

River-flat Eucalypt Forest Management Plan

Appin Area 7

Report for
BHP Billiton Illawarra Coal

River-flat Eucalypt Forest
Management Plan
Appin Area 7

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1.0 INTRODUCTION

BHP Billiton Illawarra Coal has been granted approval to develop Longwalls 701-704 at their Appin Area 7 (previously Douglas Area 7) operations.

Biosis Research Pty. Ltd. was commissioned by BHP Billiton Illawarra Coal to undertake a terrestrial flora and fauna impact assessment for subsidence impacts predicted for the proposed longwall mining in Appin Area 7, specifically Longwalls 701 to 704 (Douglas Longwalls 701 – 704). The impact assessment Biosis Research (2007), is referred to in this report as the flora and fauna assessment. A key reference for the flora and fauna assessment was (MSEC 2006), and this document is referred to as the MSEC report.

The Study Area has been the subject of several field surveys with specific reference to longwall mining. It was initially surveyed as part of the larger Appin Area 7 assessment on several occasions between the 9th September 2003 and the 26th of February 2004. The general condition of the site was assessed and observations of flora and fauna species, vegetation communities and land use patterns were made. This assessment is detailed in Richardson and English (2004).

Further detailed field surveys, specific to the Study Area, were undertaken on 7-9 and 16 of February 2006. Targeted searches for threatened flora and fauna species and their habitats were conducted, and vegetation and land use mapping was updated.

The overall finding of the MSEC report is that the predicted impacts to significant natural features (including flora and fauna) are manageable and can be controlled by the preparation and implementation of a Subsidence Management Plan for the area.

A monitoring program focusing on subsidence has been prepared and implemented by BHPBIC as per the approval conditions. This report specifically addresses the Appin Area 7 SMP Approval Condition 17, which is reproduced below.

“The Leaseholder must submit to the Director Environmental Sustainability for approval a plan for rehabilitation of the endangered River Flat Eucalypt Forest Community (Riparian Forest) likely to be affected by subsidence impacts (including Riparian Forest downstream from the application area that is indirectly affected by subsidence impacts). The plan must:

a) be prepared by a suitably qualified person;

- b) include baseline information on the condition of the Riparian Forest;
- c) detail the procedures for rehabilitation and enhancement of the Riparian Forest; and
- d) include completion criteria and a programme to monitor the effectiveness of the rehabilitation.”

The authors of this management plan are suitably qualified to determine effective management strategies for the Endangered Ecological Community, River Flat Eucalypt Forest within the Appin Area 7 Study Area having previously assessed the proposal. The authors of this management plan have extensive experience in subsidence impact assessment in relation to terrestrial ecology and also in the field of bush regeneration and mine site rehabilitation.

1.1 Baseline Information

River-flat Eucalypt Forest vegetation was extensively cleared by early settlers to gain access to highly fertile alluvial soils (NPWS 2002). The scattered remnants of this community are currently under threat from invasion by woody weeds including Privet (*Ligustrum* spp.) as well as disturbance from grazing, clearing, sand/soil mining and physical disturbance associated with recreational access (NPWS 2002).

Within the Study Area *Ligustrum* spp., *Arundo donax* and various grass and climbing plants are major weeds within this community. Furthermore, along some sections of the river it appears that this community has been almost entirely replaced by *Ligustrum* spp and other woody weed species. This vegetation community in the SMP Area is considered to be in poor condition.

Seven vegetation communities, mapped by NPWS (2002), are recognised as occurring within the Study Area. Four of these communities are listed as Endangered Ecological Communities on the *Threatened Species Conservation Act* 1999 and/or the *Environment Protection and Biodiversity Conservation Act* 1999. These include Cumberland Plain Woodland, Shale Sandstone Transition Forest, Moist Shale Woodland and River-flat Eucalypt Forest (the subject of this management plan).

Cumberland Plain Woodland, Moist Shale Woodland and Shale Sandstone Transition Forest occur on the undulating topography on shale derived and shale influenced sandy soils. While creeks and or drainage lines may cut through these vegetation communities, they are entirely terrestrial in nature. Unlike wetlands or other flow-dependent vegetation communities, they are not dependent on the flow of water from creeks or streams. River-flat Eucalypt Forest (RFEF) occurs

adjacent to the Nepean River on alluvial soils.

The potential causes of impacts are direct physical disturbance from surface cracking, rock fall onto vegetation, gas release, inundation or desiccation due to change in relative level of water with the banks of the river. All of these are considered unlikely and/or insignificant.

Gas emissions may result from sandstone fracturing above areas where coal is being extracted from longwalls. The liberation of gas emissions has been observed within the Cataract River above the workings of Tower Colliery. The MSEC report states that the gas emissions expected in the Nepean River gorge as a result of the extraction of Longwalls 701 – 704 are much less than that observed in the Cataract River gorge above the Tower Colliery workings. This is predominately due to the Area 7 longwalls not mining directly beneath the gorge. Furthermore, in the event that gas is liberated from above these workings it is likely to only occur within a limited area and would be unlikely to result in permanent vegetation die-off. Gas emissions are unlikely to result in the long term alteration of species distribution or composition within the vegetation communities and as such it is considered that the proposed longwall extraction would be unlikely to have a significant impact on flora and fauna including the Riparian Forest.

2.0 PREDICTED IMPACTS – THE MSEC REPORT

The potential causes of impacts are direct physical disturbance from surface cracking, rock fall onto vegetation, gas release, inundation or desiccation due to change in relative level of water with the banks of the river. All of these are considered unlikely and/or insignificant in relation to Longwalls 701-704.

Table 1 lists the predicted impacts (*The Douglas Project Longwalls 701-704 Report on The Prediction of Subsidence Parameters and the Assessment of Mine Subsidence Impacts in Surface and Sub-surface Features Due to Mining Longwalls 701 to 704 at the Douglas Project in Support of an EIS and SMP Application – MSEC Report 209 Revision E, April 2006*) associated with subsidence due to longwall mining of Appin Area 7 and the potential impact on the endangered ecological community (EEC) River-flat Eucalypt Forest (RFEF) along the Nepean River within the SMP Area.

Table 1. Predicted Impacts Associated with Subsidence due to Longwall Mining of Appin Area 7 on RFEF

Predicted Impact	Potential Impact on RFEF
<p>1. Surface Cracking</p> <p>Some surface cracking is likely to occur within the study area</p>	<p>Surface cracking alone, as predicted in the MSEC report, is not likely to alter the structure, composition or distribution of RFEF or other plant communities within the study area. Surface cracking has a limited potential to cause erosion though any impacts associated with this are likely to be minor.</p> <p>The native vegetation along the alluvial banks is highly weed infested and considered to be in poor condition.</p>
<p>2. Flooding of Banks of Nepean River and its tributaries</p> <p>Some narrow point bars and river islands are susceptible to inundation during major flood events and may be impacted by subsidence. In Section 3.3 and 3.4 of the MSEC report identify the likely flooding or desiccation that may be associated with the extraction of Longwalls 401-404 in the Nepean River and its tributaries.</p>	<p>Flooding of the banks of the Nepean River and its Tributaries may occur if, following subsidence related landscape movement, the river/creek bank is lowered relative to the pre-mining high water level, thus inundating previously “dry areas”. The riparian vegetation of the Study Area is adapted to flood events however prolonged inundation may lead to the “drowning of some small areas of vegetation.</p> <p>Prolonged flooding may cause some permanently submerged vegetation to die off however if this phenomena results from the subsidence the area of vegetation potential susceptible to inundation is very small and insignificant.</p>
<p>3. Desiccation of Banks of the Nepean River and Tributaries</p> <p>Water loss from the Nepean River is considered unlikely to occur as water-levels are controlled by the Menangle Weir and the flooded valley is at the lowest point in the hydrogeological landscape. The predicted uplift of the valley floor may result in some desiccation of the banks within small sections of the Nepean River, however the area likely to be impacted is minimal and not significant.</p>	<p>There is some potential for dieback due to drying of the substrate of alluvial soils. As RFEF occurs on alluvial banks and point bars within the study area, there is the potential for the community to be impacted by desiccation though it is not likely that desiccation will alter the structure, composition or distribution of RFEF or other plant communities within the study area.</p> <p>The native vegetation along the alluvial banks is highly weed infested and considered to be in poor condition.</p>

Predicted Impact	Potential Impact on RFEF
<p>4. Mass Movement</p> <p>The MSEC report assesses the likelihood of cliff instabilities within the Nepean River gorge as very low. In addition to this, large scale slope failure is unlikely as this has never been observed in the Southern Coalfields.</p>	<p>Mass movements including rock falls and land slippage is likely to be minimal if observed at all within the Study Area. Any potential impacts associated with this type of impact is likely to be limited to crushing of very small areas of vegetation by rock falls and subsequent erosion of soil.</p>
<p>5. Gas Emissions</p> <p>The MSEC report states that any gas emissions within the Nepean River as a result of the Appin Area 7 workings are likely to be isolated and minor as the workings are not beneath the river.</p>	<p>Vegetation Dieback</p> <p>Dieback associated with gas emissions due to subsidence has been previously observed within small patches of riparian vegetation in the Cataract River gorge. Dieback appears to be short lived and regeneration occurs rapidly. Section 2.5.8 of the flora and fauna assessment details the likelihood of gas emissions associated with the proposal and identifies these impacts as being minimal if they occur at all within the Study Area.</p>

3.0 PROPOSED MANAGEMENT ACTIONS

The impact of subsidence on the Endangered Ecological Community River Flat Eucalypt Forest is predicted to be minimal and insignificant (see Table 1).

Accordingly, a management strategy has been developed that takes into account the minimal nature of the impacts as well as the highly disturbed nature of the Endangered Ecological Community. The management strategy uses the following three core principles as the basis for any management activities:

1. Employ a monitoring program aimed at the detection of changes to the condition of the vegetation associated with subsidence. These inspections are currently undertaken at monthly intervals by BHPBIC field staff and will be undertaken weekly during active subsidence within the area.
2. Where an impact on River-flat Eucalypt Forest is detected, a qualified ecologist will assess that impact and recommend management actions aimed at the rehabilitation of this community. The response to impact will follow the principles outlined for each potential impact as identified below.
3. The timing of rehabilitation will take into account any active subsidence. Some rehabilitation or revegetation techniques proposed would be ineffective during active subsidence.

3.1 Surface Cracking

Potential Impacts: Soil disturbance and erosion associated with exposed surface cracks

Likelihood: Possible

Severity: Localized and minor

Management Activities:

- Large cracks should be backfilled to surface level with locally available alluvial soils or imported inert and weed free material (crushed sandstone or similar)
- Silt fencing and erosion controls should be erected around any cracks that are likely to be further subject to erosive forces (water, vehicular traffic or livestock access)
- At the cessation of subsidence any areas where cracking persists and where the surface soils are subject to possible further erosion, brush matting should be employed to establish a ground cover and promote

revegetation of the impacted areas

- Sites that have been rehabilitated with brush-matting will be monitored at six and twelve months. Where brush-matting has proved unsuccessful and or where further work is required, re-planting of affected sites will be undertaken using provenance sourced seedlings and then monitored until the affected area is revegetated.

Success Criteria and Cessation of Management

Any potential impacts of surface cracking on the RFEF will be considered to have been successfully rehabilitated when:

- Pre-mining surface soil contours have been reinstated within the affected RFEF
- Erosion of soils within the RFEF has been arrested by successful regeneration of ground cover vegetation by either natural regeneration or through assisted regeneration using brush matting or replanting

It is anticipated that successful regeneration of sites that have been affected by surface cracking should not require greater than 12 months management and monitoring from the time of observed impacts.

3.2 Flooding of Banks of the Nepean River and Tributaries

Potential Impacts: Prolonged flooding may cause some permanently submerged vegetation to die.

Likelihood: Unlikely

Severity: Localized and minor

Management Activities:

- Regular monitoring of the river will identify areas that become flooded.
- Where flooding occurs, and at the cessation of subsidence, a suitably qualified ecologist will investigate the impact on RFEF.
- It is possible for water levels to recede in some areas after the cessation of subsidence. Where vegetation has been temporarily flooded it will be monitored after the water recedes to ensure that natural regeneration occurs.
- Where required, the management strategies outlined above in this report

or any other specific actions to rehabilitate affected areas of RFEF will be employed.

Success Criteria and Cessation of Management

It is unlikely that areas of RFEF that remain flooded at the cessation of subsidence within the study area will require any active management practices.

Any potential impacts of temporary inundation within the RFEF will be considered to have been successfully rehabilitated when:

- successful regeneration of ground cover vegetation by either natural regeneration or through assisted regeneration using brush matting or replanting has occurred

It is anticipated that successful regeneration of sites that have been affected by temporary inundation should not require greater than 12 months management and monitoring from the time that waters recede.

3.3 Desiccation of Banks of the Nepean River and Tributaries

Potential Impacts: There is some potential for localised dieback due to drying of the substrate of alluvial soils.

Likelihood: Possible

Severity: Localized and minor

Management Activities:

- Regular monitoring of the river will identify areas of dieback.
- Where dieback occurs, and at the cessation of subsidence, a suitably qualified ecologist will investigate the impact on RFEF.
- Where required the management strategies outlined in this report or any other specific actions to rehabilitate affected areas of RFEF will be employed.

Success Criteria and Cessation of Management

Any potential impacts of desiccation of the alluvial soils on the RFEF will be considered to have been successfully rehabilitated when:

- the RFEF has successfully regenerated by either natural regeneration or

through assisted regeneration using brush matting or replanting

It is anticipated that successful regeneration of sites that have been affected by soil desiccation should not require greater than 12 months management and monitoring from the time of observed impacts.

3.4 Mass Movement

Potential Impacts: Any impacts associated with this mechanism is likely to be limited to crushing of very small areas of vegetation by rock falls or small areas of eroded soil due to the physical movement of soil or rocks.

Likelihood: Possible

Severity: Localized and minor

Management Activities:

- Regular monitoring of the river, riparian areas, steep slopes and cliffs will identify areas where mass movement has occurred.
- Where mass movement occurs, and at the cessation of subsidence, a suitably qualified ecologist will investigate the impact on RFEF.
- Where required, the management strategies outlined in this report and any other specific actions recommended to rehabilitate impacted areas of RFEF will be implemented.

Success Criteria and Cessation of Management

Any potential impacts of mass movement on the RFEF will be considered to have been successfully rehabilitated when:

- Unstable or eroded soils within the RFEF has been successfully arrested through the regeneration of ground cover vegetation by either natural regeneration or through assisted regeneration using brush matting or replanting

It is anticipated that successful regeneration of sites that have been affected by surface cracking should not require greater than 12 months management and monitoring from the time of observed impacts.

3.5 Gas Emissions

Potential Impacts: There is some potential for localised dieback due to the impact of the anaerobic conditions created by gas emissions in the soil profile.

Likelihood: Possible

Severity: Localized and minor

Management Activities:

- Regular monitoring of the river will identify areas that exhibit dieback.
- Where dieback occurs, and at the cessation of subsidence and associated gas emissions, a suitably qualified ecologist will investigate the impact on RFEF.
- Where required, management strategies outlined in this report and any other specific actions recommended to rehabilitate impacted areas of RFEF will be implemented. In the case of vegetation die back caused by gas emissions, it will be important to consider and review the findings of the revegetation strategy for the area of vegetation previously affected within the lower Cataract River.

Success Criteria and Cessation of Management

Any potential impacts of gas emissions on the RFEF will be considered to have been successfully rehabilitated when:

- the RFEF has successfully regenerated by either natural regeneration or through assisted regeneration using brush matting or replanting

It is anticipated that successful regeneration of sites that have been affected by gas emissions should not require greater than 12 months management and monitoring from the cessation of gas emissions.

4.0 CONCLUSION

It is anticipated that the impacts from subsidence associated with longwall mining on RFEF in the study area is likely to be low and insignificant. Additionally, the condition of the RFEF within the study area is considered to be poor because of previous land use disturbance and subsequent weed invasion.

This management plan proposes management practices consistent with the level of pre-mining condition of the RFEF and the anticipated level of impact that may be observed. Similarly, this management plan identifies the timeframe that is likely to be required in order to successfully rehabilitate any impacts subsidence may have on RFEF and recognizes that some management techniques cannot be successfully employed until the cessation of active subsidence.

It is therefore anticipated that the management plan proposed within this document is sufficient to manage any potential impacts to the Endangered Ecological Community RFEF from subsidence due to extraction of Longwalls 701 to 704.

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