

# Draft Review of Bulli Seam Operations Environmental Assessment

Total Environment Centre



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## Project control



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# **1 Introduction and Background**

## **1.1 Project Context**

Australian Wetlands Consulting Pty Ltd have been commissioned by the Total Environment Centre (TEC) to complete a review of potential impacts upon wetlands (specifically upland swamps) of the Bulli Seam Operations mine proposal at the Appin and West Cliff collieries in the Illawarra region of NSW.

Currently BHP Billiton operating as Illawarra Coal, proposes to extend mining operations in this area for a further 30 years. The proposal is currently before the NSW Planning Minister and has been referred to the Planning Assessment Commission for further assessment. TEC will make a submission to this commission on environmental and economic issues, and in relation to wetlands will rely on the findings of this report.

## **1.2 Scope of investigation**

The following scope of works was agreed upon for this investigation:

- extent of upland swamps potentially affected and their key conservation values
- risks the project poses to upland swamps threatened species, ecological communities and systems within the project area,
- the potential of proposed remediation techniques to alleviate the risks posed by mining under upland swamps.

# **2 Assessment of Wetland Impact**

## **2.1 Framework of assessment**

Sect 6.2 of Metropolitan PAC Report prescribes the framework for ecological assessment including upland swamps. The BHP Billiton/Illawarra Coal response to this requirement for upland swamps is found within Appendix O, Upland Swamp Risk Assessment (August 2009).

## **2.2 Upland swamp risk assessment approach**

Wetlands have been previously identified as a crucial issue requiring assessment and five key steps are identified within section 9.4.1 of the 2009 Metropolitan PAC, which can be briefly stated as:

1. Information on mine parameters and likely types of subsidence impacts should have gathered by the applicant,
2. It is assumed that all swamps in the Project Area will have been identified, have had their vegetation mapped and fauna surveyed and had their topographic and hydrologic characteristics recorded,
3. Any swamps of special significance need to be identified,

4. The risks of impacts and consequences for each individual swamp need to be determined,
5. The question of acceptability of negative environmental consequences for the swamps must be addressed at this point.

Despite this requirement the PAC also acknowledged the inherent uncertainty of the process given gaps in current knowledge. Lack of baseline data is the key concern for this risk assessment, with the proponent suggesting that ongoing monitoring through the project phase will inform an adaptive management response. This position requires close scrutiny.

## **2.3 Methods for predicting subsidence impacts**

No comment has been made here on methods for predicting subsidence impacts. One major concern however is the absence of case studies to which the impact of longwall mining on swamps has been compared. As such the proponent's approach is highly theoretical and inherently risky.

### **2.3.1 Closure and Subsidence Tolerances**

Swamp Impact Mechanism 3 provides no justification for the use of 200mm as the threshold for valley closure (this being defined as the process via which one or both sides a valley move horizontally towards the valley centre line due to changed stress conditions beneath the valley and its confining land mass). Based on our extensive experience changes in surface level of 200mm within wetlands will have profound consequences for species composition and distribution over potentially hundreds of metres. A tolerance of +/- 50mm is considered a more acceptable tolerance limit (Water by Design, 2008).

No comment is made of subsidence impacts noted within Appendix OB of between the 500mm and 1500mm range predicted for swamps within the study area. Such values would irrevocably change the character and function of these swamps with there being little opportunity for adequate rehabilitation, instead relying on simplistic infilling and revegetation. Impacts are particularly severe for swamps within the Northcliff domain.

## **2.4 Swamp identification**

No attempt has been made at this stage of our work to scrutinise methods employed for identifying wetlands, since this component of work is based on reputable sources (NPWS, Tozer et al, 2006).

## **2.5 Swamp characterisation**

No explanation has been provided about how and why the parameters of characterisation as detailed within Attachment OA of Appendix O have been adopted; why the assessment tables are incomplete; and the significance of each parameter considered. The results are largely anecdotal and do little to assist understanding potential impacts of the proposal upon the swamps. This component of the Appendix O is therefore considered inadequate.

## **2.6 Conservation status of upland swamps**

While Swamps within the study area are currently not listed under the TSC Act or EPBC Act, they are acknowledged by NPWS as critical habitats for biodiversity. Further, Appendix O fails to acknowledge that longwall mining is listed as a threatening process under the TSC Act, 1995.





wetlands within the study area. It is highly recommended that mapping methods adopted for the environmental assessment be reviewed using a rigorous and objective wetland boundary method.

### **3 Risk Management Rehabilitation and Offsets**

It is acknowledged in the Metropolitan PAC Report that mining related impacts are probable within the study area (page 84), while the NSW Scientific Committee lists longwall mining as a key threatening process in Schedule 3 of the Threatened Species Conservation Act, 1995. Tacitly acknowledging this probable impact, Appendix O provides a response for risk management, rehabilitation and offsets.

#### **3.1 Risk Management Plans**

Risk management plans (RMPs) are proposed to be prepared for each wetland likely to be impacted by longwall mining. Consistent with the Metropolitan PAC, plans will include options for managing risk, potential costs of options, preferred options, a monitoring regime, contingency plans, auditing requirements. No detail is provided for these management plans, and with the lack of specific field information currently available, there is currently no means for assessing the appropriateness and likely success of this risk management strategy. As the Metropolitan PAC states on page 81,

*“there are too many variables (and possible interactions) in the relationship between predicted subsidence impacts and likelihood of environmental consequences to allow a confident assessment of risk at this time”.*

#### **3.2 Avoidance**

As stated within Appendix O and confirmed by Stewart (2009), impact upon swamps is unavoidable within the subject area if mining is to proceed and is at odds with BHP Billiton’s own objective of zero harm (BHP Billiton, 2010).

#### **3.3 Rehabilitation methods**

With some degree of impact being acknowledged as unavoidable within the subject area, rehabilitation methods are discussed within Appendix O. *Good et al* (2006) is the key document relied upon for both the assertion that adverse impacts can be mitigated and the estimate of costs to undertake any rehabilitation works. Reviews of this document by us and other stakeholders is considered essential to gaining a full appreciation of the methods proposed; comparison of these methods with current best practice; and then determination of their likelihood of success. At this stage the applicant has refused to release this document as at 12 February 2010 (as requested by Total Environment Centre).

The rehabilitation methods can only be considered experimental (ACARP, 2002) and all parties acknowledge that insufficient time has passed to determine to likely success of methods currently employed (Illawarra Coal, Appendix O, Metropolitan PAC). As such there is a fundamental element missing in the environmental assessment which cannot be remedied by the future requirement for environmental plans at a later stage – there is a large inherent risk that must be seriously considered pre-approval. Any rehabilitation methods proposed must demonstrate a prior clear and quantitative understanding of physical and chemical conditions specific to the subject ecosystem. This specific information will facilitate the establishment of measurable objectives and outcomes for and practicality of the rehabilitation works.



Based on the limited information provided within Appendix O and the associated photos, the methods proposed within Appendix O are simplistic and fail to consider micro-topography and the specific hydrological requirements of the various vegetation assemblages and associated fauna species found within upland swamps.

If rehabilitation is to be considered as a requirement specific rehabilitation responses for each vegetation community and key species found within these habitats (regardless of their occurrence within other communities) need to be developed upfront and independently assessed to ensure confidence, particularly those with specific hydrological and water chemistry requirements.

### **3.4 Assemblage rules, competition and wetland zonation**

Any assessment and rehabilitation strategy must consider the basis for plant distribution within a wetland. In part there are niche preferences but also as a result of competition, plants will retreat to a niche or zone the growing conditions of which may be sub-optimal, but competition is sufficiently reduced so that a species can flourish. This is an important distinction. This is complicated further by the impact of eutrophication whereby fertility gradients can result in quite different and unnatural plant assemblages within wetlands (Keddy, 2002 after Levine et al 1998).

Existing literature suggests that empirical investigations can assist in predicting ecological responses within swamps to variations in physical and chemical parameters (Australian Wetlands, 2006).

Physical hydrologic and chemical variability will directly influence competition within the swamps, with the conditions ultimately occurring within the site creating an environment more suited to some species over others. This competition will run along a number of gradients including fertility, water depth, pH and salinity. Through confirmation of these gradients within the wetland we can predict with some confidence those species likely to dominate a site once changes have occurred.

The highly significant ecological, economic and social values of the study area justify detailed investigations into the ecology of upland swamps, notably tolerance to change/disturbance (resilience) and assemblage rules in light of key parameters (hydrology, chemistry, soils, fire). This is standard practice in the process of rehabilitating or managing a wetland and should be considered prior to an impact occurring to ensure that the intervention can result in an acceptable environmental outcome (Australian Wetlands, 2009, 2007).

The six vegetation types found within upland swamps have specific physical, chemical and hydrological requirements which should be confirmed within assemblage rules, thereby enabling the prediction and subsequent management of impacts.

### **3.5 Species diversity within wetlands and implications for management**

Species diversity and dominance will be driven by physical, chemical and hydrological considerations which cannot be ignored when conceiving a desired outcome. Ranked dominance curves can help us communicate the abundance of individual species relative to a variable such as hydrology or pH (Keddy, 2002).

It is important to be able to predict and design for species richness and diversity that is optimal relative to a natural system and complementary to regional biodiversity. Typically as growing conditions become increasingly marginalised the number of species able to cope with the site conditions will decrease (Sharpe & Baldwin, 2009). Site species diversity and in turn regional biodiversity will then reduce.

Faunal diversity will also vary in response to the chemical, hydrologic and vegetative character of the swamps. Hydrology in particular strongly influences species richness, particularly in birds and amphibians. (Keddy, 2002). We know also that vegetative structure will directly influence faunal species richness with a mixed vegetation assemblage being most desirable when trying to enhance species richness within fauna (Keddy, 2002).

Species richness is generally non-linear along gradients of different parameters including salinity, pH, nutrient availability and hydrology (Keddy, 2002 after Glaser et al 1990). This means that there are optimal ranges for maximizing species diversity at the extremes of which a reduced number of species will dominate.

When combined with habitat diversity there are clear implications for the subject site and therefore design responses required. Confirmation of hydrology combined with physical-chemical characteristics is clearly essential to confidently predict the swamp ecosystem likely to prevail within each swamp.

Predictive models for species richness (Grime, 1979) and vegetative structure (Gopal, 1990) are accepted means via which the various parameters under consideration can be compiled and therefore predict the vegetation communities likely to emerge within the subject sites – and ensure that any outcome is desirable relative to stated objectives.

### 3.6 Hydrology

In simple terms, two key principles which apply to wetland character are:

1. The greater the long-term variation in water levels, the greater the wetland extent will be.
2. The type of wetland to emerge will depend on the frequency and duration of flooding.

Hydroperiod will determine the type of swamp system that emerges (Keddy, 2002, p 34) as well as influencing mineralization, animal breeding, adsorption of nutrients, weed control and seed germination. This makes the ability to manage hydroperiod adaptively a critical design consideration (Hoban et al., 2006).

Hydrology will directly influence biota – for example macroinvertebrates are sensitive variations in water depth with species richness and abundance declining as water levels increase. A range of fauna, both species diversity and abundance are strongly influenced by hydrology.

Changes in hydrology can have profound impacts upon wetland character, not only in species abundance but also on composition. Further the influence of hydrology on wetland boundaries is a complex and unresolved issue (Keddy, 2002).

The six key vegetation types found within upland swamps are a response to variations in soils, aspect and most notably hydrology. These complex mosaics will shift in response to minor variations in topography and flow regime.

Groundwater levels are a key determinant of wetland form, however within Appendix O all mention of groundwater data is qualified as indicative. Groundwater characteristics are a key factor in upland swamp function and must be thoroughly understood in a spatial temporal context.

### **3.7 Disturbance**

To a very limited extent, disturbance is a desirable attribute within a swamp as it promotes vegetative growth, seed germination, processing of nutrients and aeration of sediments. However there are limits beyond which disturbance will have a negative impact upon the swamps by limiting plant diversity to only the most resilient species, creating niche environments for pest species and generally limiting biomass and therefore carbon production which is essential for water quality and ecosystem health (Keddy, 2002).

The principal form of disturbance within the site will be variations in hydrology associated with changes in topography. Subsequent disturbance or stressors will include salinity, acidity and nutrient deficiency.

No detail is provided in the EA on construction methods, monitoring requirements and definition of success in this context, or contingency measures in the event that proposed outcomes are not being achieved. Alteration of natural flows to rivers, stream and association floodplains and wetlands is a key threatening process which any rehabilitation method must demonstrate can be successfully overcome.

Plate O-7 within Appendix O, detailing the location of coir log dams and water spreaders is inadequate and too broad to enable precise decision making required in such sensitive habitats.

A rehabilitation design must be provided in much more detail before any approvals are considered. As a minimum the following must be provided (Australian Wetlands, 2006):

- Hydrology – groundwater and surface water,
- A detailed water balance,
- Water and soil chemistry,
- Physical soil characteristics,
- Detailed site topography at a contour interval not greater than 50mm,
- Design responses with a tolerance of +/- 25mm accuracy in placement,
- Access planning,
- A maintenance and monitoring design which enables informed management decisions in light of specific and measurable objectives for the subject site around hydrology, water chemistry and vegetation character.

### 3.8 Rehabilitation costs

No explanation of rehabilitation costs has been provided within Appendix O. Numbers offered appear preliminary and arbitrary. By comparison it is reported that BHP allocated \$2.2 M for repairs to Marhnyes Hole in their 2002/03 budget; while in another study \$1M is suggested for every 100m<sup>2</sup> of disturbance and that it is in fact cheaper to not extract coal from an area than to extract and have to undertake rehabilitation works (EcoLogical, 2004).

These figures – actual budget figures from BHP - and estimates from reputable consultants would suggest that the figures provided within Appendix O are at least an order of magnitude lower than what would actually be required for successful rehabilitation works.

Similar works undertaken by Australian Wetlands have shown that appropriate planning and design is a significant component of the rehabilitation cost. Complexity created by numerous stakeholders, hydrology, soil chemistry and plant ecology mean that multi-disciplinary teams are required (Australian Wetlands, 2006).

### 3.9 Offsets

Section O 6.4 acknowledges that significant negative impacts are difficult to predict, but based on experiences in other localities (eg Flat Rock Swamp) it also acknowledges that significant negative impacts are likely to occur within the study area – and hence the proposal for offsets and compensation. While offsets and compensation have been acknowledged by the Metropolitan PAC report as a potentially suitable solution where avoidance, mitigation and rehabilitation are not feasible, no explanation of offset and rehabilitation methods are prescribed within the subject report. Table O-5 provides no explanation of financial contributions and monetary figures sited in this table appear arbitrary.

No explanation is provided of potentially suitable donor sites, or the ratio at which lost wetlands should be compensated. There is also no explanation of the framework via which offsets and compensation should be calculated. In contrast, the NSW Compensatory Wetland Policy recommends a minimum 10:1 ratio to compensate for lost or damaged wetlands – managed in perpetuity by the applicant. This policy (nor any other policy or framework) is not acknowledged within the Appendix O.

A compensation management plan subject to public and agency consultation is required ahead of any approval being granted to ensure the offset and compensation strategy is workable. This is consistent with approvals granted by the NSW State Government for major infrastructure projects (Australian Wetlands, 2009).

## 4 General

Appendix O is a narrowly focused document which not only fails to consider current policy and legislation relevant to managing upland swamps and wetlands generally, but also does not cite a single piece of relevant literature concerned with wetland management, ecology and rehabilitation.

No case studies have been considered (or at least acknowledged) in the determination of appropriate responses or justification for decisions being made. Appendix O does not adequately consider basic

principles of wetland ecology within its decision making approach, including the spatial and temporal context, hydrology, water chemistry and vegetative responses to physical and chemical changes within a wetland (see Keddy, 2002). Any wetland management strategy being proposed must explicitly demonstrate an understanding of current ecological trajectory, how this trajectory will be changed by a proposed land-use, and the means via which this trajectory will be corrected.

There exist a variety of methods for predicting changes in wetland parameters and subsequent changes in species representation and composition (de Swart et al., 1994; Mitchell et al., 1999; Keddy, 2002; Australian Wetlands, 2007), but no such methods have been considered within Appendix O. Any risk assessment which fails to consider the means via which an ecosystem will change is inherently flawed. An acknowledgment within Appendix O of a high degree of uncertainty around potential impacts upon upland swamps suggests that additional literature reviews, monitoring and field trials are required before any approvals can be considered.

## 5 Recommendations

Recommendations made within this report must be qualified by the limited time afforded to consider available literature and the significant deficiencies in the environmental assessment, notably Appendix O.

Our recommendations at this stage are:

1. A principle of zero harm should be the basis for assessment and any approval
2. In light of the acknowledgement by all parties that longwall mining will be detrimental for upland swamps within the study area, a 30 year approval (even with conditions) should not be given to the applicant. (We note a number of key agency and community submissions propose a staged or time limited approval).
3. Rehabilitation techniques require refinement and review to determine their appropriateness within the study area.
4. Any compensation or offset measures proposed should be developed as part of the project approval process, not the operational phase.
5. Cost estimates for offsets, research and rehabilitation nominated within Appendix O are wholly inadequate due to lack of detail and require revision.
6. Mapping methods require review to encompass ecotones beyond simplistic wetland boundaries.



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