis of groundwater flow shows that 'at no stage in the life of the mine will mining cause water to flow from the Pages River into the pit. At all times there will be a net flow of groundwater from the coal measures to all sections of the river.'

In the pre-mining situation, natural recharge supports a water table higher than 450 mAHD at observation bore OH89 in the area of the proposed pit, ~80 m higher than river level at the nearest location in Pages River. The piezometric head in the G Seam is 445 mAHD at OH38, a similar distance from the river. The proponent argues that because heads are maintained at these relatively high levels, the connection between the river and the pit must be poor. At the same time, their modelling shows that groundwater discharge via layer 8 dominates their overall estimate of groundwater contribution to baseflow. This suggests that if gradients were to reverse, the groundwater contribution to baseflow could be significantly impacted.

Immediately after mining to a depth say 150 m below river level, the water level and piezometric head in unconfined and confined aquifers would fall near the pit wall, and a mound would form between the pit and the Pages River, with water flowing in both directions, i.e. towards the pit and towards the river. Water table elevations in the uppermost water table aquifer may remain high, especially if the aquifer outcrops high on the southeast side of the ridge, with water levels supported above a less permeable aquitard below. Piezometric heads in deeper layers will respond as a classical dissipating mound, with the crest of the mound lowering in time, and migrating towards the river. If the crest of the mound were to reach the river bank, the piezometric gradient would slope towards the pit and there would be direct connection between the river and the pit.

The belief by stakeholders that the proposed mine would have a significant impact on the availability of water downstream in the Pages River has led several groups of stakeholders to engage professional hydrological and hydrogeological consultants to review and assess the Water Resource Assessment and draft Water Management Plan. Several independent experts have challenged the proponent's claims that flow reversal cannot occur. The extent to which others are not convinced by the proponent's arguments relates to the adequacy of the Water Resource Assessment and is discussed in Chapter 3.

The extent of any reduction in groundwater discharge as a contribution to baseflow and the possibility of local reversal of the direction of groundwater flow such the Pages River could lose water as recharge to nearby aquifers are risks that need to be evaluated.

### **2.2.2.5 Reduction in groundwater discharge to Kingdon Ponds**

Part of the proposed project area lies within the surface water catchment of Kingdon Ponds. There is no guarantee that the 'groundwater divide' separating groundwater that flows towards Pages River from groundwater that flows towards Kingdon Ponds corresponds exactly to the surface topographic divide. However, for many intents and purposes, these hydrological divides can be considered to be the same.

A reduction in water table elevation and in piezometric heads in lower aquifers at the head of the Kingdon Ponds catchment would lead to a reduction in groundwater flow to the uppermost tributaries of Kingdon Ponds. The extent of this reduction is a risk that needs to be evaluated.

### **2.2.2.6 Contribution of groundwater to mine water balance**

From the point of view of mine water management, i.e. managing all water on an operating mine site during operations, it is essential to understand the relative magnitudes of groundwater seepage to mine pits, direct rainfall and the contribution of surface runoff within the surface water catchment of the pits.

The proponent has predicted an average of 1200 kL/d of groundwater inflow to the mine pit over the life of mine. This water is predicted to come from storage within the cone of depression and cones of depressurisation described above. The rate of inflow from storage is predicted to be several times larger than the reduction in groundwater discharge as a contribution to baseflow in the Pages River, suggesting that most of the groundwater inflow comes from coal seam aquifers to the northwest of the mine, down dip, and leading to a cone of depressurisation that extends in that direction.

The rate of seepage into the pit changes throughout the mine plan, as the pit migrates across the landscape, accessing new and deeper coal seams. The significance of seepage rates for a project like Bickham lies in the need to contain all mine water on-site. Uncertainty in groundwater seepage rates affects stakeholder confidence that the proponent has developed plans to manage mine water, given the uncertainties in rainfall and runoff and the changing availability of storage capacity on-site.

### **2.2.2.7 Post-mining recovery**

Immediately following cessation of mining, surface water and groundwater would continue to flow towards the pit. Eventually a new quasi-equilibrium would be established with groundwater levels similar to but different from pre-mining levels.

The proponent has proposed backfilling much of the pit, leaving a mine pit lake in the central section. The proponent predicts that 100 years after the end of mining, a mine pit lake would be established at a level higher than the Pages River but lower than water table elevations in the same location prior to mining. The level of the mine pit lake would be controlled by a balance between rainfall, evaporation, surface runoff into the lake, possibly some localised component of groundwater inflow but more likely recharge to groundwater from the bed of the lake.

The hydraulic properties of backfilled material include higher porosity (related to specific yield) and higher hydraulic conductivity than in most materials prior to mining. The water table throughout the backfill would be almost horizontal, at the level of the mine pit lake. The lake would therefore act as a source of water that would drain in all directions, including towards Pages River and Kingdon Ponds.



With lower levels and higher hydraulic conductivities, it is difficult to predict a priori whether groundwater contribution to baseflow would recover to pre-mining rates. The proponent's modelling suggests that the ultimate contribution might be slightly higher than before.

A number of questions can be asked about water quality in the mine pit lake, the effect of contact between water and backfill, and the possibility that groundwater quality might improve during passage from the mine pit lake to a nearby stream. The issue of water quality is important in terms of potential impacts on downstream users, whether irrigators or environmental users.

The potential impact of post-mining water levels and water quality are risks that need to be evaluated.

#### **2.2.2.8 Alternative groundwater supply to compensate neighbours for detrimental impacts**

The proponent has predicted a lowering in water table elevation that would affect a number of neighbours in several ways. These include potential loss or partial loss of capacity of groundwater bores, impact on seeps and soaks used for watering cattle, potential impact on in-stream farm dams also used for stock watering, and potential impact on GDEs, at least some of which are also integral to stock management.

The proponent has indicated that it would compensate neighbours for some of these impacts, e.g. by supplying water from an alternative source. However, this proposal will not be suitable for all identified impacts.

During the course of simulating the impact of mine dewatering on regional groundwater, the proponent included an advanced dewatering bore towards the eastern end of West Pit, pumping 0.6 ML/d of relatively fresh groundwater, on the basis that such water could be used to make up for shortfalls in mine water supply requirements during the first five years of mining operations.

It is not clear that similar efforts have been made to identify an appropriate source of fresh groundwater that could be utilised for compensation of affected neighbours for up to 100 years post mining while groundwater levels recover. The issue of identifying and licensing an appropriate source of makeup water remains a groundwater-related risk.

### **2.3. RISKS RELATED TO SURFACE WATER**

#### **2.3.1. Introduction**

The broad concepts applying to surface waters are reasonably well understood and, unlike groundwater, do not require an explanatory section to provide a platform for description and analysis. There are however two issues relating to surface water hydrology which the Commission considers to be of particular relevance to this inquiry:

- Rainfall and streamflows are extremely variable in this region and in Australia in general. Studies have shown that rainfall and streamflow in Australia are among the most variable in the world.<sup>1</sup> The consequences of this variability are that to be effective a water management plan for a mine must have sufficient capacity and

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<sup>1</sup> "Identification and Explanation of Continental Difference in the Variability of Annual Runoff"; Peel, McMahon, Finlayson and Watson, Journal of Hydrology Vol 250 Issue 1-4, Sept. 2001.

flexibility to deal with large extremes of water make over a range of time periods – from extended droughts to short extremely intense rainfall–runoff events.

- Open-cut mining results in the creation of large artificial landforms, including large mine excavations and large elevated overburden dumps. These landforms have very different hydrological behaviour to ‘natural’ catchments. They also evolve over time as the mining process progresses. Initially mining involves the removal of vegetation and stripping of surface materials. Waste (overburden) material removed from mining is placed as loose fill in piles or dumps which cover large areas. The hydrological balance between infiltration, evaporation and runoff of these mine landforms is vastly different to that of the original undisturbed landform. There are also often significant hydrochemical changes that accompany the mining process which affect drainage water quality from mine landforms. Being able to simulate and understand this changed behaviour using models is critical to understanding the environmental implications of mining and for the design of systems for managing water and water quality on mine sites to achieve required environmental performance.

Risks to surface waters can be divided into risks to flow and risks to quality. Note that because of the interdependency between groundwater and surface water, some risks that appear in this section have also been discussed under groundwater risks in 2.2 above.

### **2.3.2. Risks to Flow**

#### **2.3.2.1. Reduced runoff from the mine site**

Reduced runoff from the proposed mine site would occur as a result of catchment excision associated with the actual mine workings and possibly lower runoff from mine spoil catchments. The proponent has estimated that the maximum reduction to the Kingdon Ponds catchment would be 41 ha and that the maximum reduction to the Pages River catchment would be some 115.4 ha.

#### **2.3.2.2. Reduction in baseflow**

The proponent has predicted that there would be a reduction in baseflow (i.e. there would be less groundwater flowing from the mine site to the Pages River and Kingdon Ponds), as a result of flatter groundwater gradients between the mine and the rivers. The maximum predicted effect on the Pages River was some 225 kL/day in Year 35 and 15 kL/day on Kingdon Ponds. These predictions have been challenged by other experts. The proponent has assessed the significance of these flow reductions by comparing them to average flows. The relevance of this comparison has been challenged by most other experts and was also questioned in many of the public submissions.

#### **2.3.2.3. Potential leakage from Pages River to the mine pit**

Loss of streamflow through leakage, particularly from the Pages River to the mine, was a major concern that prompted the requirement to produce the current Water Resources Assessment and draft Water Management Plan. The proponent maintains that there will be no leakage from the Pages River to the mine. This has been challenged by other experts and by the Commission.

### **2.3.3. Risks to Water Quality**

#### **2.3.3.1. Potential impacts of changes in flow**

Changes to water quality could occur due to the indirect impacts on flow either by the removal of a pre-mining flow component that was adding to the net load and concentration of some water quality constituent, or alternatively was diluting it. Water quality changes could also occur because of the introduction of additional water quality constituents into water flowing off-site. The main water quality risks at Bickham are essentially the same as those at other open-cut coal mines in the Hunter Valley – salinity, turbidity and sediment migration. Acidity (pH), nutrients and some trace elements have also been issues at some mines and may be relevant at Bickham.

#### **2.3.3.2. Salinity**

Drainage from the proposed Bickham mine catchments (both surface overland flow and groundwater fed baseflow) will contain some level of dissolved salts (salinity). The available data suggest that the salinity of the Pages River in the vicinity of the proposed Bickham mine site is low (long term mean of 423  $\mu\text{S}/\text{cm}$  at the Blandford Gauging Station upstream of Bickham). The issue is the risk that there could be a significant additional load of salt in drainage off-site compared to the pre-mine situation. Potential sources of additional salt comprise groundwater which reports to the mine workings, saline interstitial water which drains out of exposed mine waste and salinity which could be generated following surface exposure of mine materials.

#### **2.3.3.3. Sediment**

Drainage from the Bickham mine area would contain varying concentrations of suspended sediment and could, if un-mitigated, contribute to increased turbidity in the Pages River and/or Kingdon Ponds. Turbidity and sediment concentrations in these two waterways will also reflect other non-mining land use activities particularly agricultural activities. The available data suggest that turbidity in the Pages River near the Bickham site is typically low (long term mean turbidity of 92.7 NTU at the Blandford Gauging Station upstream of Bickham). The issue for the Bickham project is whether the mining would pose a significant risk of increased turbidity and sediment to the Pages River and Kingdon Ponds.

#### **2.3.3.4. Other contaminants**

The Bickham project would introduce the risk of other contaminants (e.g. hydrocarbons, compounds used in explosives and other chemicals stored on-site), reaching the Pages River or Kingdon Ponds as a result of accidents.

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## **CHAPTER 3: ADEQUACY OF THE WATER RESOURCES ASSESSMENT FOR THE PROJECT AND ASSOCIATED DRAFT LIFE-OF-MINE WATER MANAGEMENT PLAN (TERM OF REFERENCE 1(b))**

### **3.1 INTRODUCTION**

The requirements for preparation of the Water Resources Assessment and draft Water Management Plan are summarised in Table 4.1 of Volume 1 (ppA-5.3 and A5.4) and set out in full in Appendix 1 of that document.

Since the requirements are very detailed and specific, and in many cases do not relate to the risks of the project which are the focus of the Commission's Terms of Reference, the assessment of adequacy has been confined in this report to the areas of risk identified in Chapter 2 above.

### **3.2 ADEQUACY OF THE WATER RESOURCE ASSESSMENT AND DRAFT WATER MANAGEMENT PLAN FOR GROUNDWATER**

#### **3.2.1 Hydrogeological field investigations and modelling**

The proponent's consultants have developed a groundwater flow model and assessed the response of groundwater to dewatering of an open-cut mine and associated depressurisation.

The model is based on available hydrogeological data, with more data being available in some parts of the model domain than others. The proponent has performed aquifer tests to estimate hydraulic properties of different hydrogeological units. The model has been calibrated to regional scale data and also to data collected during dewatering and mining of the bulk sample pit in 2004, hence there is more detail in this part of the model domain, near the northeastern end of the proposed pit, than elsewhere.

The proponent states that aquifers in the area near the bulk sample pit are compartmentalised. The proponent has also assumed the existence of two major lineaments trending north-northwest to south-southeast through the model domain. The easternmost of these structures lies to the west of the bulk sample pit. While an assumption of low hydraulic conductivity may reduce rates of groundwater flow pre-mining, mining through this structure would tend to connect regions to the east and west of this feature after mining and backfilling.

The locations of these structures are inferred from regional scale geological mapping, and from differences in piezometric heads in several zones within the model domain. The extent and properties of the faults are not well defined, and their role and importance has been questioned by opposing experts.

Assumptions about compartmentalisation may be conservative or non-conservative, in relation to different potential impacts. If the region to the northwest of the proposed mine, currently assumed to be homogeneous and connected, is in fact divided structurally into compartments, then current model predictions may be conservative (over-predicting the extent of the cone of depression and cones of depressurisation in deeper aquifers) and non-conservative (underestimating the difficulty of being able to install a so-called advanced dewatering bore to meet project water supply requirements in early years, or an interception bore to supply water as compensation to neighbours). The proponent's model relies on compartmentalisation to explain the relatively poor connection between groundwater aquifers

and the Pages River, but mining through multiple compartments over a strike length of several kilometres could increase the degree of connection.

Although challenged to do so by numerous stakeholders, including the relevant government agencies, the proponent has not found a way to measure hydraulic properties of the G Seam immediately to the west of Long Pool, in an area where connection between Long Pool and any future mine might lead to leakage from the Pages River to the mine via the G Seam.

The proponent has been asked on several occasions to explain whether there could be connection between the river and the pit via the G Bottoms or the Werrie Basalt, over a distance of 1-2 kilometres to the south and southwest of Long Pool. In response to questions posed by the Commission about potential connections between river and pit in part of the model where the G Seam is absent, parameters representing hydraulic conductivity in the Werrie Basalt were reduced by factors of 15 and 5.5, with very little explanation. Only two measurements of aquifer properties have been undertaken in the Werrie Basalt. Few if any tests were undertaken in the regolith (weathered G Bottoms) to the southeast of the rim of the proposed pit.

Over a period of years the proponent has continued to develop and run the model that is now used as the basis for predictions. Stakeholders have observed that the model predictions changed from meeting to meeting or document to document. It is the Commission's view that the weight of evidence suggest that significant uncertainty remains about hydrogeological structure and hydrogeological properties. There is therefore considerable uncertainty about the accuracy of the model predictions. While the current level of understanding and degree of model accuracy may be adequate in some situations (such as in far less sensitive environments), they are not adequate in an environment where water resources are severely stressed and the Pages River itself is over-allocated.

### **3.2.2 Lowering of the water table aquifer**

The proponent's predictions of the extent to which a cone of depression will develop at the surface rely on the use of the numerical groundwater flow model. The model predicts a cone of depression that extends to the northwest of the New England Highway, into neighbouring properties. The water table also extends to the southeast of the mine in layer 7 of the model, representing weathered regolith in the G Bottoms below the G Seam. The behaviour of this unit appears not to be well known. It is of interest to stakeholders because it extends from beneath the proposed mine pit to the Pages River and beyond.

Following completion of the Water Resource Assessment, consultants engaged by 'Glengarry' the property immediately to the south of the proposed mine, described and documented a number of springs and GDEs that are likely to be affected by the cone of depression caused by mining. Some neighbours, including the owners of 'Glengarry', have claimed that the proponent has neither adequately engaged with them regarding the potential impacts of the proposed mining project, nor adequately assessed the potential drawdown impacts on their properties.

The proponent's model does not predict drawdown over the ridge in 'Glengarry' because layers 1 to 6 do not extend to the southeast of the mine. Since preparation of the Water Resource Assessment, the proponent has acknowledged potential impacts in 'Glengarry', and has indicated that compensation would be arranged for some of the impacts. The Commission considers that by not assessing these potential impacts systematically during several years of investigations the proponent failed to take into account the legitimate concerns of the project's closest neighbours.

Lowering of the water table is directly related to predictions of the impact of mining on rates of groundwater discharge to the Pages River. This issue is considered separately below.

### **3.2.3 Depressurisation of confined coal seam aquifers and other layers**

The proponent's predictions of the extent to which cones of depressurisation will develop in coal seam aquifers also rely on the model. The model predicts a reduction of pressure and piezometric head down dip to the northwest, and to a lesser extent along strike. Depressurisation also occurs in layer 8, the Werrie Basalt, which extends to the southeast, beyond the Pages River.

The shape and extent of the cones of depressurisation are controlled by the relatively idealised geometry that has been used for layers to the northwest of the proposed pit.

To the extent that depressurisation has few potential environmental impacts to the northwest, other than through its impact on dewatering in the uppermost aquifer, consideration of depressurisation is adequate. Depressurisation is responsible for a significant proportion of projected inflow into the pit.

To the extent that depressurisation is a mechanism by which the floor of the pit beneath the G Seam could connect with the Pages River, and given the degree of interest in this connection and ongoing questions by stakeholders about the potential for connection with the river, consideration of depressurisation to the southeast of the mine leaves many questions unanswered, or not answered in sufficient detail to allay the concerns of stakeholders.

### **3.2.4 Reduction in groundwater discharge to Pages River or leakage from Pages River to the pit**

In addressing the question of potential leakage from the Pages River to the pit, the proponent's focus has been on a short reach of the Pages River near the northern tip of the proposed mine. This is an area where G Seam outcrops and subcrops part of the river bed. However, the question of connectivity between Pages River and the proposed pit is more complex, and an overall assessment of connectivity needs to take into account other reaches of the river and the possibility of connections via other hydrogeological units.

There is evidence to suggest relatively high hydraulic conductivities in the G Seam in an area to the northeast of the proposed pit. The potential impact of historical underground mine workings near the banks of the river has been assessed, but the assumption of low hydraulic conductivity along an inferred lineament that crosses the proposed pit has been used to explain that the northeastern end of the proposed mine is different from and effectively isolated from the greater region. The extent of this lineament has been contested by experts, because the proponent has extrapolated from limited field data and has not proven to the satisfaction of others that their extrapolation is valid or their conclusions are reasonable.

To the south of Long Pool, from near the southeastern rim of the proposed mine to the eastern and southeastern boundaries of the model domain, there are only two layers present in the proponent's model: layer 7 representing weathered regolith (presumably weathered G Bottoms below the G Seam yet above Werrie Basalt, or perhaps including some weathered basalt) and layer 8 representing Werrie Basalt. In some steady state simulations, layer 7 is dry throughout much of this critical region, hence layer 8 is the only potential connection (in the model) between the Pages River and the floor of the proposed mine, more than 150 m down dip.

The Commission asked the proponent to explain and support their claims that flow reversal towards the proposed pit cannot occur. The proponent provided partial answers, but failed to

provide plots of piezometric head in one key area, specifically the area where the deepest part of the proposed pit may connect to Pages River to the southeast. In their response to questions about contributions to baseflow from layer 8, the proponent's consultants reduced horizontal hydraulic conductivity in two zones in layer 8 by factors of 15 and 5.5. They did not provide evidence to support these changes. The reduced hydraulic conductivities had the effect of reducing the predicted groundwater contribution from layer 8 to baseflow from 65% (in the model presented in the Water Resource Assessment) to 50% (in a 'single time slice' simulation that treats the mine plan in much less detail) to 30% (in a single time slice simulation with lower hydraulic conductivities). A change in parameters was used to argue that previous estimates had been too high, leading to smaller predictions of groundwater discharge and natural contributions to baseflow. Details about hydraulic gradients along key sections between the proposed mine and the river have not been revealed with any sets of assumed aquifer properties. In the absence of data to support the change of aquifer properties, and in the absence of evidence that hydraulic gradients would not reverse in key areas, the Commission cannot accept the proponent's assessment that flow reversal will not occur.

The proponent's modelling predicts that the contribution of groundwater to baseflow in the Pages River will fall by ~25% as a result of mining, but will never fall to zero in any reach of the river. This result is only possible if a localised groundwater mound is maintained between the pit and the river for the period of ~35 years during which contributions to baseflow are predicted to fall. This proposition has been challenged by stakeholders repeatedly, but the evidence to prove the proposition remains inadequate.

In their response to the Commission's Question 15 (see Annexure 4.2), the proponent explains that piezometric heads 'in the pit area between the two linear features are around 440-450 mAHD, compared with the Pages River level of 365 mAHD just 500m to the southeast, where the river comes closest to this part of the pit. Thus there is a very steep apparent hydraulic gradient between the central pit area and the Pages River, of 75-80 m (i.e. 440-450 minus 365) per 500 m, or a gradient of 0.15 - 0.16. ... During mining, the low point in the central pit will be at 220 mAHD, but this point will be 1080 m from the Pages River, as it is at the toe of the pit high wall, i.e. on the north-west side of the pit. The equivalent hydraulic gradient between the river and the pit low point will be 145m (i.e. 365 minus 220) over a distance of 1080 m, i.e. a gradient of 0.13.'. The proponent argues that the gradient from river to pit during mining will be similar in magnitude to the gradient before mining from the area of the pit to the river. But these gradients are in opposite directions, and the effective hydraulic conductivities along potential flow paths could be very different. Before mining, groundwater flow paths would pass across seams and interburden, in the direction of lowest hydraulic conductivity, thereby limiting rates of flow. During mining, a potential groundwater flow path would be down dip, parallel to and potentially seeping upwards towards coal seams. The proponent's response does not adequately support the claim that "the potential rate of flow back towards the pit would be less than the current rate of flow into the river".

The Commission asked the proponent to explain their prediction that 65% of contribution to baseflow was via the Werrie Basalt. The proponent presented estimates for reach 114 that also receives baseflow via the Werrie Basalt, this being a reach where flow reversal could potentially occur, and for which the proponent did not provide any information in the Water Resource Assessment. By not explaining the process by which a mound can dissipate and flow directions can reverse, and by not characterising the time scale required for a reversal to take place, the proponent has failed to convince stakeholders that leakage between the Pages River and the pit is not significant.

Questions about the potential for leakage from the Pages River to the proposed mine pit have been central to community concerns since the project was first proposed. The Commission

understands that earlier mine plans may have been such that predicted flows from the river to the pit were substantial. This led to changes in the mine plan, including an increase in the proposed setback from the river, and a decision not to mine below river level within 300 m of the river.

The proponent had an opportunity during preparation of the Water Resource Assessment to demonstrate to the community that its predictions were correct, and to do this with such clarity that doubts could not remain. However, the proponent's arguments are still not supported by sufficiently robust evidence to satisfy most stakeholders and have been strongly challenged by other expert evidence. The Commission's own investigations suggest that leakage may be possible at some stage during the life of the mine. On the basis of available data, the magnitude of this leakage cannot be estimated with any precision.

### **3.2.5 Reduction in groundwater discharge to Kingdon Ponds**

Intuitively any lowering of the water table will affect rates of groundwater inflow at the upstream boundary of the catchment of Kingdon Ponds. Progressing downstream, the proportion of the catchment affected by the proposed mine decreases and the potential cumulative impact of all other users (i.e. agricultural and environmental) increases.

The proponent has estimated the reduction in groundwater flow to the Kingdon Ponds catchment, but has not assessed in detail how that reduction would influence springs and GDEs. A lowering of the water table, for example, could lead to some existing soaks becoming completely dry. The significance of this to properties close to the proposed mine and the possibilities for dealing with any impacts have not been explored adequately.

Consideration of groundwater impacts on Kingdon Ponds, being a surface drainage that extends many km south to Scone, is reasonable and adequate. The remaining questions relate to whether any reduction in groundwater contribution to the catchment is acceptable to a range of stakeholders.

### **3.2.6 Contribution of groundwater to mine water balance**

Given community concern about both quantity and quality of water in the Pages River, the requirement for the Water Resource Assessment and draft Water Management Plan was that the proponent seek to manage all minewater on-site, preventing discharge to the Pages River. This requires containment of all groundwater inflows to the mine as well as local rainfall and runoff within the catchment of the pit itself. The relative contributions of groundwater, rainfall and runoff, as well as evaporation and on-site water use, define the volume of on-site storage required at different times of the mine plan to ensure containment.

The contribution of groundwater inflows to the pit is significant. Simulation of pit dewatering has been undertaken using the groundwater flow model described above. Simulation of water levels in one or more in-pit storages has been performed independently using a lumped water balance model.

Because of the interdependence between groundwater and surface water in assessing the mine water balance the full discussion of this issue appears in 3.3.3 below.

### **3.2.7 Post-mining recovery**

The proponent has presented a mine plan based on progressive backfilling of the pit and progressive rehabilitation. The proposed final landform includes a mine pit lake at a level of about 410 mAHD, such level not being achieved until ~100 years after cessation of mining.



From a groundwater point of view, once the level in a mine pit lake starts to rise, the tendency for seepage into a mine pit declines. However, the tendency for leakage from a nearby river or stream, or for a reduction in baseflow as proposed by the proponent, does not stop instantaneously at the end of mining. This explains why the maximum impact on baseflow is predicted to occur 10 years after the end of mining.

The proponent has collected groundwater quality data since 2002. The monitoring bores are located almost entirely within 'South Bickham', and are mostly within or very near the footprint of the proposed mine. Data show that salinity in Seams A to G, interburden and the G Bottoms beneath the G Seam ranges from 410 to 890 mg/L, with salinity in the G Seam and G Bottoms averaging 470 mg/L. Salinity in the underlying Werrie Basalt averages 2220 mg/L, while salinity in higher layers (the Bickham Formation and alluvium) ranges from 1130 to 1510 mg/L. The data suggest that some coal seam aquifers, like the G Seam and the G Bottoms below, are actively flushed by recharge.

Water quality within the cone of depression and deeper cones of depressurisation of the proposed pit would influence the water quality in mine inflows, and ultimately water quality in the mine water inventory and the mine pit lake. Poor quality water to the west of the New England Highway has been found in boreholes screened in the Upper Coal Measures. This area is within the cone of depressurisation but it is possible that none of this water would travel to the proposed mine during the life of the mine, because the travel distance may be too great.

The final quality of water in a mine pit lake is difficult to predict. Water in the mine pit lake would seep into the ground, recharging the aquifer and flowing towards the Pages River and the Kingdon Ponds catchment in the long term. Seepage rates would be low. The fact that natural groundwater levels are higher in the area of the mine than the final mine pit lake may suggest to some stakeholders that long term contribution to baseflow may be reduced, however the properties of backfill and the presence of a deep lake would lead to better connections with deeper aquifers so it is possible that the long term contribution to baseflow in the Pages River and Kingdon Ponds may be larger than under natural conditions.

In periods of very low flow, long after closure, any discharge of poor quality water from the mine pit lake to Pages River and Kingdon Ponds as a contribution to baseflow would be uncontrollable and problematic.

### **3.2.8 Alternative groundwater supply to compensate neighbours for detrimental impacts**

The need for an alternative source of water to compensate neighbours for loss of groundwater in springs, soaks and GDEs has been recognised by the proponent. The quantity required has not been estimated, either as an average or year by year through the life of the project as impacts accumulate. The feasibility of using an alternative water supply to compensate for impacts on GDEs has also not been investigated. A specific source of alternate supply has not been identified.

While groundwater tends to remain available at times when surface water flows decline, all water sources are under stress in times of drought. A concern expressed by stakeholders is that the notion of compensation for loss of water is reasonable, but it is more difficult to prove that water for compensation will be available in times of drought when all users need water.

### **3.3 ADEQUACY OF THE WATER RESOURCE ASSESSMENT AND DRAFT WATER MANAGEMENT PLAN FOR SURFACE WATER**

#### **3.3.1 Introduction**

The assessment of adequacy has been applied separately to the water resource assessment and to the draft water management plan – being the two components of the Water Resource Assessment /Water Management Plan report.

#### **3.3.2 Adequacy of the Water Resource Assessment**

The surface water component of the Water Resource Assessment contains what the Commission considers to be an adequate description of the surface water resources within and in close proximity to the proposed Bickham mine.

The proponent has supplemented the existing regional surface water data from the NSW Government's regional climatic and water resources monitoring network with the results of an intensive, surface water quality sampling program that it has undertaken over 10 years. The proponent has also presented results from other detailed investigations, including a series water quality and low flow gauging surveys which provide an unusually detailed picture of the local hydrological and water quality characteristics of the Pages River. Importantly the assessment includes data from extended low flow periods of particular relevance to the assessment of water resources risks of the Bickham project. The investigations on the Kingdon Ponds have been less extensive principally due to the location of the proposed mine in the ephemeral upper headwaters of Kingdon Ponds.

To fully assess the risks of the Project on the Pages River and Kingdon Ponds however the Commission consider there also needs to be a detailed understanding of water resource<sup>2</sup> dependencies and utilization of surface and groundwater resources over the broader catchments. The Water Resource Assessment does not present the information required to fully assess these broader risks.

In the absence of this information the Commission is unable to assess risks to downstream extractive users for example. The government has classified the Pages River as being highly stressed, in part because the available surface flows have already been fully allocated – several times over. Downstream users have pointed to their reliance on the River for their livelihood. They have also told of past 'community turf wars' being fought over access to river flows during drought. What is lacking however is a substantive, objective analysis of the risks the Bickham Coal Project proposal may pose to these downstream users.

The possibility of impacts on Cameron's Gorge Nature Reserve was raised in multiple submissions. The Commission visited the Nature Reserve in company with DECCW. Whilst the Pages River is an important natural feature in the Reserve, the Commission's observations were that the Reserve is not a wetland ecosystem and that the water is primarily of benefit for the fauna and the riparian ecosystems. In the Commission's view the Nature Reserve is essentially another important downstream user and should be considered in that context in relation to the risks to flow in the Pages River.

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<sup>2</sup> The term water resources as used here includes both quantity and quality parameters.

### **3.3.3 Adequacy of mine surface water balance and draft water management plan**

The proponent has developed a draft Water Management Plan which covers the management of water on the mine site during the proposed mine life and in the longer term post mining. The plan involves separate management of mine water (including mine area runoff and groundwater inflow); dirty water from overburden dumps; clean runoff from areas unaffected by mining and clean groundwater from dewatering bores outside the mine pit. Two mine pits would be developed with mining operations being undertaken variously in one pit or the other and at some stages in both pits concurrently. The proponent's Water Management Plan allows for transient storage of excess mine water within one or other of the inactive pits during periods when the proponent has predicted mine water make would exceed demand on-site and the available out of pit storage capacity. The proponent's Water Management Plan also incorporates off-site irrigation of mine water as a means of dissipating the excess.

A water balance model has been developed to simulate the operation of the Water Management Plan. The model has been used to quantify the range of water balance conditions that could conceivably occur during the Bickham project life. The water balance conditions would change over time as mining develops. The project would also be exposed to the highly variable climatic conditions that can occur in this environment. To meet its objectives, the Water Management Plan would be required to deal with all these conditions. The Commission considers that to meet the requirements of the 2005 Strategic Review (i.e. negligible risk to receiving water resources) the report would need to demonstrate that the Water Management Plan, as it would be applied during the mine life and post mining periods, would result in either no, or insignificant impacts to receiving water resources.

This requires that the Commission be satisfied that the methods and data used in the hydrological analyses are sufficiently robust and conservative to conclude that the proposed water management system has a negligible probability of not achieving its performance objectives; and that it is a practical and achievable proposal given the nature of the project. The Commission has given separate consideration to the modelling approach and to the limitations of the modelling itself.

In the Commission's opinion the approach taken by the proponent to its assessment of the surface water aspects of the mine site water balance and the proposed mine water management system were both appropriate and adequate. The approach to the modelling was statistically based – consistent with a risk assessment. The approach was also comprehensive in that it simulated the dynamics of the entire mine water balance over its life using a wide range of possible climatic conditions (as represented in the available historic climate record).

However, as with any predictive hydrological modelling there is always uncertainty in the reliability of predicted outcomes. In the absence of the kind of data which can only be collected from the active mine the model cannot be fully calibrated. The large, artificial landforms created by open-cut coal mines have very different hydrological responses to 'natural' catchments where most hydrological monitoring data is collected. For hydrological practitioners there is a frustrating paucity of rigorous published data on the hydrology of active mine landforms. The proponent's consultants used model parameters from a variety of sources, some of which do not relate to the landforms being modelled. Other consultants employed by opponents of the proposed mine have undertaken another analysis using other model parameters taken from the same sources and have derived water balance outcomes significantly different to those reported by the proponent. The Commission is of the view that model parameter selection should have been based on mine landform catchments similar to those which would be created at Bickham.

In response to a question from the Commission, the proponent's consultants undertook reassessment of model parameters obtained from an analysis of the water balance at the Mount Thorley Coal Mine in the Hunter Valley<sup>3</sup>. The result of that analysis was a significant (i.e. 78%) increase in the yield obtained from mine pit catchments compared to their original modelling in years 13 to 18. The proponent has stated that it considers the parameters used in the revised yield modelling would represent a credible upper limit of runoff. The Commission is of the view that the revised yield modelling is likely to be more realistic than that presented in the Water Resource Assessment and draft Water Management Plan but not necessarily the credible upper limit. The Commission is therefore not convinced that the modelling results presented in the Water Resource Assessment and draft Water Management Plan, or in responses to questions posed by the Commission, cover the full range of credible water balance conditions that would need to be tested to demonstrate the adequacy of the proposed water management system to deal with all foreseeable water balance conditions.

The original Water Resource Assessment prediction was that there is a likelihood that the mine could operate in significant water balance surplus during parts of the mine life which would require significant in-pit storage of water and off-site irrigation. Subsequent yield modelling has indicated a significant increase in predicted yields. In response to other questions posed by the Commission concerning storage of excess water in-pit and the viability of the proposed irrigation scheme, the proponent has presented a preliminary assessment of an expanded water management scheme involving the construction of a significant off-site water storage, expanded irrigation and treatment (involving reverse osmosis), and discharge of treated mine water to Pages River. If able to be implemented this expanded scheme may be able to manage potential excess mine water. However, there is no clear commitment to implementation, there are a number of licensing and approvals issues that would have to be negotiated, and there is no assessment of potential impacts of any discharged water on the Pages River. Put simply, there is insufficient detail available to assess the expanded proposal.

The Commission is not convinced that the draft Water Management Plan adequately demonstrates that it has the capacity to achieve its required performance objectives under all reasonably foreseeable water balance conditions.

### **3.3.4 Adequacy of assessment of risk of reduced flows**

Both baseflow reduction and loss of streamflow by leakage to the mine (if it were to occur) will principally affect low flows. The Commission concurs with the observations of many of the Project's opponents that comparing predicted baseflow reduction with average flow downstream has little or no relevance.

Low flows occur most of the time and so, whilst the predicted flow reduction may be small volumetrically in relation to the overall resource, the relevant comparison for downstream users and flow dependent ecosystems is with low flows and changes to the frequency of no flows. The proponent has failed to assess impacts on low flow adequately. The proponent has argued that the projected baseflow reduction will not be translated downstream as a constant during low flow conditions and that low flows downstream will be principally derived from local groundwater sources and will thus be unaffected by baseflow reduction from Bickham. Whilst the Commission accepts that baseflow reduction at Bickham will not necessarily be translated as a constant over long distances under low flow conditions there is no site specific information presented on how far (or to what extent) baseflow reductions will affect flows downstream and how that might affect or impact downstream users and water-dependent ecosystems. Experts engaged by opponents of the project have indicated significant impacts to low flows and to the frequency of no flows downstream of Bickham.

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<sup>3</sup> Reference Evans and Peck Response to Commission Question 4 (see Annexure 4.2).

The Commission concludes that the potential impacts of baseflow reduction and/or flow loss have been inadequately assessed.

Actual baseflow reductions are likely to be difficult to measure but could, in the Commission's opinion, have significant effects on the frequency of no flows or low flows which fall below an extraction trigger for example. The proponent has proposed that during mining it would compensate for any baseflow reduction by discharging the equivalent flow into the River from a bore or bores such that in flow terms there would be no change. This however introduces a number of questions about the ability to accurately measure flow reduction and the ability to source the necessary water - and therefore the practicality of achieving this result over the mine life. The Commission has formed the opinion that in light of these difficulties any flow compensation should be demonstrably conservative such that there is no credible argument which could support a claim of a significant decline in flow downstream.

### **3.3.5 Adequacy of assessment of risk of increased salinity**

The Commission is of the opinion that the risk of significant increases in salinity in the Pages River (or Kingdon Ponds) during the time that the mine would be operational is low. In the Commission's opinion there could be a residual risk that elevated salt concentrations might be generated from the overburden dumps. Whilst there is currently no evidence or reason to suspect that this would be the case, the Commission is of the opinion that additional geochemical investigations would be required to discount this possibility. The geochemical report provided to the Commission by the proponent was prepared for the bulk sample pit and is in the Commission's opinion insufficient to demonstrate that all waste materials from the proposed mine would not be significantly elevated in salinity.

Salinity in the Pages River could also be affected by reduced baseflow contributions to the river from the mine site. The proponent has shown specific sources of salinity in the Bickham reach of the river which were identified by water quality survey during low flow conditions. One of the project's opponents has queried whether reduced baseflow contributions could result in increased salinity under low flow conditions downstream of the mine. This will depend on the relative salinity upstream of Bickham and the salinity of the baseflow from the Bickham mine. This issue has not been adequately assessed by the proponent. Any residual risk would need to be managed.

There is also uncertainty over the risks of salinity in the Pages River and Kingdon Ponds in the longer term – after the pit void lake has filled. Elevated salt concentrations could develop in the void (relative to the current baseflow salinity) which may lead to increased salinity in the Pages River or Kingdon Ponds.

### **3.3.6 Adequacy of assessment of risk of increased turbidity/suspended solids**

The proponent has developed a conceptual sediment and erosion control plan based on guidelines currently used to control sediment and erosion in the NSW coal mining industry. The proponent has stated that sediment concentrations discharging off-site would have suspended solids concentrations of 50mg/L or less. Beyond this the proponent has not adequately assessed likely and worst case suspended solids impacts on receiving waters from site drainage.

### **3.3.7 Adequacy of assessment of risk of accidental contamination**

There is also the inevitability that the Bickham project would introduce the risk of other contaminants (hydrocarbons, explosives and other chemicals stored on-site) migrating into

the Pages River or Kingdon Ponds as a result of accidents. The proponent has identified oil spill and leakage from the workshop in their risk assessment and have assessed that it would have a minor impact and would be either unlikely to occur or would occur rarely and would therefore have a low risk ranking. The Commission believes a more comprehensive assessment of all possible contaminants on-site and all the possible events that could lead to a 'pollution incident' is warranted.

## **CHAPTER 4: WHETHER THE WATER-RELATED RISKS OF THE PROJECT CAN BE SUITABLY MANAGED (TERM OF REFERENCE 1(c))**

### **4.1 INTRODUCTION**

Under Term of Reference 1(c) the Commission is required to advise on whether the water-related risks of the project can be suitably managed to ensure an acceptable level of environmental performance, having regard to the relevant recommendations in DoP 2005.

The Commission was advised (at some length) during the public hearings that its consideration of the water-related risks should be restricted entirely to matters raised in the recommendations of DoP 2005 by the requirement to have 'regard to the relevant recommendations' in DoP 2005.

There are at least three basic flaws in this line of argument:

- (i) no line of authority was cited to support this restrictive interpretation. In normal use the expression 'having regard to' does not mean 'without opportunity to consider beyond': it simply means 'giving consideration to'. The Commission has adopted this interpretation as being consistent with the context of the Terms of Reference;
- (ii) not all the water-related risks of the project are dealt with in the recommendations of DoP 2005. In fact, the most significant water-related risks (potential inflow from the Pages River to the mine and decrease in groundwater baseflow from 'South Bickham' to the catchments of the Pages River and Kingdon Ponds) are not mentioned in these recommendations although they are covered in the earlier discussion in Chapter 13 of DoP 2005; and
- (iii) the Terms of Reference at 1(a) and 1(b) require identification of the water-related risks and advice as to whether the Water Resource Assessment and Draft Water Management Plan are adequate. This is a much broader compass than the specific issues raised in the Recommendations of DoP 2005. Given 1(a) and 1(b) it makes no sense to confine 1(c) to the Recommendations in DoP 2005. In any event, if this were the intention 1(c) could have been framed explicitly to produce this result (e.g. 'whether those water-related risks identified in the recommendations in DoP 2005 could be managed to ensure an acceptable ...').

Term of Reference 1(c) is a logical sequel to 1(a) and 1(b) and the reference to recommendations in DoP 2005 simply draws the Commission's attention to the need to give consideration to some specific known risks that might arise in the context of open-cut mine proposals and which may be particularly relevant to proposals in this area.

The relevant recommendations in DoP 2005 are found at 13.3 and, in particular, at 13.3 (b).

#### **13.3 RECOMMENDATIONS**

- a) That the Director-General of DoP ensure that any project application under Part 3A of the Environmental Planning & Assessment Act 1979 for coal mining within the Pages River Catchment contain the report of a full groundwater and surface Water Resource Assessment and a draft life-of-mine Water Management Plan (including water management relating to mine closure and post-mining).

The local community should be consulted by the project proponent to identify its concerns during the preparation of the draft Assessment and Management Plan. An independent expert panel should review both documents and provide advice to DoP, DNR, DEC and DPI. No environmental assessment for coal mining should be prepared and submitted by the proponent until DoP has first advised it that the draft Assessment and Management Plan adequately provide for the achievement of the outcomes contained in these recommendations.

- b) That any new coal mine within the Pages River or Dart Brook Catchments should be managed so as to maintain the long-term integrity of their streams, alluvial aquifers and ecosystem values. To this end:
  - i) mine wastewater discharges should not be permitted unless they have no significant impact on the water quality of the receiving waters. All major water quality parameters in discharges (e.g. salinity, acidity, turbidity, etc) should be consistent with maintaining the water quality of the Catchments and their associated values;
  - ii) discharges should not significantly alter natural flow regimes;
  - iii) opportunities for alternative use of mine wastewater, either on-site or off-site, should be investigated prior to discharges being considered; and
  - iv) there should be no runoff of silt or sediment.
- c) That formal policy to avoid or minimise the potential impacts of coal mining on major streams and aquifers and guidelines for assessment under Part 3A EP&A Act of such potential impacts by major coal mines be developed by DoP in consultation with DNR and DPI.
- d) That the proponent of any new coal mine within the Pages River or Dart Brook Catchment should:
  - i) consider the reports of the Hunter-Central Rivers Catchment Management Authority's remnant Vegetation Project to gain a local and regional context for potential vegetation impacts;
  - ii) address conservation of endangered and identified regionally significant ecological communities and rare, threatened or regionally significant flora and fauna species, or impact abatement; and
  - iii) protect and/or rehabilitate areas of riparian vegetation within land that it owns or controls (especially land containing river red gums), so as to provide improved riverine health, improved bank stability and to assist maintenance of healthy aquatic ecosystems.
- e) That the proponent of any new coal mine within the Study Area should make an appropriate contribution to funding the work of the Upper Hunter Aboriginal Heritage Trust, as have other new mines further down the Valley.
- f) That the proponent of any new coal mine within the Study Area should:
  - i) not be permitted to use road as the primary means of coal transport (coal transport should generally be by rail, conveyor or similar methods); and
  - ii) adequately protect the transport corridor of the New England Highway and north western rail line.

The first thing to note is that there are qualitative expressions in both the Commission's Terms of Reference ('acceptable level of environmental performance') and the recommendations in 13.3(b) of DoP 2005 ('no significant impact' / 'not significantly alter'). The absence of objective standards requires the Commission to come to conclusions about how these qualitative expressions should be interpreted in giving advice on this particular



proposal. This interpretation is not context free – the context is a proposed new land use potentially impacting on already stressed catchments.

The issue of ‘significance’ was addressed in a number of written submissions and in presentations at the public hearings.

The proponent notes in a written submission dated 31 March 2010 that the terms ‘significant’ and ‘significantly’ are used some 210 times in DoP 2005 (other than in their legal or legislative uses) and that the meaning should be ‘large’ or ‘important’. The same document goes on to outline the proponent’s view that the impacts from the proposed mine are neither ‘large’ nor ‘important’.

Opponents of the mine take the view that, since the Pages River is already classed as a stressed river for which licence allocations exceed the available flow in most years, any additional diversion of flow should be viewed as a significant impact. They further support this view by noting the delicate accord that has been achieved on a draft Water Sharing Plan for the Pages River Catchments and the fact that NOW is moving to halve the unit value of shares after the first year of the Plan.

Opponents of the mine have also assembled a substantial body of expert opinion that contradicts the proponent’s assertions concerning the potentially small size of the impacts on flow in the Pages River, particularly under low flow conditions.

The wording of DoP 2005 strongly supports interpretation of ‘significant’ as being very small in this context. At p133 the statement is made that ‘Mining should not proceed if it cannot be adequately demonstrated at an early stage that the River and its associated conservation values will not be *significantly impacted*’ (emphasis added). This is preceded on the same page by suggested requirements for the Water Resource Assessment and draft Water Management Plan. Requirement (vi) is that the proponent: ‘demonstrate that there is *negligible residual risk* [emphasis added] to the River and its ecosystems (including those of the Cameron’s Gorge Nature Reserve) associated with mining’.

In this catchment it would make no sense to adopt the proponent’s position that ‘significant’ should be interpreted as ‘large’. The proponent’s alternative of ‘important’ is a value-laden term that could be interpreted as either ‘large’ or ‘any’ depending on one’s view about the importance of flow in the Pages River and the rights of existing water users. Given the sensitivity of this catchment it is the Commission’s view that the acceptable level of environmental performance should be set at no greater than negligible environmental impact.

Whilst a nil environmental impact is simple to assess since any predicted deviation from the *status quo* is, by definition, an impact, a negligible environmental impact is more difficult since it involves specific consideration of the tolerable variation from the *status quo* allowed to be caused by mining. Framing enforceable approval conditions for ‘negligible impacts’ appears to have created difficulties in the past in terms of both how much damage is ‘negligible’ and how it might be measured. However, it may not be necessary to resolve this for this project if the predicted impacts or potential impacts are clearly beyond negligible and the management options outlined in the proposal are not convincingly capable of reducing them to a negligible level.

#### **4.2 MANAGEMENT OF WATER-RELATED RISKS IDENTIFIED IN RECOMMENDATION 13b OF DOP 2005**

As noted above, the recommendations in DoP 2005 do not encompass key elements of the discussion in 13.1 of DoP 2005 and do not cover some of the key elements of the proposed Water Resource Assessment and draft Water Management Plan on p133 of DoP 2005. In

particular, there is no specific reference to water loss to the Pages River or Kingdon Ponds from either connectivity between Pages River and the mine pit or from reduction in groundwater baseflow.

There is a general comment in Recommendation 13(b) about any new mine being ‘managed’ so as to ‘maintain the long-term integrity of their streams, alluvial aquifers and ecosystem values’, but this is followed by a list of matters that relate only to management of mine water and runoff and is clearly referring to conditions for an operational mine, not considerations relevant to whether approval should be granted or not.

Whatever the reason, the recommendations in DoP 2005 are limited in their coverage of the issues raised in DoP 2005 itself, the risks identified in the Water Resource Assessment and draft Water Management Plan, the risks identified in the public and agency submissions, and the risks identified by the Commission.

The Commission has therefore ensured that the issues raised in Recommendation 13b of DoP 2005 are covered in the discussion of all relevant risks in 4.3 and 4.4 below.

### **4.3 GROUNDWATER-RELATED RISKS**

#### **4.3.1 Hydrogeological field investigations and modelling**

Considerable reliance is placed on groundwater flow modelling to predict the impact of the proposed project. Modelling is always iterative, and models can be improved after a project starts, and real data are obtained as the first impacts occur.

The approach adopted by the proponent is fundamentally sound, and consistent with standards of practice in the industry. As noted in 3.2.1 above, a difficulty in this case is the degree of sensitivity in the catchments of Pages River and Kingdon Ponds, and among stakeholders in general. When concerns are high and the level of scrutiny is high, the level of robustness required in field investigations and modelling is extremely high.

The Commission observes that model predictions have changed year to year and even during the Commission’s inquiry. Stakeholders and other experts have also commented on the fact that predictions continue to change, always supporting the case being made by the proponent. There remains concern about the representation of geological structure, lineaments that may or may not be continuous over long distances, compartmentalisation that may or may not occur throughout the region and values of aquifer properties in specific units and zones.

The Commission accepts that a significant effort has been made, however the real test of modelling is whether or not all risks to the environment have been adequately addressed. These are discussed below.

#### **4.3.2 Lowering of the water table aquifer**

The proposed mine would affect the regional water table within ‘South Bickham’ and also within neighbouring properties, specifically ‘Murulla North’ to the west and ‘Glengarry’ to the immediate south.

Lowering the water table would have impacts on soaks and a number of in-stream GDEs. The proponent has committed to compensating for such impacts, but has not demonstrated conclusively how it would do so. Indeed it may not be technically feasible to compensate for impacts on the GDEs. Financial compensation is one avenue that appears not to have been explored, let alone negotiated or agreed. Compensation by supply from an alternative source of water has been suggested, but a suitable alternative source has not been identified, the right

to access such a source has not been demonstrated, nor has the long-term viability of such a source for 50-100 years (i.e. until such time as the water table has fully recovered) been proven.

There may be mechanisms available to manage this type of risk, but the current proposals are conceptual rather than detailed and there is little or no evidence available to convince the Commission that the proponent can guarantee delivery of the proposed solutions.

#### **4.3.3 Depressurisation of confined coal seam aquifers and other layers**

The proposed mine would cause depressurisation of deeper coal seams over a larger area.

The impacts of depressurisation are indirect. Flooding of the final void post-mining would lead to recovery of pressures, and the long-term impacts of depressurisation are likely to be manageable.

#### **4.3.4 Reduction in groundwater discharge to Pages River or leakage from Pages River to the pit**

The proponent predicts that there will be no leakage from the Pages River to the pit. If the proponent's claims are correct, the impact would be manageable. There would be no such impact.

If the proponent's claims are incorrect and leakage were to occur, it is conceivable that the proponent could take steps, by grouting or construction of barriers, to reduce such leakage. It is possible that leakage could be reduced by physical intervention but not totally prevented.

Concern about leakage from the Pages River to the pit is not driven by concern about whether or not the mining operation could manage and contain the volume of water flowing into the pit, although there are issues related to management of mine water inventory, discussed elsewhere in this report. The real issue is the additional impact that any leakage from the river would have on an already over-allocated catchment. There may be legal and regulatory mechanisms that would allow the proponent to take water from the river, but from the point of view of many stakeholders, any leakage would be unmanageable, because (i) it cannot be predicted with certainty, (ii) the Pages River and its catchment are already under stress through over-allocation, and (iii) the rate of leakage is unlikely to be able to be turned off, as a pump can be turned off, in times of low or zero flow. It is the impact of leakage in times of low flow that suggests that any leakage could be unmanageable.

#### **4.3.5 Reduction in groundwater discharge to Kingdon Ponds**

There is no suggestion that water flowing in the uppermost drainage lines of Kingdon Ponds could leak to the proposed mine. Rather, a lowering of the water table caused by the mine would lead to a slight reduction in baseflow in the upper part of the catchment.

Because the affected area is so small, relative to the catchment area of Kingdon Ponds, the impact of reduction of baseflow on the whole catchment would be very small. However, the likely impacts on soaks and GDEs close to the proposed mine will be significant on some properties.

The proponent has committed to compensating for such impacts, but has not demonstrated conclusively how it would do so. This impact is a consequence of lowering of the water table, as discussed above, so the same concerns apply as to how the proponent could compensate for reduced baseflow in the long term.

### **4.3.6 Contribution of groundwater to mine water balance**

Seepage of groundwater into the proposed pit becomes an operational issue for a mining company. This water, like any other water from direct rainfall and surface runoff draining towards the pit, must be stored and managed.

The proponent has predicted that the rate of groundwater inflow will peak in years 15 and 16 of a 25-year mine plan. This is a consequence of the mine plan, and relates to where mining would be occurring in those years relative to previous years, both in terms of location in the plan and the depth of mining.

Estimates of rate of seepage appear to be reasonable. The overall volume of groundwater that would need to be managed over the life of mining could not be an order of magnitude (ten times) larger because there are limits to how much groundwater could be stored under natural conditions within and near the area of the proposed mine. Whether or not the contribution of groundwater to the mine water balance can be managed relates more to the interaction between groundwater inflows in the years when they are greatest and the possibility that these years may correspond to wet years with significant rainfall and runoff.

Risk associated with the overall mine water balance is addressed in 4.4.2 below.

### **4.3.7 Post-mining recovery**

In a post-mining situation, when a mining company has left a site under care and maintenance, the most likely situation is that all management will be passive. A mining company would set out to leave a site in such a way that it will operate itself, without manual intervention.

The recovery of water levels in the mine pit itself, being a combination of backfilled areas and a mine pit lake, will occur naturally, over a long period of time. The lake level will rise effectively at the same rate as levels in the surrounding backfill. A mine operator would aim to design the contributing catchment area to ensure that any contaminated surface water would drain inwards towards the pit lake, rather than outwards towards receiving surface water streams.

There are reasons to believe that groundwater levels would ultimately recover, ~100 years after the end of mining, and a groundwater flow pattern would ultimately be re-established with flows towards Pages River and Kingdon Ponds. The rate at which this would occur can not easily be controlled or managed, but the predicted final outcome is not unreasonable.

The remaining questions about post-mining recovery relate mainly to water quality, i.e. to the extent to which the quality of water directed towards and stored within backfill and the final void might be suitable for slow release, via groundwater flow, to receiving waters. Passage of groundwater through soil and rock may cause water to become contaminated, but in other circumstances can cause water to be filtered and cleaned. The process of subsurface reactive transport, where water passes through rock, in contact with minerals on the surface of grains, joints and fissures, is very complex.

The most effective management of water quality is at source. Any accidental spill that drained towards the final void could become unmanageable. In the context of an over-allocated catchment, with groundwater contributions to baseflow becoming more significant and having a greater impact on stream water quality in times of low flow, the risk of contamination within the final void remains a risk to downstream water supplies.

It is noteworthy that that proposed final void at Bickham is unusual in that the pit lake would naturally evolve to an equilibrium water level higher than that in Pages River. In nearly all other situations in the Hunter Valley, final voids are likely to have pit lakes with levels lower than the nearby river. From a water quantity point of view, most final voids reduce the impact on water quality but have a long-term impact on streamflow. The final void at Bickham would probably have minimal impact on flow, but there would be some finite risk to water quality.

#### **4.3.8 Alternative groundwater supply to compensate neighbours for detrimental impacts**

There is no evidence that alternative water supplies have been identified with which to compensate neighbours. It is very unlikely that additional surface water could be accessed. This leaves groundwater as the most likely option, but apart from stating this option, the proponent has not proven that an alternative exists that would continue to function for the period required.

### **4.4 SURFACE WATER RISKS**

#### **4.4.1 Introduction**

The Commission has formed the view that an acceptable level of environmental performance and suitable management require that the impacts to the water resources of the Kingdon Ponds and Pages River catchments are either negligible relative to existing conditions or where practical management measures (including avoidance, mitigation and/or compensation) are available, can be implemented to make them so (see 4.1 above). The Commission's view of whether this can be achieved depends on defining maximum credible scenarios – i.e. the magnitude of the risk.

#### **4.4.2 Managing excess mine water**

The reality for most operating mines is that they do have the capacity to manage divergent water balance outcomes (i.e. both shortfalls and excesses). However, as noted in DoP 2005, several of the options which are available for managing water in the lower Hunter (i.e. water sharing between neighbouring mines and access to the Hunter River Salinity Trading Scheme) would not be available to the Bickham mine. On the other hand the Bickham mine appears to have the advantage relative to most other coal mines in the Hunter Valley that the salinity of mine water is predicted to be comparable to that in Pages River and would be suitable for irrigation.

The proposed Bickham mine involves two pits which result in the creation of capacity to store excess water in the inactive pit. Transient storage of water in inactive pits is a commonly used strategy at many mines in the Hunter Valley. Storage of water in active pits or pits which are prevented from becoming active however can represent a significant risk of lost production and can lead to pressure on regulatory agencies to approve water releases to avoid disruption to mining and loss of employment. The absence of water balance modelling covering the range of credible water balance outcomes caused the Commission to form the view that the proponent had failed to adequately demonstrate the adequacy of its plan to use inactive pits for transient water storage.

Since the Commission was not convinced that the modelling results provided sufficient certainty over the volumes of excess mine water that could be generated and how that water would be managed, the Commission raised this with the proponent who responded with additional modelling that showed substantially higher water yields might need to be managed

and an acknowledgment that the draft Water Management Plan may need to be substantially modified with the addition of large-capacity storage off-site, major additions to irrigable land and, possibly, construction of a water treatment plant.

However, the proposed modifications do not form part of the water management plan. They are framed as a set of sequential water management facilities that would only be implemented if the data generated in early years of the project indicated that the water balance model needed to be recalibrated to cope with the higher volumes predicted as a result of the Commission's concerns.

Apart from the uncertainties surrounding how or when decisions would be made to trigger development of these water management facilities, there is little detail given about these proposed facilities and there are steps involved in their approval and licensing that lie outside the control of the proponent. It should also be noted that the one of the strategies (water treatment plant) involves a proposed discharge to the Pages River. This would require very careful consideration given the sensitivity of this catchment.

The Commission is of the view that it is theoretically possible to manage excess mine water without resorting to in-pit storage and it is possible to achieve this within a 'nil' discharge framework provided there are alternative uses for the water and there is sufficient storage capacity available to cope with the maximum mine water make. There is a likelihood that irrigation could be utilised and that additional storage to that outlined in the draft Water Management Plan could be constructed off-site. However, the Commission is not convinced that the proposal in the draft Water Management Plan is adequate. The Commission is also of the view that the options of additional off-site storage, expanded irrigation and release of treated mine water have not been fully assessed and therefore do not represent a credible proposal for management of the mine water make at this time.

#### **4.4.3 Management of salinity**

One of the critical assumptions in the Water Management Plan is that runoff and drainage from overburden areas will not contaminate downstream water resources after it has been treated in proposed sediment retention structures. These structures are unlikely to have any significant effect on contaminants other than sediment itself and constituents adsorbed to sediments. Salinity is a particular issue for many mining operations in the Hunter Valley. The information presented by the proponent of the Bickham Project point to it being significantly different to most mines in the lower Hunter Valley in that salinity in groundwater in the coal seams is low. A geochemical assessment was also conducted in support of the bulk sample pit which also concluded that salinity and sulphur, which could generate acid drainage, were low in the overburden samples tested. Whilst this is reassuring, the Commission is of the view that there is insufficient information provided to conclude that all overburden units in the full scale mine have been adequately tested. There is also uncertainty over the salinity in the final void and the contribution that the void might make to flow and salinity in the Pages River or Kingdon Ponds in the long term.

#### **4.4.4 Management of sediment and turbidity**

Sediment and erosion control are management issues that have been dealt with by the proponent via the application of a pseudo standard normally applied by regulatory authorities. Their adoption does not however guarantee that there will be no risk of increased sediment transport or increases in turbidity downstream due to mining activity. Such a guarantee is a practical impossibility. In reality the risks of significant increases in sediment migration in site runoff and increased turbidity downstream are dependent on the commitment and the operational/managerial skills of the mine operators as well as the capacity of the control system to deal with the erosion potential of large areas of disturbed and artificial landforms

which have inherently high erosion potential. The Commission is of the opinion that the risk of elevated turbidity and sedimentation of receiving water is real and to some degree inevitable. The potential impacts would need to be dealt with under existing regulatory powers to achieve a negligible residual risk outcome.

#### **4.4.5 Management of accidental spill**

The Bickham Project would introduce the risk of other contaminants (hydrocarbons, explosives and other chemicals stored on-site) migrating into the River by accident. The proponent has identified this risk in their risk assessment and has concluded that it would be low. The Commission considers that without appropriate management there is a significant risk of an incident occurring by accident during the mine life. The Commission notes however that existing regulatory powers are available to manage the risks of accidental spill to achieve an acceptable residual risk to receiving waters.

#### **4.4.6 Management of baseflow reduction**

The proponent has estimated reductions in baseflow will occur and continue well past the end of mining. Actual baseflow reductions are likely to be difficult to measure but could, in the Commission's opinion, have significant effects on the frequency of no flows or low flows which fall below an extraction trigger for example. The proponent has proposed that during mining it would compensate for any baseflow reduction by discharging the equivalent flow into the River from a bore or bores such that in flow terms there would be no change. This however introduces a number of questions about the ability to measure flow reduction accurately and the ability to source the necessary water - and therefore the practicality of achieving this result over the mine life. The Commission has formed the opinion that in light of these difficulties any flow compensation should be demonstrably conservative such that there is no credible argument which could support a claim of a significant decline in flow downstream. This could be achieved by supplementing predicted flow reductions over the mine life to ensure a minimum flow at the downstream end of the mine (predicted by the proponent to be between 650 and 850m<sup>3</sup>/day in the Pages River) is always maintained.

However, as noted in Chapter 3 and 4.3.8 above, the proponent has not demonstrated that it has identified a guaranteed source (or sources) of water for the purpose of compensating a wide array of impacts over the mining period and the period of post mining impact.

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## **CHAPTER 5: OTHER SIGNIFICANT ISSUES RAISED ABOUT THE PROJECT IN PUBLIC SUBMISSIONS (TERM OF REFERENCE 1(d))**

### **5.1 INTRODUCTION**

Only issues raised in public submissions and in presentations at the public hearings that the Commission considers to require further comment and/or have a direct bearing on its recommendations are dealt with in this Chapter. Other issues appear in the Submissions Summary at Annexures 2.1 and 2.2. The Commission has interpreted 'public submissions' to include submissions made orally or in writing in connection with the public hearings. To do otherwise would mean that there was no purpose to the Direction Variation issued by the Minister.

### **5.2 EQUINE INDUSTRY**

It became clear to the Commission during the review that the available information on the equine industry was out-of-date and that the structure and characteristics of the industry were not well understood by government, at least in the context of land-use planning.

Following presentations by equine industry participants at the public hearings, the Commission sought detailed information from the Hunter Thoroughbred Breeders Association in order to both better understand the industry concerns and to gather more recent data on the economic value and structure of the industry.

Thoroughbreds are not the only equine interests in the Upper Hunter Valley: there are substantial numbers of Australian Stock Horse breeders and the premier Australian Arab stud has also recently moved to this region. The stated attractions for these other equine interests are the quality of the environment and the aggregation of equine industry support infrastructure developed for the thoroughbred sector. Whilst these other interests are undoubtedly important contributors to the area, the highest value is found in the thoroughbred sector and the Commission's comments will therefore focus on this sector.

The Hunter Valley has been identified with thoroughbred breeding for more than a century, but it was not until the 1960s and 1970s that international interest began in earnest. The most rapid rise has occurred in the 1990s and beyond, following alignment of the Australian industry taxation regimes with those applying in New Zealand (the major Southern Hemisphere competitor). The industry is now dominated by a relatively small number of major national and international individuals and corporations, most of whom have interests and facilities in the other key breeding areas in the world (i.e. Kentucky, USA; Newmarket, UK; Coolmore, Ireland; and Normandy, France).

Growth in the industry in the Upper Hunter Valley has been very substantial since 2000 (e.g. between 2000 and 2006 the number of horses on properties increased by 153% and preliminary figures from a current survey indicate at least a further 100% increase between 2006 and 2009). Fuelling this growth has been the outstanding performance of Hunter Valley thoroughbreds in major races and in the sale ring and the consequent international investment interest from Europe, Asia and the USA.

The Asian market continues to expand (see Table 2) and there is now a very real prospect that mainland China may embrace thoroughbred racing (the racing industry is already the largest employer and source of taxation revenue in Hong Kong). This would see a dramatic



escalation in the demand for Hunter Valley thoroughbreds. The overall export market is already substantial with 2,550 thoroughbreds exported in 2009 (an increase of 50% in the decade) of which 67% came from the Hunter.

**Table 2: Expansion of the Asian Thoroughbred Market**

Exports to Key Asian Markets	Numbers 1998/99	Numbers 2008/09	% Change
Hong Kong	87	160	+84%
Singapore	126	353	+ 180%
Malaysia	40	263	+557%

Source: Adapted from Supplementary Submission, Hunter Thoroughbred Breeders Association Inc April 2010

With the growth in the industry has come a significant increase in economic value and employment. The last full figures from a 2006 survey indicate that full time employment on studs increased from 325 full time equivalent (FTE) employees in 2000 to 738 FTE in 2006 with a further 327 part-time and casual positions also on these studs in 2006. Value of capital items increased from \$951.1 million to \$2103 million (121%) over the same period.

A current (partially complete) study of the studs by Ernst & Young indicates that the economic value may now be up to double the 2006 figures, with direct employment of over 1,500 FTE on the studs and further substantial flow-on effects in both the Hunter and beyond.

A 2006 study for the Australian Racing Board estimated more than \$5 billion in value added to the national economy annually from the thoroughbred breeding and racing industry and in 2007 Racing NSW estimated that the thoroughbred industry contributed \$2.4 billion to the NSW economy. Estimates of total direct and indirect employment in the industry range up to 200,000 people nationally.

The contribution of the Upper Hunter Valley studs to this flow-on effect at the state and national levels should not be underestimated. Forty percent of all thoroughbreds born in Australia come from these studs and, at the premium end of the market, Hunter Valley sired yearlings represented the majority of premium sales in 2010 in Queensland (70%), Melbourne (80% of yearlings sold for more than \$100,000 and all 10 top-priced yearlings) and Sydney (86%). As noted earlier, 67% of exports are also Hunter stock.

The regional flow-on effects are also substantial with 74% of capital expenditure from the Upper Hunter Valley studs spent within the Hunter region over the three years 2007-2009 and significant feeder industries in the form of veterinary practices, feed suppliers, saddlers, farriers, transporters, etc.

It is not the Commission's task to quantify the value of the industry with precision. It is sufficient for the Commission's purposes to determine whether the industry is very substantial in terms of economic value to both the Hunter region and Australia, is a major employer both regionally and nationally, is expanding rapidly with opportunities for further major expansion, and is an industry offering long-term sustainability.

The submission supplied to the Commission by the Hunter Thoroughbred Breeders Association indicates that the industry meets all of these criteria. That submission is based substantially on data and studies from credible sources outside the Association including, *inter alia*, the Australian Racing Board, Racing NSW (a NSW government agency), Hunter Valley Research Trust, stud stock records and auction records.

To understand why the industry is so strongly opposed to introduction of coal mining to the Upper Hunter Valley Shire it is necessary to understand the structure of the industry:

- The Upper Hunter is the second largest thoroughbred breeding centre in the world after Kentucky in the USA.
- There are approximately 75 studs standing stallions, but the majority of the top stallions are concentrated in relatively few hands.
- Many of these top stallions are shuttled by air annually between the major Northern Hemisphere centres and the Upper Hunter studs.
- The major studs have up to 18 stallions standing and a high proportion of those are 'shuttle' stallions. Some of these are insured individually for between \$40 million and \$60 million and individually they have an approximate annual earnings capacity of \$12 million to \$15 million.
- The majority of the small number of high net worth individuals and corporations who own the major studs also have facilities in one or more of the other major world breeding centres (i.e. Kentucky, Newmarket, Coolmore or Normandy).
- There are now a substantial number of broodmare farms in the Hunter (100) of which 50 are in the Upper Hunter. These act as specialist nurseries and provide care for mares throughout pregnancy and for foals up to preparation for sale as a yearling. Approximately 50% of mares are managed in this way with the other 50% resident on the studs.
- The industry has attracted a world-class support structure in the form of veterinary practices (Scone has the largest veterinary practice in the Southern hemisphere), farriers, feed suppliers, etc. This in turn is attracting other major equine interests such as the leading Arab studs, Australian Stock Horse studs, etc.

The industry makes a number of points:

- (i) the 2010 industry in the Hunter is based on the international reputation that the Hunter has acquired for producing premium quality stock;
- (ii) there is a strongly held view in the industry that this production capacity is based on key environmental attributes including clean air, clean water and green rolling hills;
- (iii) the high net worth individuals in whose hands the top breeding stallions are concentrated are potentially very mobile, and, should they decide to move, would move offshore;
- (iv) the extent of this potential mobility could see 60% of the premier stallion strength move overseas with a consequent impact on 80% of the broodmare farms and the supply industries; and
- (v) New Zealand is already making inroads into key export markets on the back of the Australian equine influenza outbreak and would seize on any other opportunities to weaken Australia's thoroughbred reputation.

The Commission's view is that the structure of the industry, the obvious importance of reputation, and the existence of viable alternatives makes the industry very vulnerable to threats based on image. The Commission accepts that introduction of coal mining to the Upper Hunter Valley could pose such a threat and that open-cut coal mining and a viable international thoroughbred breeding enterprise are probably incompatible land-uses. Given the size and importance of the thoroughbred industry, an experiment to 'test' the extent of this vulnerability is not recommended without a comprehensive study of both the economics and the risks.

The Commission was also provided with information on the planning restrictions designed to support and protect the equine industry in Kentucky and Newmarket. It is clear that the relevant governments have moved decisively to ensure that competing land uses are controlled in these regions in order to protect the thoroughbred industry.

### **5.3 HEALTH-RELATED ISSUES**

Several health-related issues were raised in written submissions and at the public hearings. The primary issue was coal dust, although airborne toxins were also raised.

There is considerable community concern about health impacts of coal dust in the open-cut mining areas around Singleton and Muswellbrook and the issue occupied a full ABC Four Corners program on 13 April 2010. It has also featured prominently in major newspapers. Principal concerns are respiratory impairment and diseases (e.g. asthma) arising from inhalation of fine particles in the PM<sub>10</sub> to PM<sub>2.5</sub> range.

The Commission was presented with the preliminary results of some locally funded medical studies from the Singleton area that supported claims that coal dust could be a health hazard and was referred to overseas literature in the same vein. The Commission was also advised of community concerns about the track record of both the regulators and the industry in terms of monitoring, compliance and enforcement of limits on dust emissions.

Investigations of these health-related issues in the Singleton-Muswellbrook area is well outside the Commission's terms of reference except insofar as they may provide insight into possible consequences from the Bickham Coal Project proposal. In that context the scale of the project becomes relevant. Bickham is a very small mine by the Hunter standards and, while it would undoubtedly generate dust that would move beyond the boundaries of South Bickham itself, the impacts would be fairly localised. Those localised impacts could be of significant and legitimate concern to neighbours and it is obvious to the Commission that the current regulatory system is incapable of guaranteeing effective control over them at all times.

If Bickham were only the first of a number of open-cut coal mines in the area then the potential exists for there to be greater impacts over a wider area (i.e. toward the situation in Singleton and Muswellbrook). This creates a greater level of hazard and also complicates the compliance and enforcement options. Dust from coal mining is generally classed as a 'fugitive' emission which is difficult to measure at or near the source. If there are multiple possible sources then determining who is responsible for any exceedance is very difficult. The conditions causing emissions from one mine, e.g. high winds, are also likely to be affecting other mines in the immediate vicinity. The mine by mine assessment and approval system for open-cut coal mines has to date not demonstrated a capacity to deal with these cumulative emissions issues.

The Commission also notes concerns raised by neighbours of South Bickham about possible impacts of coal dust on drinking water supplies. Some neighbours are totally dependent on rainwater tanks for potable water. The Commission put this question to the proponents who advised that they were not aware of studies other than on lead contamination and that there were options to deal with any risk that might be identified in drinking water.

### **5.4 EMPLOYMENT**

The proponent has made varying claims concerning the employment-generating capacity of the mine during the history of the proposal. The most recent claims emanate from a document entitled 'A social and economic profile of the communities surrounding the proposed Bickham Coal Mine and an assessment of the Mine's economic impact on the

Hunter Region', prepared by the Hunter Valley Research Foundation in December 2009. This was provided to the Commission by the proponent on 22 March 2010.

The Commission studied this document and noted the following:

- information concerning who commissioned the study is not provided;
- economic and workforce data used for the mine component were supplied by the proponent and not verified independently;
- the population statistics were not investigated rigorously and unsubstantiated claims are made such as 'the introduction of a new mine has the potential to continue the population growth experienced in the Upper Hunter Shire over the last five year period ...' whilst failing to note that none of this significant (9.6%) increase is due to mining in the Shire (as opposed to mining elsewhere) and that introduction of mining may cause a decline in the industries that did contribute to this increase;
- the basis for the population projections in the region is unclear and it is unlikely that the rapid development of the equine industry since 2006 has been properly accounted for in terms of these potential population increases;
- economic and employment projections are maximum figures and no ranges are given. Externalities are also not included (i.e. the negative impacts on other economic wealth or employment generating industries). It is evident that these externalities are very significant and may outrank the maximum economic and employment benefits claimed for the mine;
- the employment analysis depends on an unrestricted pool of employees being available (p.24). This is unlikely in an area where unemployment is quoted as 2.8% (p.8) and for an industry that employs skilled labour with a projected increase in demand from already approved projects;
- the life of mine employment analysis also fails to account for the fact that the total available employment in coal mining in the Hunter is potentially limited by two factors: the total approved production capacity and the capacity to store, handle and export the product. If the capacity to store, handle and export is less than the approved production capacity (i.e. the current situation) then total production becomes limited and the establishment of a new mine could not increase net employment unless all new employment is directed to mine establishment activity and not to production activity;
- the document notes that 'although Bickham has a commitment to employ local labour, it is not possible to predict the proportion of total employment that is made up of people from the local area'. What the document also fails to acknowledge is that, given the small size of this mine and its isolation, the bulk of the support services required will be supplied from the established service sector in the Lower Hunter rather than a relocated service sector in the Upper Hunter. While some flow-on employment opportunities would occur in some local industries (e.g. motel, hotel, food outlets, etc) most of the flow-on employment benefits (i.e. 286 FTE jobs out of the claimed total of 386 FTE) are likely to occur outside the local area; and
- the employment created will only last for the life of the mine. Once mining ceases the direct jobs disappear as do the flow-on effects. Employment prospects in the area

would then depend on industries whose sustainability may have been damaged by the existence of the mine.

In the Commission's opinion the analysis is not rigorous and the assertions made are not necessarily supported by the evidence presented. The methodology employed ensures that only the maximum predicted benefits are reported and the possible disbenefits (i.e. the 'externalities') are specifically excluded regardless of their potential magnitude.

Many other submissions made reference to employment, with the majority noting the significant risks to both skilled and unskilled employment in existing industries should the mine proceed, the already low unemployment rate in the Shire, and the likelihood that most positions would not be filled locally. Officers of the Upper Hunter Valley Shire made the point that existing industries provided the employment base for unskilled workers in the Shire and that maintenance of employment opportunities in this category was essential.

The Commission's conclusions are that:

- (iv) the potential employment benefits from the Bickham proposal are likely to be substantially less than claimed by the proponent in terms of the net increase in mining-related employment in the Hunter region;
- (v) relatively little of any additional employment would be drawn from the local area; and
- (vi) the potential losses in employment from industries negatively affected by the mine could be substantial and may be of greater significance than any employment generated by the mine.

## **5.5 MURRURUNDI**

The perceived decline in the viability of the town of Murrurundi was raised in many submissions, with opinion strongly divided between those who believed the town to be dying and those who believed it was in transition from one phase of its history to a new and sustainable future. So stark was the contrast between these positions that the Commission visited Murrurundi and also interviewed the Council officers responsible for business development in the Shire.

Murrurundi, in common with many towns in regional NSW, has been through a number of business activity phases in the last 150 years. In more recent times employment has centered on rail, agricultural service industries, road transport, state government and local government. Of these, rail, state government and local government have moved elsewhere, road transport and agricultural service industries have declined, and key services such as banks have also departed.

However, some new industries have commenced based around art, crafts, health-related services and leisure industries and there appear reasonable prospects that, without coal mining, these industries will expand and remain sustainable. Evidence to the Commission indicated that potential further investment in these industries was 'on hold' until such time as the Bickham project was determined.

Those arguing for the mine as a potential saviour for the town tended to be involved in the motel, hotel or food supply industries, or to have an identified linkage with the proponent or a related entity. Those opposed were mostly associated with an industry that was in potential conflict with coal mining or the Chamber of Commerce (e.g. arts, health-based or equine industries). The latter group consistently questioned the validity of the proponent's claims about local employment and the sustainability of mine-related employment.

Interviews with the relevant officers from Upper Hunter Valley Shire Council supported the view that the town was slowly undergoing transition from a business and employment structure based around transport and government (both state and local) to one primarily based on arts, health, leisure and equine interests. They observed that the transition to newer industries was not without its difficulties given the very different natures of the business mixes involved and that it would take some years for the changes to become embedded. They also observed that delays in determining whether Bickham would proceed were stifling investment in the newer industries and expressed serious doubts as to whether Bickham could deliver significant or sustainable improvements in local employment.

## **5.6 VARIATIONS IN PROPOSAL AND COMMUNITY CONSULTATION**

A substantial number of submissions raised the issue of continuing changes in the mine parameters and the confusion created as a result. This was particularly focused on the intended size of the mine (variously referred to as the ‘Pinocchio Mine’ and the ‘Magic Pudding Mine’), but also referenced water-related risks and other potential impacts.

Whilst many of the changes may be attributed to the proponent, some changes have arisen from Government agency critiques at various stages, and even from questions from the Commission. These have produced responses from the proponent that have modified the proposal or aspects of it (often positively). Part of the problem has been the effectiveness of communication (or lack of it) about such changes and the reasons for them.

It was clear to the Commission that there was a significant level of distrust between the majority of the community and the proponents. This was not assisted by legal proceedings in which the proponent tried to prevent access to documents sought from the Department of Planning under Freedom of Information legislation. Whilst it is the right of the proponent to resist production, exercising that right carries with it the risk that the community will suspect that the material is both significant and prejudicial to the proponent’s case.

Community consultation on the proposal has been sub-optimal. It has gone through multiple iterations, each appearing to have degenerated after a period with significant discontent evident with both the integrity of the process and the content. Evidence from immediate neighbours about consultation was to the effect that it had been minimal to non-existent.

## **5.7 DEFERRED INVESTMENT AND ‘CLOSURE’**

A number of submissions raised the issue of investment decisions being deferred in industries that might be impacted by the introduction of coal mining to the Shire. These ranged from major investments in new veterinary facilities in Scone to health-based facilities in Murrurundi. Evidence was also provided from stock and station agents concerning the advice they were giving clients to defer sales of properties until a decision was made about Bickham and also evidence of the significant uncertainty affecting sale prices.

Apart from evidence concerning deferral of investment, many submissions raised the issue of the length of time taken to get to this stage and the fact that the community was tired of the constant disruption caused by the continued existence of the threat posed by Bickham.

It is also evident that the community feels so strongly about this threat that considerable private and industry funds have been expended engaging multiple technical experts and legal advisers to review material produced by the proponent and provide advice to government over a period of years and more recently to this Commission.

More than a few presenters made the point that both the proponent and the community had been dealing with this for a very long time and it was time to make a decision and move on. Another round of studies and uncertainty would appear to be seriously counter-productive in these circumstances.

### **5.8 ACCESS TO EMERGENCY SERVICES – SCONE**

The Commission notes the issue raised by the Upper Hunter Valley Shire Council concerning the risks associated with coal trains blocking both of the level crossings in Scone that provide access for emergency services from one side of the town to the other. With all emergency services based on one side and half the town's population on the other it is only a matter of time before one or more lives are lost because access is not available. The question of liability is interesting given that all relevant parties have notice of the risk and it would appear that decisions on coal transportation that would increase the risk are being made despite the fact that the risk is avoidable.

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## **CHAPTER 6: WHETHER THE PROJECT SHOULD BE ALLOWED TO PROCEED TO FULL MERIT ASSESSMENT UNDER PART 3A OF THE EP & A ACT (TERM OF REFERENCE 1(e))**

### **6.1 INTRODUCTION**

There are two possible interpretations of this Term of Reference. The first is that the only preliminary issue to be determined prior to Part 3A assessment is whether the potential water-related impacts are sufficient to preclude the proposal proceeding. Recommendation 13.3(a) of DoP 2005 could be interpreted as suggesting this path.

However, the water-related issues in the Commission's Terms of Reference are self-contained. They are separated from the requirement to advise on whether the project should proceed to merit assessment by the requirement in Term of Reference 1(d) to consider any other issues raised in public submissions. This latter Term of Reference inevitably brings broader considerations into play. The first is whether coal mining (and in particular open-cut coal mining) should be permitted in the Upper Hunter Valley Shire. The second is whether, even if the answer to the first question is negative or inconclusive, there are matters other than water-related risks that are of sufficient magnitude, either on their own or in combination with the water-related risks, to lead the Commission to recommend against allowing the proposal to proceed to merit assessment.

In dealing with this Term of Reference the Commission will cover all options, i.e.

- (i) should coal mining be allowed to proceed in the Upper Hunter Valley Shire either at all or in particular forms (i.e. open-cut or underground) and should any prohibitions be permanent or reviewable; and
- (ii) if there is to be no universally applied constraint: (a) are the water-related issues sufficient to warrant advice that the Bickham proposal should not proceed to merit assessment under the Part 3A process; (b) have other issues been raised in written or oral submissions that would warrant advice to the effect that the proposal should not proceed to merit assessment; or (c) is there some combination of issues arising from consideration of (a) and (b) that would lead to advice that the proposal should not proceed to merit assessment.

### **6.2 COAL MINING AS AN ACCEPTABLE LAND USE IN THE UPPER HUNTER VALLEY SHIRE**

This issue is complex. Given that the Bickham proposal is for an open-cut mine, and community opposition may have differentiated between open-cut and underground mines, the Commission will restrict its comments to open-cut mining.

There is currently no open-cut coal mine in the Upper Hunter Valley Shire and there is overwhelming opposition to establishing one (even a small one such as Bickham).

Part of this opposition to Bickham derives from the fear that Bickham is the first of many proposals and that, once the precedent is set, the NSW Planning system will deal with each proposal in isolation and the cumulative impacts will be substantial. Opponents only need look down the valley to make this point, with whole villages having disappeared, the transformation of large parts of the landscape, and the rising concerns about dust emissions.



This needs to be examined carefully. DoP 2005 points out that there are only two possible open-cut developments in the Shire within the 15 year horizon (p27). They are at Bickham and Castlerock. However, DoP 2005 also notes that there are likely to be other substantial shallow coal resources in the Pages River Catchment in an area to the north-west of Bickham and east of Blandford. This is described as Domain C in DoP 2005. It has an area of 30.5 km<sup>3</sup>, which is approximately six times larger than the combined areas at Bickham and Castlerock. Domain C has not been explored to date because of its complex geology. The potential coal resources in the Shire are shown clearly in Maps 18 and 19 in DoP 2005 and are reproduced in this report as Annexures 3.2 and 3.3.

Without full information on Domain C it is not possible to say whether Bickham is or is not the 'thin end of the wedge'. However, the likely maximum size of the wedge can be deduced from DoP 2005. The combined footprints of Bickham, Castlerock and Domain C cover about 0.7% of the Shire, which is a substantial area.

The Commission offers no comment as to the merits of mining developments in the Lower Hunter Valley. Economic development needs to occur and coal mining is a very significant contributor to economic development. However, the arguments put by the Bickham opponents are that open-cut coal mining is incompatible with existing high economic value land use patterns and lifestyle values in the Upper Hunter Valley Shire and should be prohibited. These arguments are set out and discussed in Chapter 5 under Term of Reference 1(d).

The extent to which the land use options are in conflict and the nature of that conflict is strongly disputed. The mining industry takes the position that any real impacts are in the immediate vicinity of the mine and that there are satisfactory compensation and acquisition systems in place to deal with them.

Responses from industry-based opponents depend partially on the industry affected. The equine industry is focused on maintaining the reputation of the area as 'uncontaminated' and eliminating the risks posed by mining to essential resources such as water. Their clear position is that open-cut coal mining and a viable premier thoroughbred breeding region are incompatible. The grazing industry is concerned about perceptions, the impact of dust and risk to essential resources. Tourism industries are concerned about amenity (visual, acoustic, transport corridors, etc). The developing health-based and arts-based industries are concerned about perception primarily, but also direct amenity and health impacts where these might occur. Those charged with protecting the environment are primarily concerned about impacts on the reserve system, impacts on the river and its associated ecosystems and the ancillary pollution hazards from mining.

The strength of the opposition based on the information supplied by these industries is persuasive, but the claims have not been tested in a way that would allow a quantitative assessment of the real economic impact of different levels of open-cut mining on these industries. Any such study would need to look at the potential threshold effects for cessation or shrinkage of the industries concerned based on reputational damage or loss of amenity and the consequent employment impacts.

The equine industry is particularly vulnerable to reputational damage. There are multiple reasons for this set out in Chapter 5 above and the arguments put forward to support the industry position are both plausible and persuasive. The value of this industry to NSW is substantially higher than was estimated in DoP 2005 and there is ample evidence to suggest that it will continue to grow both rapidly and sustainably in the absence of coal mining.

It is not just the current and future economic value of this industry that is important in the Shire. It is a major employer of skilled labour in the feeder industries (there are five veterinary practices in Scone, the largest of which employs 33 veterinarians and 67 other staff) and it is also the most significant employer of unskilled labour on the studs and in supporting agricultural industries. The Council noted the critical importance of this employment avenue for unskilled labour in the region. The large studs also provide substantial amounts of accommodation (e.g. 'Arrowfield' has over 70 people living on the property full-time).

The public submissions identified rural and village lifestyle as a major attraction of the Shire. This would be severely impacted if all potential areas identified in DoP 2005 were subjected to open-cut mining. The nature of one or more towns and villages would also change as they became service centres or dormitories for the mines. However, if Bickham were the only mine to proceed this impact would be significantly smaller overall, even if not for those in close proximity to the mine.

The economic cost of changes to lifestyle are unknown at this time, but the information provided by the Mayor of Muswellbrook and in other submissions suggests that they are both negative and substantial. There are many components (e.g. property values, social amenity, transport impacts) and some are more easily quantified than others. The total cost is also heavily dependent on the potential extent of mining. Some lifestyle impacts also occur well away from the mines themselves (e.g. transport impacts and changes to towns and villages).

It is noted in passing that DoP 2005 dismissed these broader concerns without attempting to assess them in depth and focused almost solely on the natural resource and environmental issues (p8). It also assumed (wrongly in the Commission's view) that these broader social and economic issues could be dealt with adequately at the environmental assessment stage for individual mines.

Balancing these negative impacts are the benefits that can flow to the Shire from coal mining in the form of mine-related employment, improved economic prospects for some local businesses and introduction of service industries for mining. These are more readily quantifiable than the externalities, but the quantum is heavily dependent on the eventual size of the industry in the Shire and its longevity. In the context of longevity, if the total open-cut resource has a relatively short life then the negative impacts of mining on the future prospects of alternative sustainable land-uses will have to be considered carefully. The history of mine rehabilitation in NSW will also be a relevant consideration.

The concerns about water resources also need to be considered in this broader context. Domain C and most of Bickham are within the Pages River Catchment. As noted in Chapter 2, there are three possible sources of loss of water to the river or its tributaries from mining: reduced runoff, reduced groundwater baseflow and direct inflow via groundwater from the river or tributaries to the mine. Which of these is most significant, and their individual and combined magnitude, will depend on the interaction between site specific characteristics and the mine. However, for two of them (reduced groundwater baseflow and reduced runoff) there is currently no clear policy position about either controlling their impact or compensating for lost water and there is no universally applied mechanism for their measurement or for managing compensation. In this context it should be noted that the proponent's predictions for impacts on flow in the Pages River are entirely due to reduced groundwater baseflow and increased capture and storage of runoff.

Given that the Pages River is already fully allocated, any further uncompensated losses must have a potential impact on downstream users and other uses. Since the total area over which mining may prove feasible is not known and, apart from Bickham, there is no information

about the possible interaction between individual mines and the Pages River, the potential risk to water resources must be considered very real, but currently unquantifiable.

Another concern is mine water management and water quality. It is unusual for mine water to be of an equivalent quality to good quality in-stream water. In this context it should be noted that, whilst Bickham is primarily operating in the lower coal measures, the area to the north (Domain C) is primarily in the upper coal measures (see Map 3 DoP 2005). Mine water from mines in Domain C would be expected to have comparatively higher salinity than Bickham and pose a proportionally greater threat to water quality in the catchment.

There is no prospect of any mines establishing in the Shire joining the Hunter Salinity Trading Scheme. Control and management of mine water will therefore be a significant issue if discharges are not to occur. The problem is exacerbated by the relative isolation of potential mines and the reduced opportunity to trade surplus water between mines.

The issue of infrastructure capacity has also been raised. At present there is more coal production capacity approved in the Gunnedah Region and Lower Hunter Valley than there is transport and port handling capacity for that production. Steps are being taken to close this gap, particularly with increases in rail capacity. However, there is no publicly available assessment of total approved production versus transport handling capacity on either a current or projected basis and also no assessment of actual production capacity<sup>4</sup> in the same context.

The obvious question is why the Government should add to this capacity shortfall by approving yet another mine. But that assumes there is some strategic planning for development of coal resources in NSW that takes account of the end to end processes covering mine planning to development of appropriate infrastructure to export of the product. If that plan exists, it is not evident to the Commission. Access to transport and handling infrastructure is currently a matter for individual operators to resolve.

The position in relation to prohibition on open-cut mining can be summarised as follows:

- (i) There are real and substantial risks and costs of introducing open-cut coal mining to the Upper Hunter Valley Shire. Some of these are dependent on the total area to be mined and some are not. As yet there has been no quantitative study designed to assess the potential costs. DoP 2005 did not undertake this task.

There is very strong opposition over a wide area to both the introduction of open-cut mining generally and to the Bickham proposal itself. This opposition is substantially industry-based. At least some of the opposition to Bickham stems from the valid perception that approval of Bickham will establish a precedent for approval of other mines in the Shire.

- (ii) There are real, but unquantified benefits of introducing open-cut coal mining to the Shire. These benefits are much more dependent on the total production capacity of all potential areas than is the case for the potential risks and costs in (i) above.
- (iii) The total size of the resource that might be mined by open-cut methods is a critical factor in assessing the sub-regional (Shire) benefits, risks and costs. This information is not currently available, nor will it be available in the foreseeable future given that there are no current proposals to proceed with Domain C.

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<sup>4</sup> Approved capacity will often exceed actual production due to a wide variety of operational factors, one of which will be access to sufficient transport and handling facilities for the product.

- (iv) It is currently not possible to undertake a sub-regional assessment based on anything other than speculation. The information from (i), (ii) and (iii) above is required before it would be possible to do a sub-regional cost-benefit analysis that would provide a platform for sound decisions about the net benefit of open-cut coal mining in the Shire.
- (v) The Commission concedes that Bickham is potentially the ‘thin end of the wedge’ and that history suggests that, if the coal resources are available, the mine by mine approval process will result in further approvals. However, not allowing Bickham to progress in the absence of the net benefit information from (iv) also creates a significant precedent in terms of the way mining approvals have been considered to date.
- (vi) Prohibition of open-cut coal mining in the Shire would be possible by adding the Shire to Schedule 1 of *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007*. This SEPP was used to prohibit open-cut coal mining in Lake Macquarie.

The Commission’s conclusion is that the qualitative information currently available would, on balance, support a prohibition. However, recommending imposition of a permanent ban in the absence of comprehensive quantitative information is a very significant step. For reasons that will become apparent in 6.3.6.4 below, the Commission’s view is that this step is unnecessary at this time. It is always open to Government to consider this issue if and when the comprehensive studies outlined above have been undertaken.

### **6.3 WATER-RELATED RISKS RELEVANT TO ADVICE AS TO WHETHER THE PROJECT SHOULD PROCEED TO MERIT ASSESSMENT**

The water-related risks of the proposal, the adequacy of the Water Resource Assessment and draft Water Management Plan, and the possibility of managing the water-related risks to achieve an acceptable level of environmental performance were discussed in Chapters 2, 3 and 4 above.

The Commission’s findings are that:

- significant water-related risks were identified;
- the evidence does not support the proponent’s interpretation of either the existence or extent of risk in some critical areas such as risk of inflow from the Pages River to the mine, extent of minewater make, and reduction in baseflow to the Pages River;
- the risks could lead to impacts greater than ‘negligible’ on flow in the Pages River and could also have localised impacts on Kingdon Ponds;
- in many cases the management options advanced by the proponent are either conceptual or only partially developed and are themselves subject to a range of uncertainties. Not all of these uncertainties are under the control of the proponent; and
- from the information provided in response to the Commission’s questions, it is unclear whether further studies could resolve some key uncertainties in relation to risk or management options.

The Commission’s conclusions are that after 10 years of studies and variations to proposals there remains a considerable level of uncertainty about the nature and extent of some significant water-related risks to the Pages River, to neighbouring properties and to that part

of Kingdon Ponds in close proximity to the mine proposal. The proponent has failed to demonstrate that the proposed management measures can achieve the required outcomes either at all, or over the extended (100 years plus) period of some impacts. The Commission is therefore unable to support the Bickham Coal Project proposal proceeding to the full merit assessment under Part 3A.

#### **6.4 ISSUES RAISED IN SUBMISSIONS RELEVANT TO ADVICE AS TO WHETHER THE PROJECT SHOULD PROCEED TO MERIT ASSESSMENT**

Many of these are a sub-set of the broader concerns discussed in 6.2 above about potential coal mining being introduced to the Shire. However, the context is the Bickham Project Proposal itself rather than open-cut coal mines in general. Only those issues raised that the Commission considers important to a decision as to whether the project should proceed to full merit assessment will be dealt with here.

By Hunter Valley standards the Bickham proposal is for a very small mine. At its maximum proposed production rate it produces less than 1.5% of the total current Hunter production and a very much smaller proportion of future projected production during the period in which the mine is proposed to operate. However, Bickham projections indicate that it would be profitable at that scale.

Claims were made by both the proponent and some Bickham supporters that there would be significant gains in employment in the region if the mine went ahead. The Commission's assessment of the information supporting the claims is that it does not stand up to scrutiny and that the employment benefits of the mine are likely to be small in the context of mining in the Hunter Valley overall and unlikely to have a significant impact in the area close to the proposed mine.

The issue of Murrurundi is more complex. There are a range of factors influencing the current employment and economic status of the town. There is no doubt that some industries could benefit from the establishment of the mine, but it is equally clear that the newer tranche of industries and investment in the local area are threatened by the prospect of an open-cut coal mine nearby. If sustainability is considered, the mine is clearly limited and it is not likely that mine service industries would establish in or relocate to the area for a single mine of this size.

There is sufficient evidence of deferred investment in non-mining industries to conclude that these industries regard open-cut coal mining as a real threat to viability. These industries have invested heavily in expert scientific and legal advice in opposition to the Bickham proposal over a long period of time and these are real dollars spent by business leaders in sophisticated industries, not a campaign run with public or donated funds.

The structure of the equine industry and its vulnerability to reputational damage provides a compelling case for treating open-cut coal mining and a premier thoroughbred breeding area as incompatible land uses. The extent of that incompatibility and the overall benefits and disbenefits can only be tested in two ways:

- (i) by a comprehensive cost-benefit analysis that takes account of all relevant factors; or
- (ii) by approving the mine and studying the effects.

The first option is not an appropriate study for a Part 3A proposal for a single small project. It is unlikely that the proponent could gain access to the detailed economic information from the competing land-use industries and, since the EA is prepared by the proponent, such a study could never have credibility with the community or competing interests. A regional

study of this kind would need to be conducted on behalf of government by a reputable institution with sufficient independence and credibility for the results to be relied upon by decision-makers.

The second option carries a very real risk of triggering a significant decline in the equine industry. With the current inability to quantify either the likelihood of occurrence of this risk or its potential magnitude, embarking on this course would appear to amount to recklessness. (This of course creates a significant obstacle for any proposed open-cut coal mine seeking to establish in the Upper Hunter Shire utilising the mine by mine approval process under Part 3A. No individual mining proposal is likely to outweigh the value of the thoroughbred industry, and, without credible quantitative information on the extent of the potential damage to this industry, it would be unwise to take the risk.)

The Commission's conclusion is that there are significant non-water-related concerns with the proposal that are of sufficient merit to warrant a comprehensive independent study of the competing interests before an open-cut coal mine such as Bickham could proceed to Part 3A assessment in the Upper Hunter Valley Shire. Within this context, the Commission is of the view that the existence of a premier thoroughbred breeding industry and open-cut coal mining are likely to be found to be incompatible land uses.

#### **6.5 CONCLUSION ON TERM OF REFERENCE 1(e)**

- The Commission recommends that the Bickham Coal Project proposal not be allowed to proceed to full merit assessment under Part 3A of the EP and A Act.
- The Commission further recommends that before any other open-cut coal mining proposal is considered in the Upper Hunter Valley Shire LGA that a comprehensive independent study of the competing land use options be undertaken with a view to determining whether any benefits of introducing open-cut coal mining to the Shire would be outweighed by the total potential impacts on the Shire and the broader NSW economy.

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**CHAPTER 7: SPECIFIC REQUIREMENTS FOR INCLUSION IN  
DIRECTOR-GENERAL'S REQUIREMENTS (TERM OF  
REFERENCE 1(f))**

This Term of Reference is dependent on a positive recommendation that the Bickham Coal Project should proceed to full merit assessment under Part 3A. As the Commission has recommended that the project should not proceed to full merit assessment under Part 3A, no advice on Director-General's requirements is provided.

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## ANNEXURE 1: TERMS OF REFERENCE

### Direction to the Planning Assessment Commission

#### Bickham Coal Project

Section 23D(1)(b)(i) & Schedule 3 of the *Environmental Planning and Assessment Act 1979*; & Part 16B of the *Environmental Planning and Assessment Regulation 2000*

I, the Minister for Planning:

1. Request the Planning Assessment Commission (the Commission) to advise on:
  - the water-related risks of the Bickham Coal Project;
  - the adequacy of the Water Resource Assessment for the project and associated draft life-of-mine Water Management Plan;
  - whether the water-related risks of the project can be suitably managed to ensure an acceptable level of environmental performance, having regard to the relevant recommendations in the *Strategic Assessment of Coal Mining Potential in the Upper Hunter Valley*;
  - any other significant issues that are raised about the project in public submissions;
  - whether the project should be allowed to proceed to a full merit assessment under Part 3A of the EP&A Act; and, if so,
  - any specific requirements that should be included in the Director-General's requirements for the environmental assessment of the project as a whole;
2. Direct, that for the purposes of carrying out the review, the Commission is to be constituted of at least 3 members, including Mr Lindsay Gilbert and Dr Lloyd Townley as casual members; and
3. Request the Commission to provide its final report to the Director General during the first quarter of 2010.



The Hon Kristina Keneally MP  
Minister for Planning

Sydney 30 October 2009

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# Direction to the Planning Assessment Commission

## Bickham Coal Project

Section 23D(1)(b)(i) & Schedule 3 of the *Environmental Planning and Assessment Act 1979*, & Part 16B of the *Environmental Planning and Assessment Regulation 2000*

I, the Minister for Planning, vary the direction to the Planning Assessment Commission (the Commission) concerning the Bickham Coal Project issued on 30 October 2009 so as to:

1. Request the Commission to conduct public hearings as part of the review, in the Upper Hunter Valley area.
2. Request the Commission to provide its final report (under clause 288V of the *Environmental Planning and Assessment Regulation 2000*) by 30 April 2010.



Tony Kelly MLC  
Minister for Planning

Sydney 2010

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## **ANNEXURE 2: SUMMARY OF SUBMISSIONS**

Submissions were received by the Department of Planning in response to the exhibition of the Water Resource Assessment and draft Water Management Plan. They were forwarded to the Commission and are summarised in Part 2.1 of this Annexure.

Submissions were also received by the Commission in response to the advertisement of public hearings and in response to issues raised at the public hearings. These are summarised in Part 2.2 of this Annexure.

At the public hearings 39 presentations were made to the Commission. Although these presentations emphasised, and in some cases expanded upon, particular aspects of the written submissions, they generally did not introduce completely new material. The scope of issues is therefore adequately described in Parts 2.1 and 2.2. The principal value obtained by the Commission from the public hearings was the opportunity to obtain more detailed information on the identified key issues, to clarify aspects of those issues and to gauge the relative strengths of some propositions and lines of argument.

The Commission's formal questions to the proponent and the proponent's response to those questions are included separately at Annexures 4.1 and 4.2.

## **ANNEXURE 2.1: SUBMISSIONS TO THE DEPARTMENT OF PLANNING**

A total of 253 submissions were submitted to the Department of Planning during the public exhibition period of the WRA and WMP from 21 October to 4 December 2009 and in the months following. A list of all those who made submissions to the Department is at Annexure 2.1.2.

4 were from government agencies:

- Department of Environment, Climate Change and Water (DECCW);
- Department of industry and Investment (DII);
- NSW Office of Water (NOW); and
- Upper Hunter Shire Council (Council).

These are available for view at: [www.pac.nsw.gov.au](http://www.pac.nsw.gov.au)

The remaining 249 were from the general public (145) and from Special Interest groups, including owners and stakeholders in local agricultural industries and other businesses (104). The submissions have been grouped in this manner to illustrate the substantial industry-led component to these submissions.

Of these 249 submissions, 140 were individual letters of which:

- 131 raised one or more objections to the proposal (100 from the general public and 31 from special interest groups, local industry and business);
- 7 provided support for the proposal (5 general public and 2 local business); and
- 2 did not take any position.

The other 109 consisted of the same form letter (39 from the general public and 70 from local industries and businesses). The key message in this letter was of risk versus reward: that the level of risk associated with establishing a strategically isolated mine in an area supporting an internationally renowned thoroughbred industry and several other productive agricultural enterprises, in return for relatively small socioeconomic gains was significant – particularly when compared with the established and rapidly expanding areas lower down in the Hunter Valley.

The following summary and analysis of issues raised excludes these form letters. This also means that quoted figures of the proportion or percentage of submissions raising a particular issue incorporate only the 140 individual letters. The main issues raised are described in descending order of appearance below.

As to be expected, almost all submissions raised water-related concerns in some way or another. The most frequently expressed concerns could be broadly split into two groups:

- 1) More than half of the general public submissions and over 40% of special interest, local industry and business submissions expressed concern over potential changes in water quantity or quality from the perspective of the Pages River itself (i.e. independent of how such changes might impact human livelihoods).

At their most basic, these concerns included simple observations of reduced flows in the Pages and Kingdon Ponds catchments as predicted in the WRA and WMP, and the potential for poorer quality water to enter these catchments via uncontained runoff from waste rock dumps or by cross-contamination from aquifers disturbed during mining.

More specific concerns included potential impacts on the overall health of the stream/catchment systems, and the aquatic ecosystems (including GDEs) and the flora and fauna which they support. The potential for blasting close to the Pages River to result in a myriad of additional impacts beyond those assessed and predicted in the Water Resource Assessment and Water Management Plan was raised, in particular the possibility of increased fracturing and connectivity between the mine pit and the Pages River, via the G-seam and other aquifers.

Other commonly raised issues included the predicted length of time for recovery of the groundwater regime and catchment functions after the completion of mining, and the view that any risk to the Pages River and Kingdon Ponds systems was unacceptable. In this respect the view was that the proponent had failed to “guarantee” that these systems would not be affected.

Finally, some submissions cast doubt on the proponent’s contention that there was no possibility of water flowing directly from the Pages River to the pit via the G-seam, pointing as evidence for uncertainty to the lack of monitoring in key areas such as Long Pool and querying the comprehensiveness of the groundwater model in incorporating all of the geological complexities of the site.

2) Half of the individual submissions and over 70% of the Special Interest, local industry and business submissions raised concerns in relation to potential reductions in the availability and/or quality of surface and ground water resources for users downstream of the proposed mine or within the predicted area of groundwater drawdown/affectation in the Pages River and Kingdon Ponds catchments.

Many of these submissions highlighted the existing over-allocation of the Pages River system, the hardship and stress this has already caused downstream users and communities such as Gundy, and questioned the wisdom of potentially exacerbating the situation by introducing another significant user (i.e. a mine) into the system.

Some called into question the effectiveness and practicality of the supply compensation measures proposed by the proponent to neighbouring landowners. Criticism was directed at both the capacity to compensate and the lack of a satisfactory mechanism for compensation beyond mine closure (the effects continue for over 100 years). In relation to groundwater-fed springs, seeps and soaks, scepticism was expressed at the capacity of the proposed measures to deliver anything over and above a simple stock water supply function, with no possibility of re-creating the hydrological conditions on which the systems themselves depend.

Several submissions pointed to the potential for a significant increase in the frequency of no-flow days, chiefly for users in the Pages River catchment. In this respect some were highly critical of the use of average flows underpinning the assessment of

impacts in the Water Resource Assessment and Water Management Plan (generally viewed as deliberately misleading), as well as the inadequate consideration of future climate change scenarios.

The potential for the mine to compromise the character and lifestyle values of the Upper Hunter Shire area (not Murrurundi specifically) was raised by about 30% of submitters. Estimates for this tarnishing influence ranged widely from modest to severe. Many of these submissions referred to the entrenched perception of the area as “unspoilt”, “pristine” and (for Scone) image as “the Horse Capital of Australia”. The apparent incongruity of coal mining with the “Clean and Green” motto of the Upper Hunter Shire Council also received mention.

Some of these submissions spoke of the intimate connection of the small communities along the Pages River with its water resources, suggesting that it was integral to how they derived their identity. Previous conflicts within these communities during periods of drought were raised to illustrate the vulnerability of these communities to further change.

About 20% of submissions suggested that the proposal made poor strategic planning sense. This position was distilled by many submitters into a catch cry of “wrong mine, wrong place”. A number of these submissions suggested, if not explicitly, that the proposal was inconsistent with the Objects of the EP&A Act, most notably Object 5 (ii) “the promotion and co-ordination of the orderly and economic use and development of land,” given the isolation of the proposal from the established and rapidly expanding mining areas lower down the Hunter and the fact that over its entire proposed 25-year life it would produce only a little more coal than the annual production of some of the larger existing and proposed mines in Muswellbrook and Singleton areas.

Approximately 20% of submissions also identified that, when considered from a purely development assessment perspective, or “on its merits”, the proposal would fail the ultimate cost-benefit analysis test. This conclusion again revolved around considerations of risk, with many submitters contending that the environmental, social and economic risks were of such magnitude that they could not justify the comparatively modest benefits that the proposal could bring in the form of local employment and economic stimulus - even if the proponent’s estimates for these positive effects were taken at face value.

Closely related to this issue, approximately 10% of general public and nearly 40% of the special interest, local industry and business submissions suggested that the proposal would generate net economic and employment losses for the local region. Most of these submissions pointed to the net economic worth and annual turnover of the thoroughbred and other equine industries, the industries and businesses they support, other local agricultural industries and the tourism industry and suggested that these were at risk.

Some submitters (including both the Upper Hunter Shire Council and Muswellbrook Shire Council) cast doubt on the proponent’s assumption that the jobs at the mine would be sourced from the local area (and Murrurundi in particular), pointing to the very low unemployment rate of 3.6% for the Hunter region and the strong evidence

that any sufficiently qualified person who is currently seeking work in a mine can get it, meaning that jobs taken up at Bickham would be highly likely to be relocations from other mines.

Approximately 14% of the general public and 36% of the special interest, local industry and business submissions were focussed on the perceived threat to the strongly established thoroughbred industry in the Upper Hunter region.

A minority of these submissions raised concerns in relation to potential reductions in water availability for stud and broodmare farms downstream or near to the mine. However, most were concerned with the fact that the current status of the part of the Upper Hunter from Aberdeen to Murrurundi as being unspoilt, fertile and mine-free has been instrumental in building its reputation as an ideal environment for rearing world-class racehorses and in more recent years attracting substantial international investment and the description “The Kentucky of Australia”. The point was made multiple times that this reputation was both hard won and fragile.

The submissions made the point that bringing coal mining into the area could wholly or partially shatter this reputation regardless of whether concerns are technically soundly based, or whether the mine was perceived to be the “thin end of the wedge”. Some submitters suggested that if this were to happen, international investment could be rapidly withdrawn and approximately 60% of the most valuable stallions relocated overseas, which would create a cascading effect through broodmare farms and support industries, including Scone Equine Hospital, feed merchants and farriers.

Several submissions highlighted that the thoroughbred industry was proven and sustainable, with a smaller number speaking of the burgeoning potential for the industry to increase significantly by tapping into the potential Chinese market, thereby realising much greater economic and employment benefits in the future.

About 22% of the general public and 18% of the special interest, local industry and business submissions raised concerns with dust emissions and related health problems. It was clear from these submissions that the perception of a strong link between mine generated dust (coarse dust, PM<sub>10</sub>, PM<sub>2.5</sub> and PM<sub>1</sub>) and reduced respiratory function is now widespread and entrenched in the Hunter Valley community. Many were fearful of a cumulative effect in conjunction with the established mines lower down in the Hunter, particularly around Muswellbrook.

Approximately 12-13% of submissions suggested various levels of distrust in the proponent, based on what they perceived as the frequently changing nature of the proposal (variously described as the ‘Pinocchio Mine’ and the ‘Magic Pudding Mine’). Submissions overwhelmingly viewed all changes to the proposal since its inception 10 years ago in a negative light, with most believing these changes were made to frustrate rather than accommodate community concerns. A subset of these submissions were highly suspicious of the proponent’s intentions to expand the mine or conduct underground mining to the west of the New England Highway, based on earlier statements and the known coal resources.

Several of these submissions considered the proponent's consultation to have been incomplete, with suggestions that it seemed to be conducted in fits and starts with extended periods of disengagement.

A smaller number of submitters queried the achievability of nil-discharge over the life of the mine and of long-term operations without a coal washery, and others were highly critical that the proponent had not rehabilitated the bulk sample pit.

12% of the general public and 18% of the special interest, local industry and business submissions raised concerns in relation to CO<sub>2</sub> emissions and the continuing use of coal in a climate-conscious era. Many of these submissions stressed that there were a range of alternative energy sources available which remove the need for new coal mines.

Approximately 4% of the general public and 12% of the special interest, local industry and business submissions suggested that a coal mine was incompatible with the creative and unconventional industries at Murrurundi, most notably arts-based, holistic health and alternative lifestyle organisations.

The threat was principally illustrated in terms of an irreconcilable discord between the values inherent in these industries and those of mining, with the suggestion that this negative association would endure despite the distance of the mine from Murrurundi itself.

About 4% of the general public and 18% of the special interest, local industry and business submissions were concerned with the visual impacts for motorists on the New England Highway, surrounding landowners and bushwalkers. The proximity of parts of the proposed western pit footprint to the New England Highway was noted by some.

About 6% of submissions from both sources mentioned the lack of support for the mine across the Upper Hunter Shire Local Government area and beyond. Some of these submissions referred to the results of previous survey work by the Council in this regard.

Other matters raised by some submitters included:

- Property devaluations both in close proximity to the mine and downstream;
- Impacts on Burning Mountain Nature Reserve, potentially through geotechnical stability issues caused by mining operations, particularly blasting;
- Potential water-related impacts on Cameron's Gorge Nature Reserve, particularly GDEs; and
- Generalised concerns about coal mining, including the poor record of compliance enforcement and rehabilitation.

The small proportion submissions supporting the proposal were strongly of the view that the town of Murrurundi had been in decline for one to two decades, with the closure of several retail and service businesses during this period. These submissions suggested that the proposal could reverse this decline by attracting new families, businesses and community growth opportunities. The point was made that only the certainty provided by a major project like Bickham could create the necessary

confidence for people and investment to return. This position was strongly challenged by other Murrurundi residents and businesses and who took the view that the future of Murrurundi required investment in the health and arts-based industries and that this investment was being stifled by the threat of the Bickham proposal.



**ANNEXURE 2.1.2: LIST OF SUBMITTORS TO THE DEPARTMENT OF PLANNING**

**GENERAL PUBLIC – INDIVIDUAL SUBMISSIONS**

<b>No.</b>	<b>First Name(s)</b>	<b>Last Name</b>	<b>Position</b>
1	Leslie	Wand	Object
2	Jan	Allen	Object
3	Fitzroy	Boulting	Object
4	Nicola	Cramsie	Object
5	Larry and Dinah	Norton	Support
6	Paul	Beiboer	Object
7	Victoria	Hine	Object
8	Greg	Scott	Object
9	Hannah	Kay	Object
10	Robert	Doonan	Support
11	Danielle	Hush	Object
12	Jayne	Crawford	Object
13	Alison	Hodges	Object
14	Harry	Ford	Object
15	Dennis	James	Object
16	Teresa	Byrne	Object
17	Audrey	Entwisle	Object
18	Sandra	Winkelman	Object
19	Eric	Benton	Object
20	Kate	Arnott	Object
21	Rosemary & Puck	King	Object
22	Philippa	Baker	Object
23	Debbie	Benton	Object
24	Pauline	Carrigan	Object
25	Jenifer	Ellis	Object
26	Judith	Wheeler	Object
27	Roslyn	Armstrong	Object
28	Stuart	Marshall	Object
29	Martin	Cousins	Object
30	Elissa	Fletcher	Object
31	Louise	Goggin	Object
32	Elaine	Goggin	Object
33	Alison	Haydon	Object
34	Ivan	Woodford-Smith	Object
35	Stuart	Carter	Object
36	Charlotte	Drake-Brockman	Object
37	Toni and Patrick	Malone	Object
38	Brett	Ward	Object
39	Sharon and Rodney	Jerrick	Object
40	Rick	Thompson	Object
41	Malcolm	Jerrick	Object
42	Lindsay	Jerrick	Object
43	Rosalind	Jerrick	Object

<b>No.</b>	<b>First Name(s)</b>	<b>Last Name</b>	<b>Position</b>
44	Marry	Nixon	Object
45	Marina	Dulhunty	Object
46	LG & CJ	Hamson	Object
47	David and Claire	Paradice	Object
48	Peter	Hodges	Object
49	Phillipa	Hargreaves	Object
50	Trish & David	Booker	Object
51	James	Hargreaves	Object
52	Lindsay	Muffett	Object
53	Amanda	Gaffney-Ray	Object
54	Beverley	Atkinson	Object
55	Aurora	Adams	Object
56	Paul	Adams	Object
57	Michaela	Malone	Object
58	Peter	Bennetto	Object
59	Ian	Archibald	Object
60	Cameron	Mackintosh	Object
61	Geoffrey	Tripley	Object
62	Caroline	Sherwood	Object
63	Emma	Ray	Object
64	Nick	Adler	Object
65	Kathryn	Jennett	Object
66	Graham	Brown	Object
67	Peter	Millgate	Support
68	Chris & Meredith	Bowman	Object
69	Sue	Adams	Object
70	Jennifer	Russ	Object
71	Paul	Bryden	Object
72	Louise	Jennett	Object
73	Carey	Guihot	Object
74	Peter	Jennett	Object
75	Sally	Ward-Thomas	Object
76	Sharna	Millgate	Support
77	Paul & David	Stevenson	Object
78	J	Peisley	Object
79	Michael	Millgate	Support
80	Anita	Lawrence	Object
81	Matt	Finlayson	Object
82	John	Stitt	Object
83	Cathy	Finlayson	Object
84	Dianne	Deery	Object
85	Ruth	Neave	Object
86	Lawson	Armstrong	Object
87	John	Wharton	Object
88	Bev	Nugent	Object
89	Di	Van Balen	Object
90	Hilary	Nicol	Object

<b>No.</b>	<b>First Name(s)</b>	<b>Last Name</b>	<b>Position</b>
91	Murray	Armstrong	Object
92	Deborah	Miller	Object
93	Pamela	Seccombe	Object
94	M & S	Watson	Object
95	MJ & ME	Smith	Object
96	Sam	Johnsen	Object
97	Cloe	Jennett	Object
98	Phillip	Adams	Object
99	Christian	Raith	Object
100	J	Hill	Object
101	James & Sally	Archibald	Object
102	Kiwa	Fisher	Object
103	George	Cliff	Object
104	Michael	Holmes	Object
105	Stephen	Tuffin	Object

**GENERAL PUBLIC – FORM LETTERS**

No.	First Name(s)	Last Name
1	Ross	Warnock
2	Philip	Clarke
3	Robyn	Wheatley
4	Gabriella	Sedgwick
5	Joseph	Sedgwick
6	Ned	Sedgwick
7	Robert	Watson
8	Julie	Leckie
9	Jamie	Kenyon
10	Kirsty	Fagan
11	Christina	Lee
12	Robert	Mailer
13	Barbara	Mailer
14	Caroline	Hayes
15	Susan	Macintyre
16	Shaneen	Crouch
17	J	Petersen
18	Magdalen	Simpson
19	Jessica	Clarke
20	Alan	Clarke
21	Gail	Clarke
22	Nicole	Blakkadder
23	J	Peisley
24	Delma	Ross
25	Kaylene	Holman
26	Lynette & Ross	Banks
27	Emma	Parkinson
28	Alastair	Pulford
29	Danielle	Hush
30	Caroline	Hayes
31	SC	Murdoch
32	Justin	Hush
33	Kate	Mailer
34	Anthony	Banister
35	Lynda	Banister
36	Keith	Bedggood
37	Skye	Petersen

**SPECIAL INTEREST, LOCAL INDUSTRY & BUSINESSES – INDIVIDUAL SUBMISSIONS**

No.	First Name(s)	Last Name	Organisation/Company	Position
1			Baker & Mckenzie c/- Bickham Coal Action Group	Object

No.	First Name(s)	Last Name	Organisation/Company	Position
2	Peter	Hodges	Kingdon Ponds and Tributaries Water User Association Inc	Object
3	Mandy	Archibald	Murrurundi Arts Council	Object
4	James	Horn	Stop Open Cut Coal Mining	Object
5			Turning the Pages Inc	Support
6	Peter	Bennetto	Pages River & Tributaries Water Users Association	Object
7	Graham	Hook	Pages River Water Users Association	Object
8	Stephen	Hostetler	Upper Hunter Water Keepers Alliance	Object
9	Steve	Guihot	Upper Hunter Progress Association Inc	Object
10	Suzie	Worth	Wanaruah Local Aboriginal Land Council	Support
11	Michael	Satara	Milbor Corporation (Aust) Pty Limited c/o Allens Arthur Robinson	Object
12	Senga	Bissett	Ashleigh Thoroughbreds	Object
13	Peter	Orton	Managing Director, Vinery Stud Australia Pty Ltd	Object
14	Ian	McDuie	Director, Hunter Thoroughbred Management Pty Ltd	Object
15	Wayne	Bedggood	President, Hunter Thoroughbred Breeders Association Inc	Object
16	Meryan	McRobert		Object
17	Peter	Boyle	Sefton Park Stud	Object
18	John and Keryn	Hutchinson	Scone Bloodstock Services Pty Ltd	Object
19			William Inglis & Son Limited	Object
20	Andrzej	Gospodarczyk	Murrurundi House	Object
21	Anthony	Williams	Magic Millions Sales P/L	Object
22	Emma	Ridley	Darley Australia Pty Ltd	Object
23	Bernard	Levy	Vice President, Pages River Water Users Association	Object
24	Simon	Ford	Murrurundi Motel	Support
25	Denis	Roberts	Owner, Trevannah Stud (Roberts Bloodstock Pty Ltd)	Object
26	Doug & Nicola	Robertson	"Turanville"	Object
27	Kerrie	Tibbey	Proprietor, Goodwood Farm	Object
28	Barry	Daniels	Buring Mountain Antiques	Object
29	A	Raymond	Sledmere Stud	Object
30	Jon	Finlayson	Manager, Scone Pastoral	Object

No.	First Name(s)	Last Name	Organisation/Company	Position
			Company	
31	Graham & Helen	Walker	"Segenhoe View B&B"	Object
32	Peter	Haydon	Haydon Horse Stud	Object
33	Vivienne	King	"Ferndale Farm"	Object
34	Paul & Maureen	Bowd	Dooleys Store	Support

**SPECIAL INTEREST, LOCAL INDUSTRY & BUSINESSES – FORM LETTERS**

No.	First Name(s)	Last Name	Organisation/Company/Capacity
1	Alice	Minter	
2	Rowan	Sedgwick	
3	Lucy	Roberts	
4	Leona	McGovern	
5	Sarah	Ryan	
6	Megan	Wayne	
7	Lynda	Pearson	
8	Jacqueline	Stewart	
9	John	Coras	
10	Artem	Butenko	
11	Mike	Timmis	Ariella Park
12	Michael	Mant	
13	Stephen	Bell	
14	Iain	Hayes	
15	John and Keryn	Hutchinson	
16	Nikki and Blair	Richardson	Vantage Hill
17	Alison	Hush	Manager, Lustre Lodge
18	Adam	O'Regan	
19	Sarah	Flynn	Braedeen
20	Tony	O'Driscoll	Coolmoore Australia
21	Jessica	Faras	Willow Park Stud
22	Sally	Gordon	Darley Stud
23	Catriona	Murphy	
24	Ebonie	Macleod	
25	Elli	Woolueridge	
26	Glenn Burrows &	Joan Faras	Willow Park Stud
27	Jennifer	Squillari	Management Accountant, Darley Stud + Dairy Farmer
28	Carole Ann	Richards	Racehorse Owner/Breeder
29	Rob	Baker	
30	Tom	Seymour	Darley Australia, Marketing Manager

No.	First Name(s)	Last Name	Organisation/Company/Capacity
31	Natalie	Welsh	Darley Australia Admin Manager
32	Luci	Metcalf	Director, Meteq Pty Ltd
33	Glenn	Fraser	Thoroughbred Industry investor
34	Alana	O'Shea	Stud farm worker
35	Paul	Brosnan	Manager, Trevannah Stud (Roberts Bloodstock Pty Ltd)
36	J	Robertson	Kingdon Ponds Water Users
37	David	Petersen	Head Gardener, Darley Australia
38	Catherine	Chicken	Consultant Vet, Scone Veterinary Hospital
39	Melissa	Clarke	
40	Warren	Park	Turangga Farm
41	Renee	Park	Turangga Farm
42	Dianne	Hewitt	Asst Stud Secretary, Darley Australia
43	Philip	Downham	Stud Worker
44	Samantha	Larder	Stud Worker
45	John & Caren	Maxwell	Priefert Australia Pty Ltd
46	Duncan	Pinfold	Director, Kyambra Financial Strategies
47	C	McDonald	
48	E	Ridley	c/- Darley Stud
49	Alastair	Pulford	Darley Australia Pty Ltd
50	Alison	Sedgwick	
51	Clifford	Ellis	
52	Ross	Dillon	Co-owner, Goanna Downs Broodmare Farm
53	Pavela	Dillon	Co-owner, Goanna Downs Broodmare Farm
54	Stuart	Ramsey	Owner, Turangga Farm
55	Jackie	Long	Darley Crown Lodge
56	Brad	Widoup	Asst Trainer, Darley Crown Lodge
57	Jeremy	Metcalf	Farrier, Meteq Pty Ltd
58	Anna	Barker	Goodwood Farm
59	Steve	Murray	Goodwood Farm
60	Darrell	Speck	Goodwood Farm
61	Richard	Sonnichsen	Darley Australia Pty Ltd
62	Henry	Plumptre	
63	Lisa	O'Neill	
64	James	Griffiths	Theydon Hall Farm
65	Elizabeth	Robertson	"Turanville"
66	Lorraine	Rea	Darley Australia Pty Ltd
67	G	Witters	Horse Breeder
68	Andrew	Perryman	Stud Manager, Darley Woodlands
69	Kathryn	Black	PA, Kyambra Financial Strategies
70	Matthew	Hill	Farm Manager, Racehorse Production

## ANNEXURE 2.2: SUBMISSIONS TO THE PLANNING ASSESSMENT COMMISSION

39 verbal presentations were made to the Commission (see Annexure 2.2.1 for a list of those who presented at the public hearing). 12 written submissions were also made to the Commission these are summarized below and were not supported by verbal presentations.

	<b>Name</b>	<b>Objection/Support</b>	<b>Issue</b>
1	Anonymous	Support	<ul style="list-style-type: none"> <li>• Economic activity</li> <li>• Job creation</li> <li>• Several other projects have failed to establish in the area</li> </ul>
2	Bill Howley	Objection	<ul style="list-style-type: none"> <li>• Risk to ecology and pastoral environment</li> <li>• Incompatibility with Council's Vision and Mission Statement</li> <li>• Horse breeding industry</li> <li>• Ecologically Sustainable Development</li> <li>• There are no other mines in the general vicinity</li> <li>• Social justice</li> <li>• Social conscience</li> <li>• Visual reference</li> <li>• Cost of infrastructure</li> <li>• Construction pollution</li> <li>• Traffic</li> <li>• Mud during rainfall events</li> <li>• Air pollution</li> <li>• Noise pollution</li> <li>• Threat to overall integrity, viability and sustainability of the horse stud industry</li> <li>• Threat of relocation of horse stud industry and job loss</li> <li>• Risk to water catchment</li> <li>• Impact on baseflows</li> <li>• Damage to avi-fauna, fauna and flora</li> <li>• Impact on great Eastern Range Wildlife Corridor</li> <li>• Heritage impacts</li> <li>• Impact on property values</li> <li>• Impact on resident's general amenity</li> <li>• No significant benefit to the local community</li> </ul>



	<b>Name</b>	<b>Objection/Support</b>	<b>Issue</b>
3	Nickie Cramsie	Objection	<ul style="list-style-type: none"> <li>• Modifications to the original plan have not removed the risks, particularly to the Pages River and Kingdon Ponds.</li> <li>• Ecologically Sustainable Development and the precautionary Principle.</li> <li>• Horse breeding industry</li> <li>• Upper Hunter is the centre for horse industries</li> <li>• Scone is the 'Horse Capital of Australia'</li> <li>• No thought given to strategic planning for the co-existence of coal mining and the thoroughbred breeding industry.</li> <li>• Scone vet hospital has put plans to expand on hold due to uncertainty.</li> <li>• Broodmare agistment farms face an uncertain future.</li> <li>• Deterioration in water quality</li> <li>• Air pollution</li> <li>• Artistic community of Murrurundi attracted due to the Pages River</li> <li>• Threat to Kingdon Ponds and Pages River</li> <li>• Sustainable development</li> </ul>
4	R.N Doonan	Support	<ul style="list-style-type: none"> <li>• Impact on the Pages River</li> <li>• Dust, noise and aesthetics could all be managed in a well run operation.</li> <li>• Potential job creation and economic activity from the mine.</li> <li>• Mine commencement site has been moved a considerable distance from the River.</li> </ul>
5	Elaine Goggin	Objection	<ul style="list-style-type: none"> <li>• Water related risks of the project <ul style="list-style-type: none"> <li>- Changes in runoff</li> <li>- Impact on aquifers</li> <li>- Effect of dissolved minerals leaching into underground water</li> <li>- Air pollution</li> </ul> </li> </ul>
6	J.H. Hill	Objection	<ul style="list-style-type: none"> <li>• Toxic metals and elements contaminating air and groundwater</li> <li>• Range of associated human and equine health risks</li> </ul>
7	Milbor Corporation Pty Ltd	Objection	<ul style="list-style-type: none"> <li>• Drawdown impacts on groundwater-fed springs and seeps</li> <li>• Monitoring measures and trigger points vague; not credible</li> <li>• Proposed compensation and remedial measures inadequate</li> <li>• Insufficient baseline monitoring during low-flow conditions</li> </ul>

	<b>Name</b>	<b>Objection/Support</b>	<b>Issue</b>
8	Mr David and Ms Claire Paradise	Objection	<ul style="list-style-type: none"> <li>• Decline in productivity of springs, soaks and bores</li> <li>• Contamination of tank drinking water supplies</li> <li>• 100 year period for recovery of water table</li> <li>• Geological complexities of site not fully understood</li> <li>• Others in mining industry consider site lacks suitability</li> <li>• Perception threat to cattle business</li> <li>• Proponent/consultants not sufficiently across details of site/area</li> <li>• Net economic losses for local area</li> <li>• Murrurundi demographic has few potential mineworkers</li> <li>• Deferred investment decisions due to uncertainty about mine</li> <li>• Need for closure</li> <li>• Poor strategic planning; high pain for little gain</li> <li>• Potential risks far outweigh potential rewards</li> <li>• Lessons from lower Hunter should not be revisited in Upper Hunter</li> <li>• Value and reputation of Thoroughbred industry at risk</li> <li>• Last remaining area of intensive agriculture in Hunter Valley</li> </ul>
9	Upper Hunter Shire Council	Objection	<ul style="list-style-type: none"> <li>• Centrality of thoroughbred and other equine industries to local economy and community</li> <li>• Strategic planning study into protecting these industries required; lessons from Kentucky and Newmarket</li> </ul>
10	Gavin Beard on behalf of Landmark	Objection	<ul style="list-style-type: none"> <li>• Uncertainty surrounding future of proposal impacting property sales and prices</li> <li>• Need for closure and certainty for investors</li> <li>• Value of thoroughbred and other agricultural industries</li> </ul>

	<b>Name</b>	<b>Objection/Support</b>	<b>Issue</b>
11	Angus Adkins on behalf of Scone Equine Hospital	Objection	<ul style="list-style-type: none"> <li>• Significant investment decisions stalled;</li> <li>• future of Scone Equine Hospital on hold</li> <li>• Risks to Thoroughbred Breeding and supporting industries much greater than potential economic benefits</li> <li>• Strategic study into Upper Hunter needed to thoroughly assess the present and future value of the equine and other long established agricultural industries</li> </ul>
12	Peter Hodges on behalf of Kingdon Ponds Waterusers and Tributaries Assoc.	Objection	<ul style="list-style-type: none"> <li>• Other mining operations approved in the area have resulted in residents relocating.</li> <li>• Potential relocation of horse stud industry</li> <li>• Air pollution <ul style="list-style-type: none"> <li>- from other mines in Muswellbrook</li> <li>- toxic plumes from diesel fuel</li> <li>- acceptable particulate size</li> <li>- Katabatic drift</li> <li>- diesel fumes</li> <li>- dust from coal mining</li> <li>- lack of water during drought will exacerbate the impacts</li> <li>- coal dust</li> <li>- moisture applied to dust dries up quickly</li> <li>- pollution will be made worse by the failure of the WRA</li> </ul> </li> <li>• Galenia introduced to provide groundcover for degraded mine sites has spread beyond mine boundaries.</li> <li>• Impact on other industries.</li> <li>• Potential relocation of horse studs.</li> </ul>

	<b>Name</b>	<b>Objection/Support</b>	<b>Issue</b>
13	Hunter Thoroughbred and Breeders Association	Objection	<ul style="list-style-type: none"> <li>• 150 year history and hard-won international reputation of Thoroughbred Breeding industry</li> <li>• ‘Critical mass’ of Thoroughbred Breeding operations in area promotes plethora and diversity of support industries</li> <li>• Value of industry and international investment increased significantly in recent years</li> <li>• Mine could threaten perception among investors of area as ideal for rearing world-class racehorses</li> <li>• Relocation of stallions by international investors would have cascading effect through supporting industries</li> <li>• Billions of dollars of future investment at risk</li> <li>• Major employer of skilled and unskilled labour in LGA</li> <li>• Lessons from the effects on the character of the Lower Hunter Valley</li> <li>• 50 stud and broodmare farms reliant on Pages/Kingdon Ponds catchments</li> <li>• Risks to equine and other industries eclipse potential benefits</li> <li>• 100-years for restoration of pre-mining flows</li> <li>• Bickham decision a ‘watershed’ for future of Thoroughbred industry</li> <li>• Need for closure</li> </ul>

## ANNEXURE 2.2.1: PUBLIC HEARING SCHEDULE

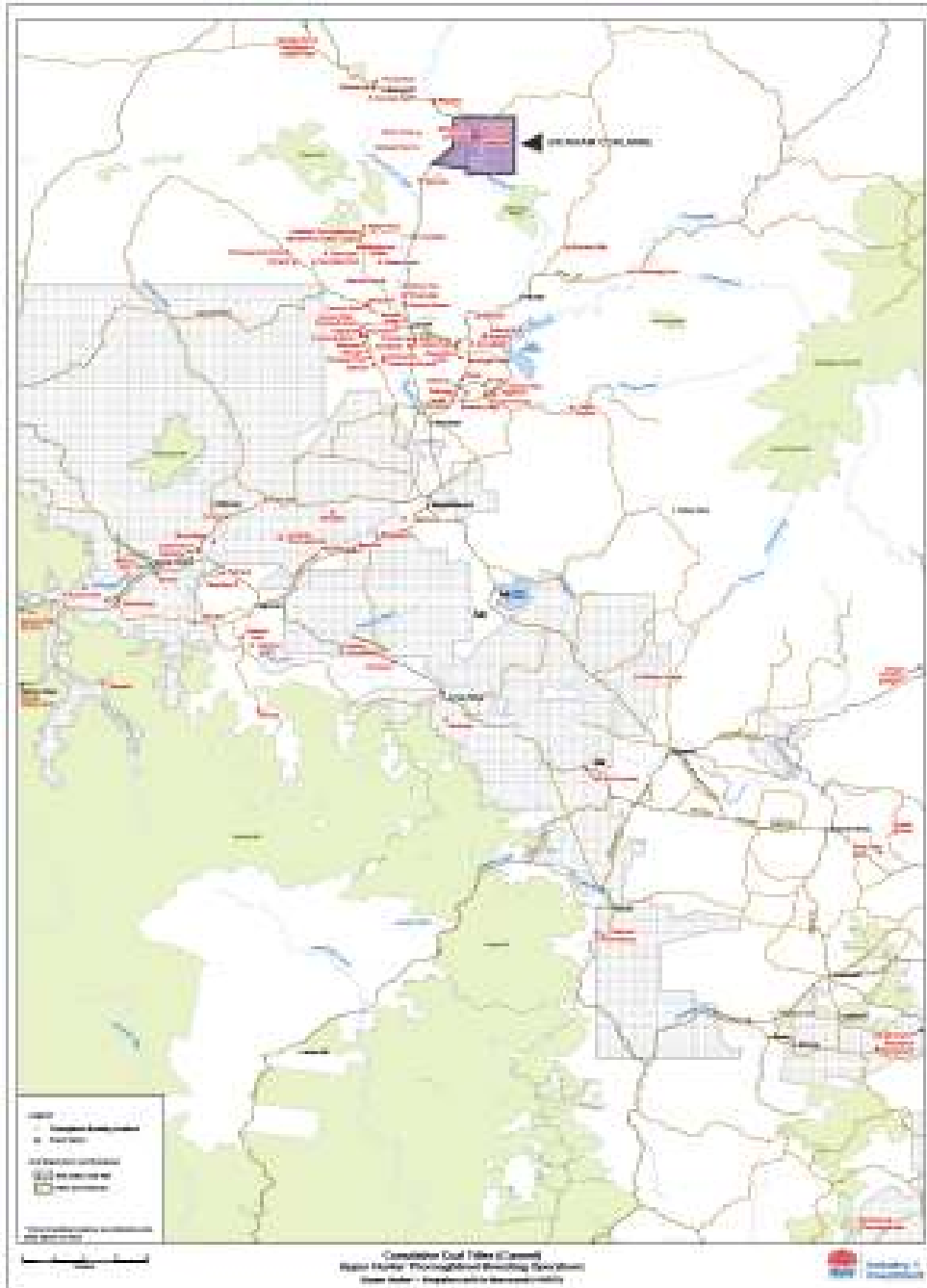
### Schedule of Planning Assessment Commission Hearings Bickham Coal Project

Held at Scone Council, 135 Liverpool Street, Scone  
17 & 18 March 2010

<b>Wednesday, 17 March 2010</b>			
<b>Time</b>	<b>#</b>	<b>Name of Speaker(s)</b>	<b>Representation of Speaker(s)</b>
09:00-09:10		Dr Neil Shepherd	Panel Chair Opening Statement
09:10-09:40	1	Peter Dundon Dr Steve Perrens	Bickham Coal Company
09:40-10:10	2	Peter Bennetto	Pages River & Tributaries Water Users
10:10-10:40	3	Steve Guihot	Paddock to Pantry
<b>10:40-11:00 MORNING TEA</b>			
11:00-11:30	4	Patrice Newell	Gundy Water Users Association
11:30-12:00	5	John Messara	Hunter Thoroughbred Breeders Association (HTBA)
12:00-12:10	6	Ali Haydon	Individual
12:10-12:20	7	Simon Ford	Individual
12:20-12:30	8	Matthew Randle	Individual
12:30-12:40	9	Christian Paget	Individual
<b>12:40-1:30 LUNCH</b>			
1:30-2:00	10	Peter Haydon	Haydon Horse Stud
2:00-2:30	11	Lisa Foster	Murrurundi House
2:30-2:40	12	John Hill	Individual
2:40-2:50	13	Alison Coates	Individual
2:50-3:20	14	Suzie Worth	Wanaruah Local Aboriginal Land Council
<b>3:20-3:40 AFTERNOON TEA</b>			
3:40-4:10	15	Boyd Dent Peter Hodges	Kingdon Ponds & Tributaries Water Users Association
4.10-4.20	16	Angus Adkins	Scone Equine Hospital
4.20-4.30	17	Roslyn Armstrong Catherine Finlayson Sarah Finlayson	Upper Kingdon Ponds Concerned residents
4.30-4.40	18	Stuart Marshall	Individual
4.40-4.50	19	Peter Bush	Individual
4.50-5.00	20	Katrina Partridge	Individual

<b>Thursday, 18 March 2010</b>			
<b>Time</b>	<b>#</b>	<b>Name of Speaker(s)</b>	<b>Representation of Speaker(s)</b>
9:00-9:10		Dr Neil Shepherd	Panel Chair Opening Statement
9:10-9:40	1	Steve Webb	for Michael Satara (Individual)
9:40-9:50	2	Laurie Ninness	Murrurundi Sand & Gravel Pty Ltd
9:50-10:00	3	Brian Fields	Individual
10:00-10:30	4	James Horn	Stop Open Cut Coal Mining
10:30-10:50	<i>MORNING TEA</i>		
10:50-11:00	5	Traci Lamey	Individual
11:00-11:20	6	Phillip Adams	Individual
11:20-11:35	7	Martin Rush (Mayor)	Muswellbrook Council
11:35-11:45	8	Catherine Chicken	Individual
11:45-12:00	9	Mandy Archibald	Murrurundi & District Arts Council
12:00-12:45	<i>LUNCH</i>		
12:45-1:15	10	David & Claire Paradice	Individual
1:15-1:30	11	Daryl Dutton (General Manager)	Upper Hunter Shire Council
1:30-2:00	12	Steven Hofsteter	Upper Hunter Waterkeepers Alliance
2:00-3:00	13	Paul Smith Neil Sutherland James Warren Owen Droop Erin Holton Andrew Beatty	Bickham Coal Action Group
3:00-3:10	14	Jonathan Darcy	William Inglis & Son
3:10-3:30	<i>AFTERNOON TEA</i>		
3:30-4:15	15	Sandra Duggan Steve O'Connor	Upper Hunter Progress Association
4:15-4:25	16	Dr. Tuan Au	Individual
4:25-4:35	17	Kaye Monro	Individual
4:35-4:45	19	Nickie Cramsie	Individual
4:45-4:50	20	Cameron Smith	Individual

**ANNEXURE 3.1: MAP OF UPPER HUNTER SHOWING EXISTING MINING AREAS AND THE LOCATION OF THE BICKHAM PROJECT**



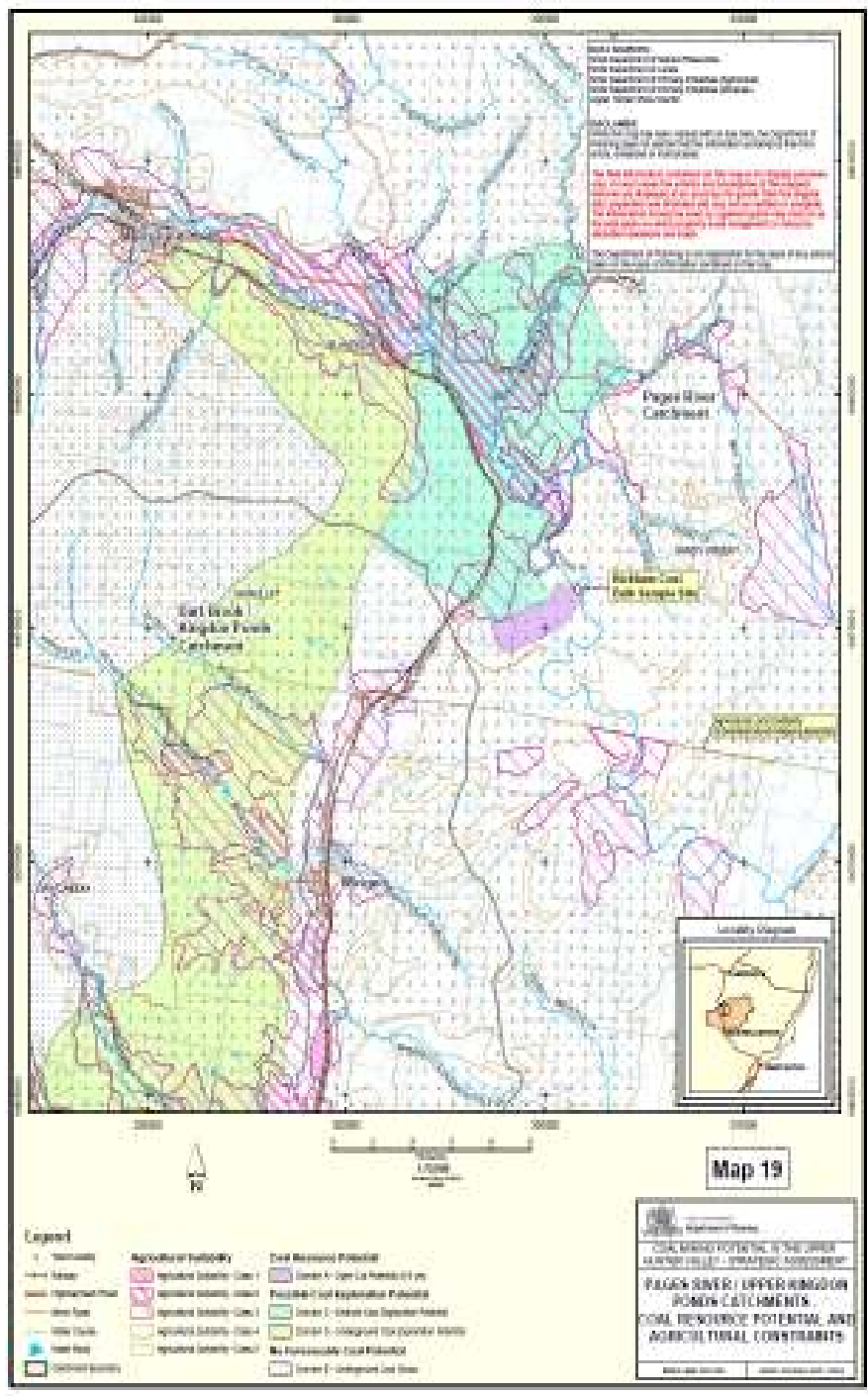
**Location of mining areas**

Source: *Cumulative Coal Titles (current) Upper Hunter Thoroughbred Breeding Operations*, Department of Industry and Investment





### ANNEXURE 3.3: POTENTIAL COAL RESOURCE IN THE UPPER HUNTER VALLEY SHIRE – PAGES RIVER CATCHMENT



#### Pages River Catchment Water Landuse Constraints

Source: *Coal Mining Potential in the Upper Hunter Valley – Strategic Assessment*, Department of Planning, 2005

**ANNEXURE 4.1: QUESTIONS AND REQUESTS TO THE PROPONENT**

**ANNEXURE 4.2: THE PROPONENT'S RESPONSES TO  
QUESTIONS FROM THE COMMISSION**