Appendix A – Terms of Reference

Request to the Planning Assessment Commission

Boggabri Coal Project

Section 23D(1)(b)(ii) of the Environmental Planning and Assessment Act 1979. Clauses 268R(1)(a) and 268V of the Environmental Planning & Assessment Regulation 2000.

I, the Minister for Planning and Infrastructure request the Planning Assessment Commission (the PAC) to:

1. Carry out a review of the merits of the Boggabri Coal Project, which:
   a. takes into consideration the environmental assessment for the project, issues raised in public and agency submissions and any other information provided during the review process;
   b. assesses:
      - the potential cumulative dust, noise, blasting and water impacts of the project;
      - the potential biodiversity impacts of the project;
      - the merits of the mine plan, paying particular attention to the proposed final void and future rehabilitation of the project; and
      - any other potentially significant impacts of the project.
   c. recommends appropriate measures to avoid, minimise and/or offset these impacts; and
   d. provides advice on the merits of the project as a whole.

2. Conduct public hearings during the carrying out of the review.

3. Submit its final report on the review to me by 16 December 2011, unless the Director-General of the Department of Planning and Infrastructure agrees otherwise.

The Hon Brad Hazzard MP
Minister for Planning & Infrastructure

14 SEP 2011

Sydney

2011
## Appendix B – Summary of Submissions to the Planning Assessment Commission

<table>
<thead>
<tr>
<th>Name</th>
<th>Issues raised</th>
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</table>
| Narrabri Shire Council        | • The project is important to the shire and would have major impacts should it not proceed  
• An alternative to Leard Forest Road needs to be provided  
• Agricultural activities on buffer zone properties should continue to operate  
• Ongoing community consultation will be needed  
• Proactive real-time dust and noise monitoring and management  
• Namoi Water study  
• Need for surface and groundwater monitoring  
• Waste and the need to integrate mine waste plan with other mines  
• Transport and the need for a shuttle bus for workers  
• Need for contributions to infrastructure such as child care and Narrabri Airport, as well as a per tonne contribution to cover maintenance  
• Social impacts such as housing availability and on services such as police, medical and aged care  
• Cumulative impacts need independent monitoring and an ombudsman should be appointed to report to the minister and the public.                                                                                                                                                                                                                                                                                                                                                       |
| Maules Creek Community Council| • Long-term negative impacts of clearing native forest  
• Air quality  
• Cumulative impacts on social impact resilience thresholds  
• Noise  
• Blasting  
• Compliance  
• Socio economic impacts, including:  
  o impacts on labour force availability for the existing farms;  
  o the impacts of a fly in fly out workforce;  
  o depopulation and crowding out of the local community;  
  o long term viability of the mine – potential boom bust cycle  
• Greenhouse gas emissions from the downstream use of the coal  
• Underground mining would be preferable to open cut, including:  
  o Reduced impacts on local community;  
  o Reduced biodiversity offset requirements and associated depopulation;  
  o Cumulative impacts would be minimised; and  
  o Underground mining would provide a net benefit to the community.  
• Land Capability and rehabilitation, including:  
  o The land capability assessment did not assess the existing forest;  
  o Proposed rehabilitation considered unacceptable for long term viability;  
  o Soil depths need to be restored to ensure there is adequate provision for the rehabilitation vegetation.                                                                                                                                                                                                                                                                                                                                                                                   |
<table>
<thead>
<tr>
<th>Name</th>
<th>Issues raised</th>
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</table>
| Namoi Water                             | • Potential inaccuracies in the groundwater model including:  
                                            o the need for further calibration;  
                                            o the interface between the bedrock and alluvial aquifers;  
                                            o not in accordance with scientific guidelines;  
                                            • Cumulative groundwater impacts of Boggabri and the surrounding mines need to be assessed  
                                            • Loss of well yield needs to be appropriately measured and described  
                                            • The mine should be required to measure its water use, including groundwater, in accordance with the monitoring and compliance guidelines that apply to other industry including agriculture.  
                                            • The principles of the draft Aquifer Interference Policy should be applied to the mine  
                                            • The Namoi Catchment Water Study is expected to provide useful input into the potential impacts of mining and should be used to determine the magnitude of the potential risks to water quality and quantity. |
| Northern Inland Council for the Environment | • The Laird State Forest is a high priority for additional conservation, including:  
                                            o As a conservation corridor; and  
                                            o As one of the few reserves within the Liverpool Plains province.  
                                            • The project would have a significant impact on biodiversity, given:  
                                            o The magnitude of the clearing proposed (includes 646 ha of critically endangered Box-Gum Grassy Woodland);  
                                            o Cumulatively mining will reduce the amount of woody vegetation below the 30% threshold;  
                                            o The conservation significance of the Leard State Forest; and  
                                            o Less than 0.1% of Grassy White Box Woodland remains in a near-intact condition;  
                                            • The proposed biodiversity offsets are inadequate and do not provide like for like habitat:  
                                            o The vegetation in the offset areas is sparse and heavily cleared;  
                                            o Vegetation communities are not always consistent; and  
                                            o Offsets have an inferior spatial configuration.  
                                            • Success of proposed mine rehabilitation efforts is uncertain  
                                            • Greenhouse gas emissions will accelerate global warming  
                                            • Health and social impacts on the wellbeing and livelihoods of the community |
| Mr Robert Crosby                        | • Dust impacts, including:  
                                            o Visible dust plumes;  
                                            o Potential impacts on cattle; and  
                                            o Potential impacts on tank water used at residence  
                                            • Noise, including:  
                                            o Reversing alarms are audible at residence;  
                                            o Operational noise; and  
                                            o Need for a noise monitor at residence  
                                            • Traffic safety, including:  
                                            o Speeding; and |
<table>
<thead>
<tr>
<th>Name</th>
<th>Issues raised</th>
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<tbody>
<tr>
<td></td>
<td>o Potential conflicts with school bus</td>
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<td></td>
<td>• Health impacts</td>
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<tr>
<td></td>
<td>• Monitoring currently inadequate.</td>
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<tr>
<td>Name withheld on request</td>
<td>• Cumulative impacts of the Boggabri, Tarrawonga and Maules Creek mines on dust, noise, lighting, water use and traffic</td>
</tr>
<tr>
<td></td>
<td>• Impacts on stable agricultural operations</td>
</tr>
<tr>
<td></td>
<td>• Need for community consultation to be ongoing</td>
</tr>
</tbody>
</table>

The Commission also received submissions from the NSW Office of Environment and Heritage and the Namoi Catchment Management Authority. These submissions are appended below.
Submission to the Planning Assessment Commission for the Continuation of the Boggabri Coal Project

1. Introduction

Namoi CMA has decided to undertake an additional review of the development for the proposed Continuation of the Boggabri Coal Project (proponent). This decision is based on the following:

- The establishment of the Planning Assessment Commission (PAC), its terms of reference and the call for additional submissions from agencies,
- The Response to Submissions prepared for the proponent by Hansen Bailey, primary consultant,
- The Residual Matters Report prepared for the proponent by Hansen Bailey,
- Re-examination of the relevant sections of the Continuation EA and the specialist consultants reports for Boggabri Coal Project,
- Discussions with representatives from the PAC and from the Department of Planning and Infrastructure (DoPI),
- Namoi CMA’s submission prepared in January 2011 on the Continuation EA,
- Namoi CMA’s submission on the proponent’s EA for the Modification to the Development Application (DA36/1988 MOD 2), the response to that submission and the DoPI Determination,
- Namoi CMA’s submission on the EA for the Maules Creek Coal Project, and
- Submissions made by the public and other agencies.

Namoi CMA is primarily interested in major developments such as the Continuation of the Boggabri Coal Project from the perspective of Catchment and community impacts and benefits especially in the areas of protection of biodiversity, management of riparian areas, sustainability of agricultural soils, maintenance of long term productive land uses and enhancement of social and economic values.

Namoi CMA has three documents which guide developments and activities, including mining, in the Catchment:

- Namoi Catchment Action Plan 2007 (Namoi CAP), and
• Extractive Industries Policy (NCMA EIP 2009) for the Namoi Catchment.
• Biodiversity Offsets Policy (BOP 2011)

Namoi CMA's review and brief submission on the Continuation EA prepared in January 2011 requested that the proponent, in their response to submissions, address the relevant Namoi CAP targets and NCMA EIP 2009 principles. Furthermore, Namoi CMA suggested, in its submission, that the Continuation EA had addressed the issues of ecology, biodiversity offsets, surface water, flooding, groundwater, soil management, rehabilitation and final landform.

However, in light of the recently developed BOP 2011, Response to Submissions and Residual Matters Report, Namoi CMA has some reservations as to whether the Continuation EA and more recently, the Response to Submissions and the Residual Matters Report has adequately addressed the issues of soil management and rehabilitation which impacts on a range of other issues of concern.

2. Soil Management

The Response to Submissions and the Residual Matters Report both state that the proponent proposes to restore the project disturbance area to achieve a biodiversity outcome rather than a commercial forestry outcome.

Furthermore, the proponent is extensive in its proposal to achieve a biodiversity outcome for the loss of vegetation, habitat and threatened species through avoiding, mitigating and compensating for the clearing impacts. Significant studies have been undertaken by the proponent, areas of land purchased for biodiversity offsets and large tracts of land proposed to be replanted and re-established as woodland and forest with resultant habitat and biodiversity values.

However, biodiversity is more than maintaining vegetation above the soil surface. To achieve a biodiversity outcome above the soil surface a viable and productive soil base is required. A 10 to 15cm layer of topdressing material placed over overburden will not allow for a long term sustainable biodiversity outcome to be achieved. Soil depth and type are major drivers of above ground biodiversity.

The Residual Matters Report on page 24 states that the 'overburden material is not simply 'solid rock', it is made up of gravel, sand, silt and clay sized particles'. The issue here is the definition of 'overburden'. On various mine sites across the Gunnedah Basin, the definition of overburden can range from solid rock that is blasted out of the ground to subsoil and even discarded topsoil. Overburden generally implies inert, coarse, waste rock material, no matter whether it is further defined as 'weathered' overburden or spoil.

Furthermore, soil is more than 'gravel, sand, silt and clay sized particles that improves water holding capacity'. It is acknowledged that soil texture is important, but so are other physical characteristics including soil structure (grading of soil texture, water holding capacity); soil biology (including organic matter, nutrient cycling); soil chemistry (including pH, salinity, nutrient availability). The soil is more than a medium to grow trees and shrubs.
The topsoil and subsoil provide a number of ecosystem services which have been largely discounted by the proponent. As well as being a growing medium for trees and shrubs, the soil also provides water regulation and storage, water purification, carbon storage, habitat for a range of fauna and flora, nutrient cycling, climate regulation and disease and pest regulation.

Both the topsoil and subsoil provide these ecosystem services which in turn lead to biodiversity outcomes. By not replacing the subsoil in the soil profile, the ability of the soil to provide these services is significantly reduced.

A key principle embedded in biodiversity management policies and procedures from the Commonwealth and State is ‘no net loss’ of biodiversity. However, without the return of a biological functioning soil profile, there is a net loss of biodiversity. A 10 to 15cm layer of topdressing material over overburden will not result in the return of a biological functioning soil.

It is well known that the subsoils are vitally important for re-establishing the soil profile during rehabilitation. Subsoils provide foundations for plants, nutrient cycling, soil water storage, soil formation, soil biological activity, buffering against pH and EC, and erosion mitigation.

Namoi CMA’s believes that some of the subsoils and unsuitable top soils from within the project disturbance area can be used for re-establishing the soil profile. These soils should be assessed more thoroughly by the proponent and included in a soil balance for the rehabilitated areas.

Namoi CMA believes that the return of the soil profile will have enormous benefits to the catchment and community, as well as the proponent, in the longer term.

<table>
<thead>
<tr>
<th>Concern</th>
<th>Recommendation</th>
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<tbody>
<tr>
<td>Without replacement of subsoils that biodiversity outcomes will not be achieved</td>
<td>The proponent needs to thoroughly assess the value of the subsoils and their role in achieving biodiversity outcomes.</td>
</tr>
<tr>
<td>Unsuitable topsoils and subsoils will be indiscriminately discarded</td>
<td>The proponent needs to thoroughly assess the unsuitable topsoils and subsoils and provide a plan for their stripping, amelioration, storage and respraying</td>
</tr>
</tbody>
</table>

The DoPI in their ‘Assessment Report’ for the Modification for Boggabri Coal have stated that it ‘agrees that both top soils and sub soils are a valuable resource for rehabilitation and for meeting long term biodiversity objectives for the site’. The DoPI have included a requirement in the Biodiversity Management Plan that Boggabri Coal ‘maximise the salvage and beneficial reuse of resources, including top and sub soils and other habitat features’. Namoi CMA supports DoPI for including this statement in their ‘Assessment Report’.

Furthermore, the Determination for the Modification for Boggabri Coal makes reference to a Biodiversity Management Plan which is to be prepared in consultation.
with OEH, Forest NSW and DRE with no mention of Namoi CMA. The Biodiversity Management Plan has requirements that include procedures for revegetation, soil management, rehabilitating riparian areas, managing salinity, controlling weeds and feral pests, grazing and general land management. Namoi CMA has considerable knowledge, experience and resources in these areas that would assist Boggabri Coal to develop a sustainable long term biodiversity management plan for the whole project site.

Namoi CMA recommends to the PAC that they strengthen the soil and biodiversity management condition statements within the Determination for the Continuation for the Boggabri Coal Project (see Recommended Condition Statements in section 7 of this submission)

3. Rehabilitation

As detailed above, the replacement of topsoil and subsoil is vitally important to achieve rehabilitation of and biodiversity outcomes for the project disturbance area.

Appendix S in the Continuation EA discusses soil suitability and availability for top dressing. This appendix specifies the depth of soil to be stripped, the area of suitable soil and the resultant volumes. However, there is no soil balance in appendix S so it is impossible to assess whether the proposed rehabilitation soil replacement will be achievable and acceptable.

However, it is possible to undertake some simple calculations based on the limited information in the Continuation EA and appendix S to ascertain indicative replacement topsoiling depths. Based on the area proposed to be disturbed (approx 1350ha), top dressing material that is suitable and available with the expected losses (volume available is 1,066,041m³ table 7 appendix S), there will be only enough top dressing material to spread it to a depth of less than 8cm across the 1350ha.

Furthermore, if only the subsoils from the Grey Brown Gradational loam are acceptable for rebuilding the soil profile then 8,263,500m³ (787ha by 1.05m deep) of subsoil will be available. This amount respread over 1350ha results in a depth of subsoil of 6cm, giving a total soil profile depth overlying the overburden of approximately 70cm. Namoi CMA believes that 70cm deep soil profile made up of topsoil and subsoil will achieve better and quicker rehabilitation than less then 10cm of topsoil overlying overburden.

Namoi CMA acknowledges that these simple calculations oversimplify the spreading depths and that spreading depth is dependent on land capability, agricultural suitability and final land use. However, it does highlight the need for more assessment of soils, pre and post mining land capability and agricultural suitability and the proposed rehabilitation. Also, this is a further reason why the subsoils and unsuitable topsoils should be retained and used to build the soil profile.

The Residual Matters Report lists a number of factors that influences the salvaging, stockpiling and respreading of the subsoils. Most of the factors can easily be overcome by placing the subsoils on reformed areas prior to topdressing and Namoi
CMA is sure this can be done as a part of the mining operations and rehabilitation sequencing.

<table>
<thead>
<tr>
<th>Concern</th>
<th>Recommendation</th>
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<tbody>
<tr>
<td>That there will not be enough suitable top dressing material to rehabilitate the project disturbance area</td>
<td>The proponent needs to re-assess the suitability, availability and constraints to respreading top soil and sub soil to the project disturbance area.</td>
</tr>
</tbody>
</table>

The Residual Matters Report in section 2.3.3 discusses Land Capability and provides figures 4 and 5. Figure 4 depicts the pre-mining Land Capability which classes the land on the northern project boundary as Land Capability class V. When compared with the Land Capability maps for the Maules Creek Coal project which borders Boggabri Coal project, the corresponding land on the Maules Creek Coal project's southern boundary is classified as Class VII.

These differences in Land Capability classes from one project to another raises doubts as to the accuracy of the Land Capability assessments for the Boggabri Coal project. These doubts were further raised in the comments provided to DoPI regarding the recent Modification Application for the Boggabri Coal Project.

Land Capability and Agricultural Suitability assessments are important in EAs and project proposals as they determine rehabilitation activities and post mining land uses.

<table>
<thead>
<tr>
<th>Concern</th>
<th>Recommendation</th>
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<tbody>
<tr>
<td>The Land Capability assessments are inaccurate</td>
<td>The proponent needs to re-assess the Land Capability assessments for the project area.</td>
</tr>
</tbody>
</table>

The Residual Matters Report in section 2.3.4 discusses rehabilitation success. It is acknowledged that revegetation of mine sites may be achieved through a minimalist approach of direct seeding of overburden, however, Boggabri Coal have stated a number of times in the Continuation EA, Responses to Submissions and the Residual Matters Reports that it wants to demonstrate ‘best practice’ and to achieve biodiversity outcomes.

Namoi CMA believes that with very thin layers of top dressing material over ill-defined overburden on reasonably varying slopes, that long term post mining biodiversity outcomes will not be achieved. Furthermore Namoi CMA believes, through the replacement of the subsoil, the biodiversity outcomes proposed by Boggabri Coal will more readily achievable and be more beneficial to the Catchment and the community.

The Response to Late Submissions for the Modification for the Boggabri Coal project makes reference to the development of a Mine Rehabilitation Plan, Land Management Plan and Mine Closure Plan which Boggabri Coal will revise in consultation with Namoi CMA and other regulatory authorities. Namoi CMA would be happy to be consulted during the development of these plans.
However, it is disappointing that this missive from Boggabri Coal did not translate into the DoPI’s Determination for the Modification for Boggabri Coal Project. According to the Determination for the Modification, the Rehabilitation Management Plan will be prepared in consultation with DoPI, NOW, OEH, Narrabri Shire Council and the Community Consultative Committee.

<table>
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<tr>
<th>Concern</th>
<th>Recommendation</th>
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<tbody>
<tr>
<td>Final rehabilitation of the project site</td>
<td>Namoi CMA is consulted during the development of the revised Rehabilitation Management Plan.</td>
</tr>
</tbody>
</table>

Namoi CMA recommends to the PAC that they strengthen the Rehabilitation Management Plan condition statements within the Determination for the Continuation for the Boggabri Coal Project (see Recommended Condition Statements in section 7 of this submission)

4. **Biodiversity Offsets**

Namoi CMA supports the Boggabri Coal on their biodiversity offsets proposal consisting of:
- 5,866ha of remnant vegetation managed for habitat conservation
- 1,831ha of derived grasslands revegetated for habitat restoration
- 626ha of grassland revegetated for corridor enhancement
- 754ha of mine rehabilitation

(Note: Namoi CMA has difficulty reconciling 754ha of mine rehabilitation as specified in table 7 Residual Matters Report with approximately 1350ha of native vegetation cleared across the project disturbance area.)

Namoi CMA has studied figure 3 in the Residual Matters Report and would like to be assured that no prime agricultural land is being used as part of the above biodiversity offset proposal.

<table>
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<th>Concern</th>
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<tbody>
<tr>
<td>That Prime Agricultural land may be used for Biodiversity Offsets</td>
<td>The proponent undertakes Agricultural Suitability assessments for the Biodiversity Offset properties.</td>
</tr>
</tbody>
</table>

Furthermore, Namoi CMA understands that the proponent is required to source an additional 1000ha of biodiversity offset (included in the above figures) comprising of 650ha of Box Gum woodland or 'like for like' conservation value and 350ha of derived grasslands. Namoi CMA would be able to assist the proponent to source this land within the catchment in close proximity to the project area. Namoi CMA would also be able to assist the proponent with tenure security and environmental bond arrangements as well as management requirements for the offset properties. Namoi CMA believes a partnership with Boggabri Coal's Biodiversity offsets program would have significant benefits for Boggabri Coal and for the Catchment and community.
5. **Surface Water**

Namoi CMA has considerable knowledge, expertise and resources in the surface water management area including catchment management, surface hydrology, soil conservation, riparian management, water storage and management. This knowledge, expertise and resources would greatly assist Boggabri Coal develop a sustainable Surface Water Management Plan. Namoi CMA would be happy to be consulted during the development of this plan.

6. **Catchment Action Plan 2007 and Namoi CMA Extractive Industries Policy**

Namoi CMA in its review of the Continuation EA requested that the Namoi CMA’s Catchment Action Plan and Extractive Industries Policy be considered and addressed by the proponent. Both have been developed by Namoi CMA in conjunction with the Catchment community with the former being approved by the former Minister of Natural Resources in 2007.

However, after examining the Continuation EA, Response to Submissions and the Residual Matters Report, they all fail to consider and/or even adequately address the 2007 CAP and its targets or the NCMA EIP and its principles. The Response to Submissions refers to Narrabri Shire Council’s Growth Management Strategy (NSC GMS) and a reference to consideration of the CAP within that strategy. The NSC GMS has a very minor reference to the Namoi CMA CAP in the form of 3 paragraphs that provide a basic introduction and explanation of the purpose of the CAP. Namoi CMA believes that this is an inadequate attempt to address the CAP with no mention of the EIP.

To reiterate, Namoi CMA would like the proponent to explain how the proposed Boggabri Coal Project will improve and/or maintain the catchment by either contributing and/or impacting on catchment assets, especially with regard to natural landscapes, native plants and animals, and surface and groundwater systems.

The CAP targets we would like the proponent to address include:

- **MTL1** From 2006, increase the area of land managed according to Best Management Practices.

- **MTL2** From 2006, increase the area of land used in accordance with land capability.

- **MTW2** From 2006, maintain or improve surface and ground water quality suitable for irrigation, raw drinking water and aquatic ecosystem protection.

- **MTB1** From 2006, maintain or improve the extent, distribution and condition of existing native vegetation of the catchment.

- **MTB2** From 2006, support the recovery of priority fauna populations, and Threatened Species, Populations and Communities.
It appears that the Boggabri Coal Project development will erode the CAP targets especially with regard to vegetation condition, land capability and long term land use, landforms and landscapes, water availability and quality. The Continuation EA, Response to Submissions and the Residual Matters Report all make a number of inferences towards improving and maintaining the catchment, however none of them are specific.

The Response to Late Submissions for the Modification for the Boggabri Coal Project makes reference to the development of a Biodiversity Offset Management Plan and Mine Closure Plan which Boggabri Coal will develop in consultation with OEH, DITRIS-MRE and Namoi CMA; to the satisfaction of DoPI which will achieve the CAP targets as far as practicable. Again, it is disappointing that this missive from Boggabri Coal did not translate into the DoPI Determination for the Modification for Boggabri Coal.

Even though Namoi CMA is a statutory authority, the CAP is legislated under the Catchment Management Authorities Act 2003 and it was approved by the Minister of Natural Resources in 2007.

<table>
<thead>
<tr>
<th>Concern</th>
<th>Recommendation</th>
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<tbody>
<tr>
<td>The Continuation EA, Response to Submissions and the Residual Matters Report all fail to consider and adequately address the 2007 CAP and its targets.</td>
<td>The proponent needs to address how the CAP Management targets will be enhanced or impacted in the respective Environmental Management Plans.</td>
</tr>
</tbody>
</table>

Furthermore, Namoi CMA has developed an Extractive Industries Policy which includes a number of policy statements including the requirement to undertake a risk assessment before and after development. Within the Continuation EA there is a rudimentary risk assessment pre development that identifies the potential impacts and assigns a risk rating against those issues. The Continuation EA also contains a brief Statement of Commitments which highlights the actions and safeguards the proponent will incorporate to mitigate the risks, however there is no following up post development risk assessment.

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<thead>
<tr>
<th>Concern</th>
<th>Recommendation</th>
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<tbody>
<tr>
<td>The Continuation EA fails to consider and adequately address the EIP and its principles</td>
<td>The proponent needs to address how the Extractive Industries Policy principles will be adhered to and met in the respective Environmental Management Plans. The proponent needs to complete a thorough pre and post mining risk assessment.</td>
</tr>
</tbody>
</table>

7. **Recommended Condition Statements**
As mentioned above, Namoi CMA recommends that the PAC strengthen a number of standard condition statements within the Determination for the Continuation for the Boggabri Coal Project.

- **Biodiversity Management Plan**
  
  "The Biodiversity Management Plan must be prepared in consultation with OEH, Forests NSW, DRE and Namoi CMA and be submitted …….
  
  This plan must address the relevant catchment targets within Namoi CMA’s CAP,
  
  This plan must include conserving and reusing topsoil and subsoils to meet rehabilitation objectives
  
  This plan must detail the integration with the Rehabilitation Management Plan to achieve biodiversity outcomes.

- **Rehabilitation Management Plan**
  
  "The Rehabilitation Management Plan must be prepared in consultation with DoPI, NOW, OEH, Council, CCC and Namoi CMA;’
  
  This plan must address the relevant catchment targets within Namoi CMA’s CAP,
  
  This plan must include a Soil Balance detailing topsoil and subsoil suitability, availability and respreading; soil handling, stockpiling and management; Land Capability and Agricultural Suitability.

- **Biodiversity Offset Management Plan**
  
  "The Biodiversity Offset Management Plan must be prepared in consultation with OEH and Namoi CMA and be submitted …….
  
  This plan must address the relevant catchment targets within Namoi CMA’s CAP,
  
  This plan must include Agricultural Suitability assessments for the offset properties.

- **Water Management Plan**
  
  "The Water Management Plan must be prepared in consultation with OEH, NOW, DRE and Namoi CMA, by suitably qualified …….’
  
  This plan must address the relevant catchment targets within Namoi CMA’s CAP.

8. **Contacts**

For further information regarding this matter, please contact Glenn Bailey, Catchment Coordinator, Namoi CMA ph 02 6742 9204, email glenn.bailey@cma.nsw.gov.au

26th October 2011
Dear Ms Poon

PROPOSED BOGGABRI COAL MINE – PAC REVIEW AND HEARINGS

I refer to your letter of 12 October 2011 providing advice of a Planning Assessment Commission (PAC) review for the Boggabri Coal Project and the public hearing to be held on 3 November 2011.

Office of Environment and Heritage (OEH) reviewed the information provided in the Boggabri Coal Mine Environmental Assessment (December 2010 – Volumes 1-6) and provided written comments to NSW Department of Planning and Infrastructure in a letter dated 7 February 2011. Since that submission OEH has undertaken an assessment and provided comments on the Maules Creek Coal project which adjoins the Boggabri Coal project.

In recognition of the expanding presence of coal mining in the Gunnedah basin and the cumulative impacts of multiple mines OEH has proposed targeted air quality control conditions on the Maules Creek proposal. It is appropriate that these conditions also be recommended for the Boggabri Coal project given the synergies between both projects.

Recommendation:

As approval conditions for the proposal, OEH recommends that Boggabri Coal provide:

1. a Project Air Quality Management Plan incorporating the site-specific Best Management Practice (BMP) Report (see Attachment 1) and Reactive Particulate Management Strategy (see Attachment 2); and,

2. a Regional Air Quality Management Plan, prepared in consultation with the local community and adjoining mines (see Attachment 3).

PAC Hearing

It is understood that the PAC wishes to meet with OEH to discuss its submissions on the Boggabri Coal project. OEH welcomes this opportunity to provide further clarification of the issues raised and seeks early notification of when the PAC would like to meet. This would allow OEH to organise the appropriate staff to assist the PAC with their review.
If you have any questions, or wish to discuss this matter further please contact Robert O'Hern in the Armidale office on 6773 7000.

Yours sincerely

ROBERT O’HERN
Head Regional Operations Unit - Armidale
Environment Protection and Regulation
Office of Environment and Heritage
Department of Premier and Cabinet

Enclosed:  
Attachment 1 – Site-Specific Best Management Practice (Bmp) Report
Attachment 2 – Reactive Particulate Management Strategy
Attachment 3 – Regional Air Quality Management Plan
ATTACHMENT 1 – SITE-SPECIFIC BEST MANAGEMENT PRACTICE (BMP) REPORT

Prior to construction, the Proponent must undertake a site-specific Best Management Practice (BMP) determination to identify the most technically and economically feasible measures to minimise particulate matter emissions from the Boggabri Coal Mine.

Coal Mine Particulate Matter Control Best Practice Assessment and Report

1. The Proponent must conduct a site-specific Best Management Practice (BMP) assessment to identify the most practicable means to reduce on-site particle emissions.

2. The Proponent must prepare a Coal Mine Particulate Matter Control Best Practice Assessment Report (the Report) in consultation with the Department of Planning and Infrastructure and the Office of Environment and Heritage which includes, but is not necessarily limited to, the following:
   - identification, quantification and justification of best practice measures that could be used to minimise particle emissions during various stages of the Boggabri Coal Mine Plan; and,
   - evaluation of the practicability of implementing these best practice measures.

   In preparing the Report, the Proponent must utilise the document entitled Coal Mine Particulate Matter Control – Guideline for Site-Specific Best Management Practice (BMP) determination, included below.

3. The Report must be submitted by the Proponent to the Department of Planning and Infrastructure at <<address>> by <<deadline>>.

4. The Report must be made publicly available by the Proponent on the Boggabri Coal Mine website by <<deadline>>.
Appendix B - Submission from the NSW Office of Environment and Heritage

Coal Mine Particulate Matter Control – Guideline for Site-Specific Best Management Practice (BMP) determination

PURPOSE OF THIS GUIDELINE

The purpose of this guideline is to provide details of the process to be followed in conducting a site-specific determination of best practice measures to reduce emissions of particulate matter from coal mining activities. This guideline also provides the required content and format of the Coal Mine Particulate Matter Control Best Practice – Assessment and Report (the Report).

THE SITE-SPECIFIC DETERMINATION PROCESS

In preparing the Report, the following steps must be followed, as a minimum:

1. Identify, quantify and justify best practice measures that could be used to minimise particle emissions for each stage of the Mine Plan

1.1 Estimate baseline emissions of TSP, PM_{10} and PM_{2.5} (tonne per year) from each mining activity. This estimate must:

• utilise USEPA AP42 emission estimation techniques; and,
• calculate uncontrolled emissions (with no particulate matter controls in place).

(Note: these particulate matter controls must be clearly identified, quantified and justified with supporting information).

1.2 Using the results of the uncontrolled emissions estimates generated from Step 1.1, rank the mining activities from highest to lowest according to the mass of TSP, PM_{10} and PM_{2.5} expected to be emitted by each mining activity per year.

1.3 Identify the most significant mining activities (e.g. cumulative 95th percentile) from Step 1.2 that would contribute the highest emissions of TSP, PM_{10} and PM_{2.5} for each year.

1.4 For each of the most significant mining activities identified in Step 1.3 (e.g. cumulative 95th percentile), identify the best practice measures that could be implemented to reduce emissions taking into consideration:

• the findings of K盛世one (2010), NSW Coal Mining Benchmarking Study - International Best Practice Measures to Prevent and/or Minimise Emissions of Particulate Matter from Coal Mining, K盛世one Environmental Pty Ltd, Terrace 5, 249 Coronation Drive, PO Box 2217, Milton 4064, Queensland, Australia. http://www.environment.nsw.gov.au/resources/air/KE1006953coalminebmpreport.pdf;
• any other relevant published information; and,
• any relevant industry experience from either Australia or overseas.

1.5 For each of the significant mining activities identified in Step 1.3 (e.g. cumulative 95th percentile), estimate emissions of TSP, PM_{10} and PM_{2.5} from each mining activity following the application of the best practice measures identified in Step 1.4.

1.6 This analysis must include each stage of the Mine Plan.

2. Evaluate the practicability of implementing these best practice measures

2.1 For each of the best practice measures identified in Step 1.4, assess the practicability associated with their implementation, by taking into consideration:

• implementation costs;
• regulatory requirements;
• environmental impacts;
• safety implications; and
• compatibility with current processes (if applicable) and proposed future developments.
2.2 Identify those best practice measures that will be implemented at the premises to reduce particle emissions for each stage of the Mine Plan.

REPORT CONTENT

The report must clearly identify the methodologies utilised and all assumptions made.

The report must contain detailed information justifying and supporting all of the information used in each step of the process.

In evaluating practicability of best practice measures in Step 2, the Proponent must document the following specific information:

- Estimated capital, labour, materials and other costs for each best practice measure on an annual basis for every year in each stage of the Mine Plan. This information must be set out in the format provided in Appendix A;
- Quantification of any new environmental impacts that may arise from the application of a particular best practice measure, such as increased noise or fresh water use;
- The details of safety impacts that may result from the application of a particular best practice measure; and,
- The details of any incompatibility with current operational practices at the premises (if applicable); and or details of any incompatibility with future development proposals at the premises.

REPORT FORMAT

The report must be structured according to the process outlined above and submitted in both electronic format as .PDF format and hard copy format in triplicate. All emission estimates, costs and supporting calculations must be submitted in electronic format as .XLS format.

ABBREVIATIONS AND DEFINITIONS

USEPA AP42 Emission Estimation Techniques – all of the following:


- USEPA (2006), AP 42, Chapter 13.2.4 Aggregate Handling and Storage Piles, Technology Transfer Network - Clearinghouse for Inventories & Emissions Factors, United States Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC 27711, USA. http://www.epa.gov/tnn/chief/ap42/ch13/final/c13s0204.pdf ; and


$PM_{10}$ – Particulate matter of 10 micrometres or less in diameter

$PM_{2.5}$ – Particulate matter of 2.5 micrometres or less in diameter
**Mining Activities** – means:

- Wheel generated particulates on unpaved roads
- Wind erosion of overburden
- Blasting
- Bulldozing Coal
- Trucks unloading overburden
- Bulldozing overburden
- Front-end loaders on overburden
- Wind erosion of exposed areas
- Wind erosion of coal stockpiles
- Unloading from coal stockpiles
- Dragline
- Front-end loaders on overburden
- Trucks unloading coal
- Loading coal stockpiles
- Graders
- Drilling
- Coal crushing
- Material transfer of coal
- Scrapers on overburden
- Train loading
- Screening; or
- Material transfer of overburden

**TSP** - Total Suspended Particulate Matter
Appendix A: Presentation of Information on Cost of Implementation

The report should provide spreadsheets including estimates of the annual capital, labour and materials costs for each year over a ten year period for implementing each best practice measure identified in Step 2.

A template is given below for one best practice measure.

<table>
<thead>
<tr>
<th>Mining Activity</th>
<th>Example: Wheel-generated particulates on unpaved roads</th>
</tr>
</thead>
<tbody>
<tr>
<td>Best practice measure</td>
<td>Example: Procurement of large trucks/vehicles</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year</th>
<th>Yr1</th>
<th>Yr2</th>
<th>Yr3</th>
<th>Yr4</th>
<th>Yr5</th>
<th>...</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost of specific capital items (e.g. new vehicle)*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total capital costs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Labour costs including directly related on-costs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cost of specific materials and other items (e.g. fuel)*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total material and other costs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Estimated additional cost per tonne of particulate matter suppressed for TSP, PM₁₀ and PM₂.₅*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cost savings from implementing each best practice measure*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Estimated net cost per tonne of particulate matter suppressed for TSP, PM₁₀ and PM₂.₅*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* each item must be specified – one item per row in spreadsheet.
ATTACHMENT 2 – REACTIVE PARTICULATE MANAGEMENT STRATEGY

Strategy for real-time management of site-specific particulate emissions

1 The Proponent must develop (prior to construction), and implement a Reactive Particulate Management Strategy (the Strategy) for the Boggabri Coal Mine site, which is to be prepared in consultation with the Department of Planning and Infrastructure and the Office of Environment and Heritage.

2 The Strategy is to be developed for the purpose of real-time management of short-term ambient particulate concentrations resulting from the Boggabri Coal Mine operations, at residences in the Maules Creek community and also the regional community impacted by other mines. To enable the effective reactive management of particulate emissions from facility-wide operations, the Strategy should incorporate the following elements:

   2.1 As outlined in condition 3.1, nominate and establish ambient particulate monitoring sites for management and compliance purposes.

   2.2 As outlined in condition 3.2, use weather data (e.g. wind speed and direction) from an on-site meteorological station to assist in selecting and implementing the most technically and economically feasible particulate mitigation strategies (as identified by the BMP determination).

   2.3 As outlined in condition 3.3, identify specific mitigation measures for the effective reactive management of significant particulate-generating activities at the Project site in response to inputs such as wind speed and direction and trigger particulate concentration levels, including, but not limited to, cessation of activities under adverse conditions.

3 The Strategy must aim to monitor local meteorology and particulate impacts of the mining operations within/at the Project boundary and at receiver locations, by incorporating the following as a minimum:

   3.1 Real-time ambient monitoring of particulates

   3.1.1 Establish reliable ambient particulate monitoring program as follows:

   • Nominate and establish a network of real-time particulate monitoring sites within and beyond the Project boundary for the purpose of gauging project activity emissions on short time-scales (i.e., less than 1-hour). These monitoring sites shall be referred to as “management monitoring” sites and monitoring data used for informing day-to-day reactive management measures. The management monitors should be fit-for-purpose but need not comply with AM-22.

   • Nominate and establish a suitable number of ambient PM10 monitoring sites at relevant locations for the purpose of determining compliance with the OEH 24-hr average concentration criterion (50 μg/m³). These shall be referred to as “compliance-monitoring sites”. The compliance-monitoring program must be maintained so as to be capable of continuously monitoring the parameters specified in the following table.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Units of measure</th>
<th>Frequency</th>
<th>Averaging Period</th>
<th>Sampling Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>PM10</td>
<td>μg/m³</td>
<td>Continuous</td>
<td>24-hour</td>
<td>AM-22</td>
</tr>
<tr>
<td>Additional requirements</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Siting</td>
<td></td>
<td></td>
<td></td>
<td>AM-1 &amp; AM-4</td>
</tr>
<tr>
<td>Measurement</td>
<td></td>
<td></td>
<td></td>
<td>AM-2 &amp; AM-4</td>
</tr>
</tbody>
</table>
3.1.2 Establish trigger levels for reactive management of on-site emissions

The particulate monitoring program should be designed to:

- Identify short-term (i.e., less than 1-hour) particulate concentration trigger level(s) at “management monitoring sites” consistent with achieving 24-hr averages of 50 µg/m³ at “compliance-monitoring” site(s).

- Alert the mine manager when particulate levels exceed the nominated trigger level(s).

3.2 Real-time meteorological monitoring

3.2.1 Establish a reliable meteorological monitoring station

A real-time meteorological weather station must be established and maintained on-site so as to be capable of continuously monitoring the parameters specified in the following table.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Units of measure</th>
<th>Frequency</th>
<th>Averaging Period</th>
<th>Sampling Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rainfall</td>
<td>mm</td>
<td>Continuous</td>
<td>1 hour</td>
<td>AM-4</td>
</tr>
<tr>
<td>Wind speed @ 10 metres</td>
<td>m/s</td>
<td>Continuous</td>
<td>15 minute</td>
<td>AM-2 &amp; AM-4</td>
</tr>
<tr>
<td>Wind direction @ 10 metres</td>
<td>°</td>
<td>Continuous</td>
<td>15 minute</td>
<td>AM-2 &amp; AM-4</td>
</tr>
<tr>
<td>Temperature @ 2 metres</td>
<td>°C</td>
<td>Continuous</td>
<td>15 minute</td>
<td>AM-4</td>
</tr>
<tr>
<td>Temperature @ 10 metres</td>
<td>°C</td>
<td>Continuous</td>
<td>15 minute</td>
<td>AM-4</td>
</tr>
<tr>
<td>Sigma theta @ 10 metres</td>
<td>°</td>
<td>Continuous</td>
<td>15 minute</td>
<td>AM-2 &amp; AM-4</td>
</tr>
<tr>
<td>Solar radiation</td>
<td>W/m²</td>
<td>Continuous</td>
<td>15 minute</td>
<td>AM-4</td>
</tr>
<tr>
<td>Additional requirements</td>
<td></td>
<td></td>
<td></td>
<td>AM-1 &amp; AM-4</td>
</tr>
<tr>
<td>- Sampling</td>
<td></td>
<td></td>
<td></td>
<td>AM-2 &amp; AM-4</td>
</tr>
<tr>
<td>- Measurement</td>
<td></td>
<td></td>
<td></td>
<td>AM-2 &amp; AM-4</td>
</tr>
</tbody>
</table>

3.2.2 Establish trigger levels for reactive management of on-site emissions

- Identify meteorological parameters, such as wind speed categories and wind direction (at specified averaging periods) that would form the trigger(s) for the operational management of specific particulate-generating mining activities.

- Alert the mine manager when the nominated trigger(s) are tipped.

3.3 Identify management strategies

Options to be adopted in response to meteorological and ambient particulate concentration triggers, for the reactive management of specific particulate-generating activities should be outlined, including the following as a minimum:

- All specific activities that are particulate-generating must be identified.
- Avoid high particulate-generating activities during adverse wind conditions, such as when winds are blowing directly towards the nearest sensitive receptors.
- Cease or reduce excavator and dozer operations when prevailing winds are in the direction of sensitive receptors.
- The mine manager must be provided with weather updates consistent with alerting to sudden onset of strong winds to enable timely application of water sprays necessary to reduce the potential for wind erosion.
The Strategy must incorporate reporting provisions for the local community. A Complaints Register for the Project must be established and any complaints regarding the mining operations must be recorded. All complaints must be correlated with prevailing weather conditions and operational activities undertaken at the time of reporting. The Complaints Register must be available to the OEH and external auditors upon request.

Annual reviews of the effectiveness of the Strategy must be undertaken upon implementation (i.e. every 12 months). In accordance with the findings of the annual review, management practices implemented for controlling emissions from significant particulate-generating activities must be revised and the Strategy documentation updated. The outcome of the annual review must be included in the Boggabri Coal Mine’s Annual Environmental Management Report (AEMR), and details made available to the OEH.

The monitoring and air quality management program established through this Strategy should be incorporated into the Regional Air Quality Management Plan (Attachment 3).

The Reactive Particulate Management Strategy must be documented and submitted by the Proponent to the Department of Planning and Infrastructure at <<address>> by <<deadline>>.

The Reactive Particulate Management Strategy must be made publicly available by the Proponent on the Boggabri Coal Mine’s website by <<deadline>>.
ATTACHMENT 3 – REGIONAL AIR QUALITY MANAGEMENT PLAN

Regional Air Quality Management Plan – Development and Report

1 Prior to construction, the Proponent must develop a Regional Air Quality Management Plan (the Plan) in cooperation with neighbouring mines (proposed Maules and Tarrawonga), members of the local community, the Department of Planning and Infrastructure and the Office of Environment and Heritage.

2 The Plan must be developed with the objective of real-time management of cumulative impacts of all mining operations in the Gunnedah Coal Basin region, consistent with achieving 24-hr average PM$_{10}$ concentration of 50 µg/m$^3$ at receivers located within the Maules Creek community and also the regional community impacted by other mines.

3 The Plan should enable the co-operative development, implementation and maintenance of a holistic regional network capable of providing:
   - real-time ambient air quality monitoring; and,
   - real-time meteorological monitoring.

4 The Plan should incorporate predictive air quality modelling capability for the reactive management of particulate emissions from various mining activities in the region.

5 The Plan must also incorporate all site-specific measures identified through the BMP determination (Attachment 1) and the Reactive Particulate Management Strategy (Attachment 2), and identify specific monitoring locations for particulate management and compliance-monitoring purposes.

6 The Proponent must document the Regional Air Quality Management Plan in consultation with the Department of Planning and Infrastructure and the Office of Environment and Heritage. This should include, but not be limited to:
   - an evaluation of the practicability of implementing the Regional Air Quality Management Plan; and,
   - the strategy for long-term management or maintenance of the holistic regional network.

7 The Regional Air Quality Management Plan must be submitted by the Proponent to the Department of Planning and Infrastructure at <<address>> by <<deadline>>.

8 The Regional Air Quality Management Plan must be made publicly available by the Proponent on the Boggabri Coal Mine’s website by <<deadline>>.
Appendix C – Dr Mackie’s Expert Advice on Groundwater
Department of Planning
Planning Assessment Commission
GPO Box 3415
Sydney NSW 2001

Att. G. Kibble AO

Re: Continuation of Boggabri Coal Mine – Environmental Assessment, 2010

Further to instructions, I have conducted a review of the likely groundwater impacts associated with the continuation of mining of coal resources at Boggabri Coal Mine. I have not conducted an exhaustive review but rather focused on key areas of concern that relate to the regional impact of depressurisation associated with development of a larger coal pit, and the long term likely impacts of the mining operations after mine closure.

Documents reviewed include:

- Continuation of Boggabri Coal Mine – Environmental Assessment, December 2010 (main volume) authored by Hansen Bailey P/L;
- Continuation of Boggabri Coal Mine – Environmental Assessment (Appendix O) Groundwater Assessment, October 2010 (main volume) authored by Australian Groundwater and Environmental Consultants P/L;
- Continuation of Boggabri Coal Mine – Environmental Assessment (Appendix P) Geochemical Assessment, November 2009 (main volume) authored by RGS Environmental P/L;
- Maules Creek Coal Project - Transient Groundwater Model, December 2011 authored by Australian Groundwater and Environmental Consultants P/L;
- Maules Creek and Boggabri Groundwater Assessments, Groundwater Modelling Information – Letter response to Planning Assessment Commission Questions, 18/01/2012;
- Assessment Report – Boggabri Coal Mine Section 75W Modification (DA 36/88 Mod2) authored by NSW Dept of Planning and Infrastructure, 19/10/2011.

Review of hydrogeological and groundwater flow models

The proposed continuation of mining at Boggabri provides for an increase in coal production to 7 Mtpa over a further period of 21 years by extending the existing mine pit to the north and north-west. Coal will continue to be mined from four seams, the lowermost being the Merriown seam. As mining progresses northwards, the pit shell will be backfilled with waste rock material to a proposed maximum elevation of RL395 m. As a consequence of mining, the groundwater contained within the coal seams intercepted by the pit will flow into the pit thereby leading to loss of seam and interburden strata pore pressures. Depressurisation of strata will extend beyond the pit shell (as it has done for the existing operations), inevitably leading to regional depressurisation of the coal measures with maximum loss of pressure at the coal face, and zero loss of pressure at some distance from the coal face which is governed by the permeability and storage properties of the regional rock strata.
The alluvial lands associated with the Namoi River catchment host an extremely important groundwater resource which has been historically exploited for town water supply and agricultural activities in the region. These lands are typically more than 2 km distant from mining operations with the exception of a small enclave immediately south-west of the existing mine pit where the distance to the alluvium is indicated to be about 500m\(^1\).

The alluvial groundwater resources are managed within the regulatory framework of the Water Management Act 2000 and the relevant Water Sharing Plans for prescribed areas defined within the Namoi Alluvial Aquifer. Boggabri Coal project is situated in proximity to three groundwater management zones - Zone 4 to the south, Zone 5 to the west and Zone 11 to the north as illustrated on Figure 1 below.

\[\text{Figure 1: Upper Namoi Alluvial Aquifer Zones}\]

Assessment of the probable extent of regional groundwater depressurisation induced by the proposed continuation of mining, has been undertaken using a groundwater flow simulation model. The specific code adopted by Australian Groundwater and Environmental Consultants (AGE) for this modelling is known as Modflow-Surface which can handle variably saturated flow conditions in a robust manner. It is an acceptable code for the simulation of open cut mining operations providing that groundwater

\(^1\) AGE 2010 – Appendix O in EA, Page 25 (Figure 12)
\(^2\) AGE 2010 – Appendix O in EA, Page 4 (Figure 1)
flow systems can be reasonably represented as porous media systems. That is, the systems are not dominated by fracture flow or if they are, then the model is divided into cells that are sufficiently large that fracture network behaves in a manner consistent with porous media flow. In assimilating the available data, I believe these conditions have been met.

The material properties assigned to the model (permeability, porosity and elastic storage) have been obtained from various prior groundwater studies which appear to have focused on the coal seams. These studies also appear to lack any measurements on rock core, relying instead on a relatively small number of packer tests conducted in exploration boreholes over intervals which include both coal seams and non coal (interburden) strata. No test work has been undertaken in the Boggabri volcanics which lie to the west of the project. Alluvium material properties are apparently based on previous studies and groundwater flow modelling undertaken by NOW and CSIRO.

The proponent has simulated the progression of mining from initial pre-mining conditions (taken to be the second quarter of 2006) through to the completion of the proposed 21 years continued mining period and giving a total mining simulation period of nearly 27 years. Simulations include Tarrawonga mine situated just south of Boggabri Coal mine.

Model output has been provided as a sequence of drawdown contours which show the cumulative effects of both mines. Figure 2 below illustrates the predicted impact extent for drawdowns equal to or greater than 1m at various stages of mining. The minimum impact level (of 1m) is considered to be appropriate – often the 2m drawdown impact zone is regarded as appropriate based upon typical cyclic behavior of bore water levels over time.

![Figure 2: Extent of groundwater depressurisation at the completion of mining](image)

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3 AGE 2010 – Appendix O in EA, Page 20
4 AGE 2010 – Appendix O in EA, Page 31
5 AGE 2010 – Appendix O in EA, part of Drawing 13
Reference to Figure 2 indicates the impacts are generally contained within the Permian coal measures except for a small area of alluvium within Zone 4 situated to the south-west. In this area the results of modelling indicate leakage losses (from the alluvium) will be of the order of 73 ML/year.

The impact zone at the completion of mining in Year 21, is predicted to extend between 3 and 3.5 km beyond the pit shell and is likely to affect some 28 boreholes identified on the NOW borehole register. The majority of these bores are situated on land owned by Boggabri Coal or other neighbouring mining companies. There are 15 bores used for groundwater monitoring purposes at either Boggabri Coal mine or Tarrawonga Mine. No irrigation bores that draw water from the alluvial lands, are present within the zone of influence.

At the completion of mining a void will remain at the northern extent of the pit shell. Assuming that mining ceases after 21 years, the final void will be backfilled and reshaped with waste rock spoil to a point where the ground surface will be at or above the pre-mining groundwater elevation of about RL 285 m. The period of time required for recovery of the water table has been estimated using the groundwater flow model. The proponent correctly identifies that the rate of recovery will depend largely upon the catchment area surrounding the final (reshaped) void and the infiltration and percolation capacity of the rehabilitated spoils. Various infiltration rates ranging from 1 mm/year to 500 mm/year have been tested. Studies elsewhere suggest that a reasonable long term expectation is about 5% of annual rainfall or about 30 mm/year based on a long term mean annual rainfall of about 600 mm/year for the region. Results of simulations suggest recovery to an elevation of RL 285 m would take at least 100 years. After this time the spoils groundwater level would apparently remain stable (below ground level) as evapotranspiration removes surplus water.

If the rehabilitated void can sustain high enough evapotranspirative losses in the reshaped final void depression, then the water table would indeed stabilise at or near RL 285 m but concentration of conservative ionic species like Na and Cl in the spoils water may occur leading to an increase in void water salinity. However, the rise in the water table is also constrained by the pit shell spill point which is the point of lowest topographic elevation intercepted by the mine pit. This point is situated in the head waters of Nagero Creek as shown on Figure 3 at an elevation of about RL 283 m or 2 m lower than the proposed minimum surface elevation of the reshaped final void (RL 285 m). It is buried beneath spoils but should invariably act to constrain water level rises since the water transmission capacity of spoils is normally very high. Any discharge from rising pit water levels would therefore migrate down the Nagero Creek drainage system from the spill point. The quality of void groundwater exiting the spill point will be governed largely by the geochemistry of spoils at or above the spill point elevation.

**Long term void water quality**

The long term quality of groundwater-leachate has been assessed by the proponent in terms of acid generating potential determined via leach column tests and short term dissolution trials. Long term batch reaction trials to determine void water chemistry appear to be absent.

Results of tests to determine acid generating potential of percolating rainwater in contact with overburden indicate that approximately 87% of the tested overburden samples have negligible risk of acid generation and a high factor of safety. These would be the materials that dominate higher elevations in the spoils profile and are likely to be associated with the rehabilitated land form. For the remaining 13%, it is likely that there is sufficient buffering capacity in surrounding materials to mitigate acid generation.

Coarse and fine coal rejects (tailings) will be co-disposed at depth in the pit shell. Results of similar tests conducted on potential rejects materials indicate that approximately 86% of the samples tested have a low risk of acid generation and a high factor of safety. Most potential coal reject samples have negligible (< 0.1%) total sulphur content and have been classified as non acid forming (NAF)-barren.

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6 AGE 2010 – Appendix O in EA, Page 39  
7 estimated from Boggabri EA main text, Figure 9  
8 RGS 2010 – Appendix P in EA, Page 9
Since these materials will be located in the pit shell below the long term recovered water table, they are unlikely to represent a risk to the regional shallow groundwater systems.

Discharge from the spill point is expected to be slightly alkaline and low salinity with ionic species dominated by sodium bicarbonate, chloride and sulphate. The electrical conductivity (EC) is likely to be lower than 1000 uS/cm.

![Figure 3: Interpreted pit shell spill point](image)

**Additional groundwater flow modelling to assess cumulative impacts**

AGE 2012 provides a relatively detailed summary of additional groundwater flow modelling undertaken to address concerns regarding transient calibration of the groundwater flow model. This Version 2 model addressed cumulative impacts of historical and proposed mining at Boggabri and Tarrawonga mine sites, and proposed mining at the Maules Creek coal project.

Transient calibration was restricted to the adjustment of material properties (hydraulic conductivity and storage) and the rates of rainfall recharge to the alluvial aquifer systems in model layers 1 and 2. Results are reported to be generally consistent with NOW modelling. It should be noted that since the material properties of the alluvial lands are reported to be orders of magnitude higher than the material properties associated with the Permian coal measures, the impacts of mining in terms of induced leakage (from the alluvial lands) are likely to be relatively insensitive to the alluvium material.

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9 RGS 2010 – Appendix P in EA, Page 21
10 AGE 2012, Page 6
properties. That is, the predicted regional drawdowns induced by mining will be similar over a reasonably wide range of alluvium material properties.

Impact plots have been prepared for Year 21 of mining at Maules Creek. These cannot easily be compared to prior modelling of the Boggabri Coal project since drawdowns have been calculated specifically for the Maules Creek project (excluding Boggabri Coal project). Only the 1 m drawdown contour is presented for cumulative assessment purposes\textsuperscript{11}. This contour is shown on Figure 4 as the green 1m contour.

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{figure4.png}
\caption{Cumulative extent of groundwater depressurisation at the completion of mining}
\end{figure}

\textbf{PAC Additional questions in relation to regional impacts}

While the reported impacts of continued mining on regional groundwater systems are assessed to be largely contained within the Peronian coal measures, it was considered important to understand the impacts on surface drainage systems by examining the predicted changes to baseflows. Accordingly, a number of questions were asked of the proponent in relation to the additional groundwater flow modelling and the predicted outcomes. Specifically, baseflow changes were requested for 7 stream reaches in the area. These flows were extracted by the proponent from the Version 2 model output and subsequently reported\textsuperscript{12}. Table 1 provides a useful summary and is represented below.

\begin{table}[h]
\centering
\begin{tabular}{|c|c|}
\hline
Region & Baseflow Changes (m³/s) \\
\hline
Maules Creek & 0.5 \\
Boggabri & 0.3 \\
Tarragonga & 0.1 \\
\hline
\end{tabular}
\caption{Predicted baseflow changes for selected streams}
\end{table}

\textsuperscript{11} AGE 2012, Drawings 10 and 11
\textsuperscript{12} AGE 2012, Table 1 and Appendix 1
Table 1: Summary of river and creek flow loss due to mining

<table>
<thead>
<tr>
<th>Zone</th>
<th>Total Cumulative Loss over 21 Years</th>
<th>Proportion of Cumulative Loss over 21 Years</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Boggabri Project</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Maules Creek Project</td>
</tr>
<tr>
<td>D1 - Back Creek in Permian Ridge area</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>D2 - Back Creek traversing the alluvial aquifer</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>D3 - Maules Creek from Namoi River to Back Creek</td>
<td>23.4</td>
<td>3.6</td>
</tr>
<tr>
<td>D4 - Namoi River – Bollol Creek to Maules Creek confluences</td>
<td>377.4</td>
<td>58.6</td>
</tr>
<tr>
<td>D5 - Upper Goombri to Bollol Creek confluence</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>D6 - Bollol / Namoi confluence to Goombri Creek</td>
<td>56.7</td>
<td>6.5</td>
</tr>
</tbody>
</table>

Results indicate no changes to baseflows in drainage systems traversing the Permian coal measures, volcanics, and some elevated parts of the alluvial lands (largely because they are reported as ephemeral), and negligible change to baseflows in drainages systems hosted within the alluvial lands. Highest losses attributed to Boggabri Coal mine are apparently associated with the D4 reach of the Namoi River. These losses are identified as 58.6 ML over the term of 21 years or about 2.8ML/year. Summatine all alluvium losses attributed to Boggabri Coal project:

\[
\text{Leakage from alluvial aquifers} = 73.0 \\
\text{Baseflow losses to surface drainage systems} = 3.3 \\
\text{Total groundwater losses} = 76.3 \text{ ML/year}
\]

I consider these findings to be consistent with expected outcomes. In respect of constraints imposed by the Water Sharing Plan, the proponent has indicated that these losses are likely to be offset through the acquisition of existing licences in the same region.

**Recommended conditions**

In addition to any considerations by NSW Planning and Infrastructure, it is recommended that:

- The proposed 11 additional monitoring bores\(^{13}\) (MB1 to MB11) be equipped with pore pressure monitoring transducers installed at vertical separations such that the future impacts of mining induced strata depressurisation can be adequately monitored;
- Core tests be conducted to assess the distribution and variability of hydraulic conductivities of (unfractured) interburden at a sufficient number of bore locations to quantify porous groundwater flow and storage contributions;
- XRD-XRF analyses be undertaken on core samples obtained at a sufficient number of bore locations to establish the mineralogy of interburden likely to be exposed to pit re-saturation;
- Hydrochemical modelling be undertaken in order to determine the long term void water quality. This study should include batch reaction (full saturation) trials on waste interburden (spoil) to confirm hydrochemical modelling outcomes;
- Reject materials or any potentially acid forming interburden materials must not be emplaced at elevations within the pit shell that are likely to promote acid or sulphate species generation in leachate, and migration of such leachate beyond the pit shell;
- Any coal barrier between the final void and any future surrounding mining operations must remain intact in order to impede exchange of any contained groundwaters in the Boggabri pit shell;

\(^{13}\) AGE 2010 – Appendix O in EA, Page 48 Table 10
• A mine closure plan be prepared prior to mining year 14. An important part of this plan must address future stability of the proposed landform, long term groundwater recovery and void water quality characteristics to the satisfaction of the Director General. In particular the long term landform must not generate a pit (void) lake. Emplaced spoils must have a capacity to drain to the natural catchment and drained waters must not adversely impact upon the downstream environment. The hydrochemistry, hydrogeology and hydrology components of the mine closure plan must be subject to independent review and verification.

Yours sincerely
Mackie Environmental Research Pty. Ltd.

Dr. C. Mackie

References:
Continuation of Boggabri Coal Mine – Environmental Assessment, December 2010 prepared by Hansen Bailey on behalf of Boggabri Coal Pty. Ltd.
Maules Creek Coal Project -Transient Groundwater Model, December 2011 prepared by Australian Groundwater and Environmental Consultants for Hansen Bailey on behalf of Aston Resources Ltd.
Assessment Report – Boggabri Coal Mine Section 75W Modification (DA 36/88 Mod2), NSW Dept of Planning and Infrastructure, 19/10/2011.
Appendix D – Emeritus Professor Galvin’s Expert Advice on the Mine Plan
6 February 2012

Ms G Kibble AO
Chair
Planning Assessment Commission
GPO Box 3415
Sydney NSW 2001

Dear Gabrielle

Subject: Review of the Boggabri Coal Project

I refer to your request of 15 November 2011 to review aspects of the EA for the Boggabri Coal Project, specifically in respect of Minister's terms of reference to assess the merits of the mine plan, paying particular attention to the proposed final void and future rehabilitation of the project. You also requested that I consider the underground versus open cut mining issue raised in submissions and whether there are any principles that might be used to consider the appropriateness of open cut mining compared to underground mining.

My advice is based on the following select material provided by the Commission Secretariat:

- Main Report: Boggabri Coal Mine EA
- Appendix C - Underground Concept Study: Boggabri Coal Mine EA
- Appendix P - Geochemical Assessment: Boggabri Coal Mine EA
- Appendix Q - Economic Assessment: Boggabri Coal Mine EA
- Boggabri Coal Mine Response to Submissions: Hansen Bailey, March 2011
- Boggabri Coal Mine Residual Matters: Hansen Bailey, July 2011
- Assessment Report - Boggabri Coal Mine. Section 75W Modification (DA 36/88 Mod2): NSW Dept Planning and Infrastructure. 19/10/11

Subsequently, Mackie Environmental Research Pty Ltd was engaged by the Planning Assessment Commission to assist in responding to your request. This prompted additional questions of the Proponent in regards to groundwater. Therefore, my advice is premised also on discussions with Dr Mackie and on the responses to his questions contained in the following document:

- Macles Creek and Boggabri Coal Mine Proposals: Responses to Groundwater Modelling Questions from the NSW Planning and Assessment Commission. Hansen Bailey Pty Ltd. 16 January 2012.

The Boggabri Coal Project is not described in this review, having been adequately described in the EA. The only point of particular note in relation to my brief is that because the approval period (of 21 years) is defined by administrative requirements and not by coal reserves or economic considerations, there is potential for coal mining to continue beyond 21 years.
years. This has implications for the size and shape of the final void that may ultimately be formed.

**Surface v. Underground Mining**

In evaluating future mining options, the Proponent commissioned a conceptual study of utilising underground mining to extract coal down to the same depth as that of the proposed open cut mine. Consistent with studies of this nature, it has a reported accuracy of ±30%. The study identified that three of the eight seams extractable by open cut mining also had potential to be mined from underground. It concluded that the longwall mining method offered the greatest benefits, with the potential to produce 5.3 Mtpa. However, the study identified a number of disadvantages with the underground mining proposal, which contributed to it being dismissed in favour of ongoing surface mining. These disadvantages included:

- The large initial capital cost;
- The significant lead time to achieve economic production levels;
- The sterilisation of more than 100 Mt of coal due to the multiseam nature of the deposit;
- Lower annual production rates, resulting in less social and economic benefit to the community;
- The requirement for all run-of-mine (ROM) coal to be washed, resulting in poorer environmental outcomes;
- The requirement for the construction of a large tailings dam to manage coal fines and rejects, resulting in poorer environmental outcomes.

The need to wash the coal arises because underground mining virtually eliminates the capacity to selectively mine and blend coal from different seams in order to meet market specifications.

The Manules Creek Community Council (MCCC) has submitted that underground mining offers a number of environmental benefits over surface mining. Furthermore, on the basis of an economic analysis commissioned by it, the MCCC has contended that underground mining may be more profitable than that of the open cut operation for which approval is being sought.

With few exceptions, longwall mining is the only competitive underground coal mining method under Australian conditions today. Whilst it can be a very productive and cost efficient mining system, and may be competitive with open cut mining, it has three major disadvantages that present serious risks to economic viability. These are:

- It concentrates all mining operations in one area of the mine, such that if this area is affected by an unplanned event (roof fall, high gas make, flood, fire), mining operations may come to a stop and, in some circumstances, have to be abandoned.
- It is extremely inflexible for coping with breakdowns, geological disturbances and other unexpected conditions. There is no redundancy in equipment and the longwall equipment takes many weeks to months to relocate to a new work place, assuming that it can be recovered in the first instance and that the tunnels to accommodate the equipment at the new work site have already been developed.
- In addition to the longwall equipment constituting a very large component of the capital invested in an underground mine, there is a lead time of 2 to 3 years to replace it if it is lost.
In the case of the Boggabri Mine, it was considered essential for economic reasons that the same set of longwall equipment be capable of mining in all three seams. Because of the significant differences between the thickness of the seams, the limited mineable coal reserves in the three target seams, and the need to maximise extraction from the thickest, most extensive seam, the study was premised on employing a concept novel to the Australian mining industry. This involved utilising Longwall Top Coal Caving (LTCC) to extract coal to a height of 4.9m in the upper seam, and then modifying this equipment to extract coal by conventional longwall mining to a height of no more than 2.5m in the lower two seams.

The viability of the underground operations at Boggabri Mine is dependent on this approach because of the high capital cost of longwall mining equipment and the limited amount of mineable underground coal reserves against which to write off the cost of the equipment. The LTCC mining technique which the Proponent evaluated for extracting the thicker coal seam has only been employed in one Australian Colliery to date and its production rate (~1.8 Mtpa) falls well short of that on which the financial analysis for underground mining at Boggabri Coal has been based (~5.3Mtpa).

The conceptual underground mine design for Boggabri Mine has been based extensively on research into US multiseam mining experience. This produced a lower design limit for multiseam workings which falls well outside Australian experience to date and which the study acknowledged as possibly resulting in extreme mining conditions. A number of other parameters on which the conceptual design has been based also fall well outside those adopted in Australia to date. One of the more significant is that the conceptual mine design is based on superimposing extraction panels and coal pillars in an exact vertical alignment in each seam, resulting in surface subsidence of up to 6 metres being concentrated over the extraction panels.

Mine layouts of this type have been the subject of a number of studies in Australia, from which it can be concluded that at the relatively shallow depths of the Boggabri Coal Project, such a layout is likely to result in surface cracks more than 0.5m in width; steep changes in the slope of the surface; reverse of flow over sections of surface water courses; and ponding. Groundwater will also be seriously impacted by caving and fracturing of the overburden. Nevertheless, provided mining induced changes in near surface groundwater are minimal, overall impacts on fauna and flora can be expected to be much less than those associated with surface mining, at least in the short to medium term.

Consistent with the assessment of the potential for underground mining only being at the conceptual stage, there are a number of other areas that warrant much more detailed study before it could be concluded that underground mining is viable and an acceptable risk. The EA acknowledges that “a great deal of research would be required to accurately predict the likely recovery from a top cooling operation” and “specific areas where further work needs to be done are the geotechnical environment and subsidence impacts, groundwater behaviour due to underground mining, ventilation systems and optimisation of the mine design.”

A risk assessment is presented in the EA of the major hazards associated with underground mining. After the introduction of controls, a high residual risk is still associated with spontaneous combustion, inundation of water, and windblast (air blast). Incendiary sparking between coal cutting picks and the hard conglomerate roof that overlies some mining areas has also been identified in the EA as a potential risk. The Regulator may not approve underground mining operations until these residual safety risks have been reduced to an acceptable level, which could present a considerable challenge, especially in regards to spontaneous combustion.

Against this background, it is my advice to the PAC that:
1. The primary principles to be considered when comparing the appropriateness of open cut mining to underground mining are safety, environmental impact, resource recovery, geological conditions, availability of a skilled underground work force, operational flexibility, productivity, market requirements and financial risk arising out of poor longwall performance and/or loss of the longwall equipment.

2. In the case of the Boggabri Coal Project, underground mining should offer considerable benefits over surface mining in respect of surface related environmental impacts. Otherwise,

3. Underground mining has disadvantages in respect of all of the other noted principles.

4. The elevated safety and financial risk associated with underground mining would require a decision to mine by underground means to be based on a far more detailed study than the conceptual study presented in the EA.

Mine Plan

The EA reports that the mine plans presented in proposal have been modified from those presented in the Preliminary EA (presumably in response to agency input) by:

- redesigning the mine layout to remove the need to cut through a ridgeline for drainage purposes;
- rescheduling of mining activities to provide flexibility to avoid operating in high or exposed areas during noise enhancing weather conditions, particularly at night; and
- relocating haul roads.

No submissions were received specific to the internal layout of the mine. The EA contains limited justification for the overall mine layout, other than that relating to the overburden emplacement areas (OEAs).

My advice to the PAC is that:

1. The general layout of the mine was largely predetermined by the original DA, embedded in mining operations to date. In any event, there are limited alternatives for laying out a multisummine of this nature.

2. The mine layout is appropriate for this type of operation.

3. Should the project be approved, any further modifications that are required to the mine plan in order to safeguard environment values should be able to be addressed effectively through the various environmental and mining operational management plans normally associated with Approval Conditions.

Overburden Emplacement Areas

The mine plan does not specifically identify the two overburden emplacement areas (OEAs, or overburden dumps) located in the south and east, instead referring to these areas as Rehabilitation. However, the OEAs are identifiable by the increasing contour levels in the conceptual mine plans. Although I have not visited the site, I consider the information contained in the EA (assuming that it is accurate) to be adequate to offer this advice.

The EA reports that:

- The (southern) OEA will reach an RL of 395m, an increase of 45m from that originally approved.
• This is not considered visually significant due to its distance from sensitive receptors and shielding from surrounding topography.

• The southern OEA will be completed over approximately the first five years of the mine life. During this period, exposed areas of pre-rehabilitated OEA will have high contrast and low integration with the surrounding landscape; however, it will not exceed 2.5% of the primary view and so result in moderate visual effect.

• The entire mining area will be shielded in all directions following the completion and rehabilitation of the southern slopes of the OEA.

• In the interim, visibility of the OEAs is to be minimised in a three step process involving:
  o shaping overburden to the final landform;
  o land stabilisation with grass planting which restores colour and reduces contrast with the existing landscape;
  o the reintroduction of tree cover.

I have consulted with Dr Mackie regarding the potential for leaching, leachate properties and disposal methodologies for potential acid forming (PAF) materials disposed of in the OEAs and agree with, and defer to, his advice and recommendations in these regards.

Against this background, it is my advice that:

1. Provided commitments given in the EA are honoured and Dr Mackie’s recommendations are enacted, the south and east OEAs should not present an risk to environmental values.

2. The various environmental and mining operational management plans associated with any Approval Conditions should include provisions for monitoring compliance with commitments given in the EA regarding:
   a. the location, timing, and height of construction of the OEAs;
   b. the progressive rehabilitation of the OEAs.

Final Void

If mining were to cease at the end of a 21 year approval period, the EA reports that a final void will remain in the northern section of the Project Boundary. A final void has implications primarily for groundwater, public safety, landform and aesthetics. Dr Mackie has addressed groundwater. In respect of the other factors, the EA states that:

• The final void would have a catchment area of approximately 413 ha, with a surface area of up to 120 ha.¹

• The surface catchment of this final void will be minimised as far as practical by the use of diversion drains and contour banks as required.²

• In the event that open cut or highwall mining does not proceed beyond this point, the final void is to be backfilled to RL 280m to ensure that it does not remain a groundwater sink in the landscape. It will be reshaped to ensure that the land

¹ Main Report, page 167
² Main Report, page 24
form is safe, stable, non-erosive and revegetated as is practical. Catchments areas that are not free draining will report to the reshaped final void.

- The final mining void will not be visible to external views, except from the sky.
- At the end of a 21 year approval period, there will still be potential for a further seven years of mining at 7 Mtpa to the north of the currently designated final void. Should mining continue into this area, the proposed final void could be significantly reduced in size and potentially could be rehabilitated such that limited void remained in the landscape.
- Further to this, there is potential for future open cut mining within the adjacent mining authorities (not held by Boggabri Coal) which could utilise any final void area left by Boggabri Coal.

It is my advice that, in this specific case:

1. From a technical perspective, the characteristics of the proposed final void and the associated management plan are highly likely to result in the void satisfying public safety, landform and aesthetics requirements.

2. The recommendation of Dr Mackie to prepare a mine closure plan prior to mining year 14 should serve as an adequate safeguard for ensuring that the proposed void does satisfy public safety, landform and aesthetic requirements.

3. If any Approval Conditions incorporate those EA commitments that have been premised on the phrases 'as is practical' or 'as far as practical', performance measures and/or outcomes should be assigned to these commitments.

**Final Landform**

The EA reports that a soil and land capability survey has been undertaken and that four distinct soil units were identified within the Project Boundary. Appropriate stripping depths have been determined for each soil type and the potential for acid generation from the regolith material (top soil and sub soil) assessed and found to be low. The EA commits to:

- Utilising previously stripped loam as top dressing in rehabilitation areas;
- Salvaging and storing the sub-soil in manners determined in consultation with the Department of Trade and Investment and Regional Infrastructure and Services (DTIRIS) during the development of the site's revised Rehabilitation Management Plan (RMP);
- Developing the final landform to promote visual characteristics that generally conform to the existing landscape;
- Ensuring long term stability and sustainability by shaping the slopes of the final landform within the mine disturbance area so as to have a maximum slope of 10 degrees;
- The rehabilitation strategy being focussed on biodiversity and the establishment of habitat for threatened species, consistent with contemporary practice;

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3 Main Report, page 167
4 Main report, page 167
5 Main Report, page 24
- Revising the current Environmental Management Plan and an Environmental Monitoring Program for Boggabri Coal to ensure consistency with the Project and the achievement of the biodiversity, water management and aboriginal archaeology outcomes as described in the Environmental Assessment.

Advice on the adequacy and likely effectiveness of the environmental aspects of these commitments is outside my area of expertise. Otherwise, it is my advice that:

1. From a geographic perspective, the proposed final landform is consistent with established practice;
2. The final landform appears appropriate;
3. The recommendation of Dr Mackie to prepare a mine closure plan prior to mining year 14 should serve as an adequate safeguard for ensuring that the proposed final landform is consistent with commitments provided in the EA and with contemporary landform standards at the time of closure;

Should you have any queries arising from this review, please do not hesitate to contact me.

Yours sincerely

Emeritus Professor JM Galvin