



**BULLI SEAM OPERATIONS**

**SECTION 4**  
**FRAMEWORK OF**  
**ENVIRONMENTAL ASSESSMENT**

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## 4 FRAMEWORK OF ENVIRONMENTAL ASSESSMENT

This section briefly describes the approach taken for the EA in relation to the findings and recommendations of the NSW Government Southern Coalfield Inquiry and NSW Planning Assessment Commission's (PAC's) assessment of the Metropolitan Coal Project, in so far as they relate to future applications such as this Project. The Project environmental assessment is provided in Section 5.

### 4.1 SOUTHERN COALFIELD INQUIRY

The NSW Government announced a strategic inquiry into underground mining in the Southern Coalfield (the Southern Coalfield Inquiry) on 6 December 2006. A Panel was appointed to conduct the inquiry. The Terms of Reference for the Inquiry were:

1. Undertake a strategic review of the impacts of underground mining in the Southern Coalfield on significant natural features (i.e. rivers and significant streams, swamps and cliff lines), with particular emphasis on risks to water flows, water quality and aquatic ecosystems; and
2. Provide advice on best practice in regard to:
  - a) assessment of subsidence impacts;
  - b) avoiding and/or minimising adverse impacts on significant natural features; and
  - c) management, monitoring and remediation of subsidence and subsidence-related impacts; and
3. Report on the social and economic significance to the region and the State of the coal resources in the Southern Coalfield.

The Panel reported in July 2008. The findings of the Southern Coalfield Inquiry are documented in the SCPR (DoP, 2008).

As part of the Director-General's EARs, the EA must include an assessment of the potential impacts of the Project, taking into consideration the findings and recommendations of the Southern Coalfield Inquiry. The key issues raised in the SCPR and the findings and recommendations of the Panel as described in the SCPR have been considered and addressed in this EA.

## 4.2 METROPOLITAN COAL PROJECT PLANNING ASSESSMENT COMMISSION REPORT

The Metropolitan Coal Project was the first mining proposal in the Southern Coalfield to be assessed under Part 3A of the EP&A Act since the SCPR was published in 2008.

The Honourable Kristina Keneally (MP), Minister for Planning, directed a PAC be constituted to assess the project application for the Metropolitan Coal Project, pursuant to Section 23D(1)(b)(ii) and Schedule 3 of the EP&A Act and Part 16(B) of the EP&A Regulation. The PAC comprised five members.

The Minister for Planning requested that the PAC:

- (a) carry out a review of the potential subsidence related impacts of the Metropolitan Coal Project on the values of Sydney's drinking water catchment, and in particular its potential impact on the Waratah Rivulet and Woronora Reservoir, taking into consideration the recommendations of the Southern Coalfield Inquiry;
- (b) advise on the significance and acceptability of these potential impacts, and to recommend appropriate measures to avoid, minimise, or offset these impacts; and
- (c) identify and comment on any other significant issues raised in submissions regarding the Metropolitan Coal Project or during the public hearings.

The Minister for Planning also directed that public hearings be held for the Metropolitan Coal Project. The hearings were held in Wollongong in March 2009. Submissions made to the DoP in relation to the project were also considered by the PAC.

In June 2009, the Minister for Planning released the PAC's *Metropolitan Coal Project Review Report* (May, 2009) (herein described as the Metropolitan PAC Report) (PAC, 2009).

In regard to the applicability of the Metropolitan PAC Report to the Project, the report states (page i):

*The Panel has taken the view that its Terms of Reference require it to do two things: (i) to review the Metropolitan Coal Project specifically; and (ii) provide an assessment of how the SCI recommendations might be applied to a substantive mining proposal and to suggest any variations or enhancements that may facilitate application of these recommendations to future proposals.*

Further, the Metropolitan PAC Report states (pages vi and 132):

*The Panel considers that it would be desirable if future proposals for mining in the Southern Coalfield were required to take account of the SCI recommendations as modified by this report in preparing the Project Application and the subsequent EA. It follows that a rigorous review of adequacy of the EA prior to exhibition would assist in making the review stage as short and productive as possible.*

It is important to note that this EA was close to completion when the Metropolitan PAC Report was released in June 2009. Given the Metropolitan PAC Report's relevance to the Project, ICHPL chose to delay submission of the Project EA by approximately two months in order to review the Metropolitan PAC Report and where time has permitted, address the findings and recommendations of the Metropolitan PAC Report where they apply to the Project.

The Metropolitan PAC Report includes a number of recommendations for future proposals in the Southern Coalfield. These are discussed in Sections 4.2.1 to 4.2.7 below. Other findings and recommendations of the Metropolitan PAC Report of relevance to the Project (e.g. aspects pertaining to the assessment of surface water, groundwater, swamps, Aboriginal heritage etc.) are addressed in the specialist studies included in the EA Appendices or elsewhere in this EA.

#### 4.2.1 Risk Management Zones for Significant Natural Features

In relation to Risk Management Zones (RMZs), the Metropolitan PAC Report states (page v):

*The Panel spent considerable time developing methods for applying the SCI principles. In doing so it has derived an expanded risk framework for natural features using the Risk Management Zone (RMZ) concept and set out suggested approaches for assessing relative significance of natural features and the acceptability or otherwise of subsidence induced impacts and consequences for those features.*

and (page 35):

*... definition of RMZs should be an obligatory requirement in all future coal related EAs. In this respect, the Panel reinforces the findings of the SCI that there is a need for government to provide guidelines on what constitutes a 'significant natural feature'. The features suggested by the SCI Panel in this regard have already been noted in Section 3.2.3.*

Section 3.2.3 of the Metropolitan PAC Report includes the Southern Coalfield Inquiry

recommendations, which state the following in relation to the identification of significant natural features (page 8):

*... RMZs should be identified for all significant environmental features which are sensitive to valley closure and upsidence, including rivers, significant streams, significant cliff lines and valley infill swamps.*

and

*RMZs for watercourses should be applied to all streams of 3rd order or above, in the Strahler stream classification. RMZs should also be developed for valley infill swamps not on a 3rd or higher order stream and for other areas of irregular or severe topography, such as major cliff lines and overhangs not directly associated with watercourses.*

RMZs have been applied to upland swamps, rivers and significant streams, Aboriginal heritage sites and major cliffs in Appendices O, P, Q and R, respectively. The RMZ boundaries are based on the definition prescribed in the SCPR (i.e. 400 m surface lateral distance from the outside extremity of the boundary of the feature or by a 40° angle from the vertical down to the coal seam which is proposed to be extracted, whichever is greater).

#### 4.2.2 Risk Framework

The Metropolitan PAC Report recommended that the RMZ concept described above be incorporated into a broader risk framework. Recommendation 2 of the Metropolitan PAC Report states (pages 135 to 136):

##### **Recommendation 2**

*The Panel recommends that the concept of RMZs enunciated in the SCI report be incorporated into a broader risk framework that includes:*

- *Identifying natural features likely to be at risk of negative environmental consequences from subsidence impacts.*
- *Assessing the potential risk to those features from the mining proposal.*
- *Identifying the options for dealing with any significant risk.*
- *Determining which of these options will form part of the management plan.*
- *Monitoring the subsidence impacts, consequences for the feature, and outcomes from the management strategies.*
- *Contingency options and planning to deal with exceedances, and*
- *Auditing of the risk management process.*

The proposed risk framework is described in Sections 6.2 and 9.4.1 of the Metropolitan PAC

Report. Relevantly, Recommendations 3 and 17 of the Metropolitan PAC Report state (pages 136 and 140):

**Recommendation 3**

*The Panel recommends that the steps set out in Section 6.2 of this review for assessing risk be considered for inclusion in future requirements for the assessment of proposals for mining in the Southern Coalfield to ensure that appropriate information on risks to significant natural features is available in the EA.*

**Recommendation 17**

*The Panel recommends that the framework in Section 6.2, as adapted to swamps in Section 9.4.1, be used as a guide for future Southern Coalfield proposals involving upland swamps and that the production of RMZs be obligatory for all upland swamps (ie headwater and valley infill). These RMZs should trigger a requirement to provide comprehensive information on predicted impacts and consequences that might be expected from both conventional and non-conventional subsidence sources. The adequacy of the information provided should be subject to rigorous scrutiny at the adequacy review stage of the assessment process.*

The assessment approach to upland swamps, rivers and significant streams, Aboriginal heritage sites and major cliffs has been conducted consistent with the steps described in Section 6.2 of the Metropolitan PAC Report, and as adapted to swamps in Section 9.4.1 of the Metropolitan PAC Report. Risk assessment reports are provided for upland swamps, rivers and significant streams, Aboriginal heritage sites and major cliffs in Appendices O, P, Q and R, respectively.

**4.2.3 Assessment of Significance and Acceptability of Environmental Consequences**

In relation to assessment of significance and the acceptability of environmental consequences, Recommendations 4, 11 and 18 of the Metropolitan PAC Report state (pages 136, 138, 140 and 141):

**Recommendation 4**

*The Panel recommends replacement of the concept of Reverse Onus of Proof as used in the SCI report by a single requirement that the Proponent demonstrate the reasonableness (or overall merit) of its proposals in relation to the significant natural features that may be exposed to subsidence impacts. The decision-maker can then assess reasonableness (or merit) in the context of the importance of the feature, the predicted risk and any management options for that risk.*

**Recommendation 11**

*The Panel recommends that until objective measures or policy guidance are available, adoption of an approach to significance and protection be adopted that is characterised by a case by case assessment of the values attributed to the watercourse, the options for protecting these values and the feasibility and costs of doing so. A suggested set of values is included in Section 7.4.1 of this report.*

**Recommendation 18**

*The Panel recommends that, in considering the acceptability or otherwise of negative environmental consequences for swamps, an approach based on the material in Section 9.4.1 of this report be adopted ie: negative environmental consequences are considered undesirable for all swamps and:*

- (a) *swamps of special significance will be protected from negative environmental consequences; and*
- (b) *a presumption of protection from significant negative environmental consequences will exist for all other swamps unless the Proponent can demonstrate for an individual swamp that costs of avoidance would be prohibitive and mitigation or remediation options are not reasonable or feasible. Under circumstances where the decision is to allow significant negative environmental consequences to occur and remediation is not feasible offsets and other forms of compensation may be considered appropriate.*

*The Panel also recommends that the steps for implementing this approach set out in Section 9.4.1 of this report be adopted.*

...

The approach taken in the risk assessments presented in Appendices O, P, Q and R is consistent with the recommendations described above.

**4.2.4 Subsidence**

In relation to subsidence, Recommendation 6 of the Metropolitan PAC Report states (page 136):

**Recommendation 6**

*The Panel also recommends that the deficiency in the EA concerning the provision of net subsidence effects at significant features be noted and that future EAs be scrutinised at the adequacy review stage to determine whether all the required information has been provided.*

The findings and recommendations of the Metropolitan PAC Report of relevance to subsidence have been reviewed and the key aspects have been addressed in the Subsidence Assessment provided in Appendix A. The risk assessments presented in Appendices O, P, Q and R include provision of systematic and non-systematic subsidence predictions for each significant natural feature.

#### 4.2.5 Groundwater

In relation to groundwater, the Metropolitan PAC Report states (page 72):

*The Panel recommends that:*

...

2. *Future analyses and prediction of impacts of mining on groundwater either by the Proponent or by other mining companies in the region, give more focused consideration to:*
  - *data assessments – the use of airborne laser survey for detailed topographic mapping, GIS for groundwater systems assessment and management, and consideration of data generated by other mine sites is encouraged.*
  - *wireline geophysical logging – to improve interpolation of measured hydraulic properties like permeability and porosity. Useful logs might include natural gamma; density (neutron), resistivity, sonic, acoustic scanner;*
  - *predictive aquifer modelling - The SCI noted that 3D groundwater modelling as a management tool is especially important since it promotes an understanding of natural recharge processes, the role of creeks and rivers in constraining the water table, base flow estimations (including swamp contributions), and rates and directions of groundwater movement throughout a system for pre-mining, mining and post mining conditions. The SCI also stated that it is especially important to ensure that the adopted model code can adequately address high contrasts in hydraulic properties and steep hydraulic gradients that are typically associated with underground mining operations. In addition, the code must be able to simulate unsaturated and perched conditions that nearly always prevail above extracted longwall panels or beneath upland headwater swamps. The Panel notes that this was not the case for HCPL groundwater studies presented in the EA. Whilst subsequent modelling addressed this issue for the current Project Proposal, the Panel recommends that it be dealt with properly at the EA stage in future proposals.*

Detailed topographic mapping is available across the Project extent of longwall mining area and was used in the development of the numerical groundwater model for the Project. Topographic data was obtained using airborne laser scan methods across the majority of the Project extent of longwall mining area in 2005 with supplementary areas obtained in 2007.

A conceptual model of the hydrogeological regime was developed for the Project based on the review of existing hydrogeological data including:

- Southern Coalfield geology mapping;
- surrounding and regional geological logs;
- relevant data from the DWE register on the Natural Resources Atlas;
- geological and hydrogeological assessments undertaken for the Appin Mine and West Cliff Colliery and other Southern Coalfield mining operations;
- hydrogeological investigations and assessments undertaken for the Upper Nepean (Kangaloon) Borefield Project for the SCA;
- piezometric monitoring and geological information from the Longwall 10 Goaf Hole and PM02 Hole at the nearby Metropolitan Colliery;
- results of the Bulgo Sandstone Injection Trial conducted at the Appin Mine;
- groundwater level and quality monitoring data for the Project area; and
- piezometric monitoring and geological information from multi-level piezometers.

Indicative permeabilities for the various stratigraphic units in the numerical groundwater model were informed by SCA pumping tests, model calibration at Kangaloon (KBR, 2008), model calibration at Mangrove Mountain (Alkhatib and Merrick, 2006), model estimates at Dendrobium Mine (GHD Geotechnics, 2007), and core measurements with model calibration at Metropolitan Colliery (Heritage Computing, 2008). Wireline geophysical logging would be considered as part of future investigations.

Groundwater modelling has been conducted in accordance with the Murray-Darling Basin Commission (MDBC) Groundwater Flow Modelling Guideline (MDBC, 2001). Under the modelling guidelines, the model is best categorised as an Impact Assessment Model of medium complexity. Numerical modelling has been undertaken using the Groundwater Vistas (Version 5.33) software interface (Environmental Simulations Inc [ESI], 2009) in conjunction with MODFLOW-SURFACT (Version 3) distributed commercially by Hydrogeologic, Inc. (Virginia, USA).

The model used is considered adequate to simulate contrasts in hydraulic properties and hydraulic gradients that may be associated with changes to the groundwater system as a result of the Project. The Groundwater Assessment for the Project is presented in Appendix B.

#### 4.2.6 Vegetation

In relation to vegetation surveys, Recommendation 19 of the Metropolitan PAC Report states (page 141):

##### **Recommendation 19**

*The Panel recommends that future Director-General's requirements for vegetation surveys in relation to upland swamps should specify that the surveys are to be of an adequate standard and intensity to detect the presence of valley infill vegetation associations where these might reasonably be expected to occur.*

In relation to the vegetation of upland swamps, the Metropolitan PAC Report states (pages 74 to 75):

##### **9.2. DESCRIPTION OF UPLAND SWAMPS**

*The Southern Coalfield area contains numerous habitat areas defined broadly as 'upland swamps'. These swamps are identified by their distinct wetland vegetation composition (primarily sedges and heaths) compared with the surrounding dry sclerophyll forest which occurs on the better-drained ridge-tops and hill slopes. They are mostly hosted on Hawkesbury sandstone and can be classified broadly into 'headwater' and 'valley infill' swamps<sup>49</sup>.*

*Headwater swamps occur in the higher catchment reaches and systems where relatively shallow topographic grades prevail. Rainfall usually exceeds evaporation in these swamps and as a result there is a perched water table within the sediments that is independent of the regional water table in the underlying Hawkesbury Sandstone. In headwater swamps the degree of saturation varies depending upon climatic conditions. During and following rainfall events, surface runoff prevails. As runoff subsides, groundwater seepage dominates through gravity drainage towards the lowest drainage point in a particular swamp. It is this drainage which (importantly) contributes to downstream baseflow within the host drainage system. There are 6 different vegetation associations found in headwater swamps<sup>50</sup>.*

*Valley infill swamps occur within well-defined drainage lines in the more deeply incised valleys. Their formation may be associated with sediment deposition behind temporary barriers (e.g. log jams) or steps in the underlying substrate where the gradient suddenly becomes steeper. They may receive water from multiple sources (e.g. rainfall, streamflow, and groundwater seepage) and may also be in contact with the regional water table in some cases. Only 2 of the 6 vegetation associations found in headwater swamps are generally found in valley infill swamps.*

*As with any sub-classification along an ecological continuum, some characteristics overlap between upland swamp categories and there will be some examples that are difficult to classify definitively. Also, some of the larger swamps may be clearly headwater in one part and valley infill in another. This does not provide justification for abandoning the sub classification, particularly if the vast majority of swamps can be described as belonging to one or other category and there are category attributes that are useful in understanding the likely impact of mining.*

...

Further, Section 9.4.1 of the Metropolitan PAC Report states (page 80):

*iv. The swamps are not a collection of homogenous units. There is substantial variation between (and within) swamps, primarily driven by their hydrological characteristics.*

A total of 226 swamps have been identified within the Project area (Appendix O). Vegetation mapping of the swamps is described in Appendix E of the EA and is based on mapping of the NPWS (2003), Tozer *et al.* (2006) and Biosis Research (2007a). Vegetation mapping is provided in Section 5 and Appendix E.

As described above, there is overlap in the vegetation characteristics of swamps broadly classified as headwater and in-valley swamps. As a result, there is difficulty in classifying some swamps definitively based on vegetation mapping. Rather than attempting to categorise the 226 swamps as headwater or in-valley swamps, each individual swamp has been assessed in the Upland Swamp Risk Assessment presented in Appendix O from first principles by considering the characteristics of each individual swamp and the predicted systematic and non-systematic subsidence parameters to assess the likelihood of impacts and environmental consequences.

Additional design considerations included undertaking a split sample on the main questionnaire to test for the impact of different temporal payment structures (i.e. lump sum payments versus annual payments for 20 years<sup>1</sup>) in the questionnaire.

The design of the study is described in further detail in the Socio-Economic Assessment provided in Appendix L.

#### 4.2.7 Economic and Social Impacts

In relation to economic and social impacts, the Metropolitan PAC Report states (pages 144 to 145):

*The Panel considers that the issue of non-market valuation techniques for obtaining estimates of environmental costs and community attitudes of protection of significant natural features has enormous potential for use in the EA process. However, concerns were expressed by the Panel regarding the appropriateness of the context statements provided in the application of the Choice Modelling technique for non-market environmental and social impacts in the Metropolitan Coal Project Area. To address these concerns, further testing of the relationship between the context provided to the Choice Modelling respondents and the value estimates so obtained is required.*

The Metropolitan PAC Report comments in relation to the design of the Choice Modelling study undertaken for the Metropolitan Coal Project were considered in the design of the Choice Modelling study for the Project. Specifically:

- The estimated cumulative environmental impact of all mines in the Southern Coalfield was included in context statements in the main Choice Modelling questionnaire.
- Additional contextual information on employment prospects in 31 years time was included.
- Versions of the questionnaire were developed, with the cumulative impact context for all mines in the Southern Coalfield and without it, to test the sensitivity of the Choice Modelling results to this information. This approach is consistent with Recommendation 28 of the Metropolitan PAC Report.
- Modelling of the Choice Modelling results included investigation of the non-linearity of the years (life-of-mine) attribute.

<sup>1</sup> A 20 year payment schedule is consistent with the temporal payment structure used for the Metropolitan Coal Project Choice Modelling study (Gillespie Economics, 2008).