



**Flora and Fauna Assessment
Appin Area 7: Longwall 703
End of Panel Report**

May 2011

Wollongong:

8 Tate Street Wollongong 2500
Ph: (02) 4229 5222 Fax: (02) 4229 2500
email: wollongong@biosisresearch.com.au

Sydney:

15 – 17 Henrietta Street Chippendale 2008
Ph: (02) 9690 2777 Fax: (02) 9690 2577
email: sydney@biosisresearch.com.au

Canberra:

PO Box 7303, Canberra, ACT 2610
Ph: (02) 6228 1599 Fax: (02) 6280 8752
email: queanbeyan@biosisresearch.com.au

Melbourne:

38 Bertie Street Port Melbourne 3207
Ph: (03) 9646 9499 Fax: (03) 9646 9242
email: melbourne@biosisresearch.com.au

Ballarat:

449 Doveton Street North Ballarat 3350
Ph: (03) 5331 7000 Fax: (03) 5331 7033
email: ballarat@biosisresearch.com.au

Wangaratta:

26A Reid Street, Wangaratta VIC 3677
Ph: (03) 5721 9453 Fax: (03) 5721 9454
email: wangaratta@biosisresearch.com.au

Project no: 12959

Author:

Ben Coddington

Nathan Garvey

Reviewer:

Robert Speirs

Mapping:

Ashley Pritchard

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- Bruce Blunden (BHPBIC)
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- Luke Pascot (BHPBIC)
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ABBREVIATIONS

EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
MSEC	Mine Subsidence Engineering Consultants
ROTAP	Rare or Threatened Australian Plant as listed by Briggs and Leigh (1995)
SCT	SCT Operations Pty Ltd
SMP	Subsidence Management Plan
sp.	Species (singular)
spp.	Species (plural)
ssp.	Subspecies
TSC Act	<i>Threatened Species Conservation Act 1995</i>
var.	Variety

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1.0 INTRODUCTION

This report assesses the post mining conditions associated with terrestrial ecology in the Subsidence Management Plan (SMP) area associated with Longwall 703 within Area 7 of the Appin Colliery. The Colliery is located near the township of Douglas Park (Figure 1). Coal was extracted from Longwall 703 between 22nd October 2009 and 8th March 2011.

This report compares the predicted impacts to terrestrial flora and fauna of Longwalls in Appin Area 7 as assessed by Biosis Research (2006) with observations made during post mining field investigations conducted by Biosis Research as well as relevant reports from monitoring by the Illawarra Coal (IC) Environmental Field Team.

Mine Subsidence Engineering Consultants (MSEC) 2006 (MSEC document 209) report predicts the impacts of subsidence to landscape features within Appin Area 7. The implications of the modified longwall layout are considered in a 2009 MSEC report (MSEC document 385). These predictions form the basis of Biosis (2006) predicted impacts to flora and fauna and are referred to in regard to potential impact to landscape features throughout this report.

This end of panel assessment for Longwall 703 was prepared shortly after the cessation of mining to meet the requirements of Condition 20 of the Subsidence Management Plan. Some minor subsidence movements and effects of longwall mining are likely to continue for a period after the completion of mining. In addition, planned Longwall 704 extraction will initiate some subsidence movements over Longwall 703. An assessment of impacts to flora and fauna will be conducted following the completion of Longwall 704.

The Study Area incorporates the area immediately above Longwall 703 and an additional 500m from the edge of the workings to account for any far field or indirect impacts. The Study Area includes a section of the Nepean River.

2.0 PREDICTED IMPACTS

The following is a summary of the predicted impacts as reported by the pre-mining ecological assessment conducted by Biosis Research in April 2006, which was prepared for the SMP area encompassing Longwalls 701 to 704 (Biosis Research 2006). A summary of the predicted subsidence impacts on natural features occurring in the Study Area is sourced from MSEC 2006 and MSEC 2009. A summary of the ecological values of the Study Area in regard to threatened flora and fauna is source from Biosis 2006.

2.1 Nepean River and Tributaries

Coal extraction through longwall mining methods may result in lowering of the surface and has the potential to cause surface cracking. Surface cracking can lead to redirection of water from rock bar controlled pools into the dilated strata below, before it emerges further downstream. From an ecological perspective this fracturing can result in the draining of pools or substrates supporting flora and fauna dependent on surface water flows. As such, the key focus areas for the ecological assessment of subsidence impacts within the Study Area are the Nepean River and its tributaries.

2.1.1 Nepean River

Subsidence predictions

- MSEC (2006) predicted that the Nepean River valley floor would experience a net uplift of the base of the river.
- Uplift was predicted to be most pronounced where the river valley is closest to an area of coal extraction (goaf) which coincides with the end of Longwalls 702 and 703. Further uplift is predicted to occur during the extraction of Longwall 704.

Potential for Desiccation (Banks of the Nepean River and Land Prone to Flooding)

- Pool water loss from the Nepean River was considered unlikely to occur as water levels in the Nepean River within the Study Area are controlled by Menangle Weir such that this section of the river is a flooded valley, even in periods of low flow. MSEC (2006) predicted that the water level along the Nepean River would remain unchanged after mining.
- It was predicted that the uplift of the valley floor could result in some minor desiccation of the banks along short sections of the Nepean River. The area of land predicted to be affected by desiccation was considered to be very small due to the steepness of the river banks. MSEC (2006) stated that the maximum predicted movement of the shoreline (and hence potential for desiccation) would occur in a small area near the end of Longwall 703.
- The predicted uplift of the banks could reduce the frequency of inundation of some elevations of the river banks.
- During periods of low flow, areas subject to uplift that were previously permanently below the baseline water level of the Nepean River were expected to experience some periods of desiccation as a result of the predicted movements.

Potential for Scouring of the River Bed and Banks

- Predicted changes to flow velocities and the rate of scouring were considered to be insignificant.

Potential for Fracturing of the River Bed and Rock Bars

- Only minor and isolated fracturing of the Nepean River bed rock was predicted, as the longwall mining would not mine directly beneath the Nepean River.

Surface Water Flow Diversion

- The potential for subterranean flow diversion or rockbar leakage was considered to be very low as the river bed is flooded and the gradient of the river is very flat.
- Any fractures in the bedrock that developed as a result of mining were likely to be immediately filled by water or sediment. The volume of water that filled these fractures was predicted to be small when compared to the total volume of water in the Nepean River within the Study Area.
- Potential for redirection of surface water flows to the groundwater system was very low as the Nepean River represents the bottom of the regional water table.
- The volume of water available for use by terrestrial ecosystems within the Study Area was not expected to be significantly impacted.

Water Quality

- The potential for adverse water quality impacts from the formation of springs or by stream bed fracturing was predicted to be low.

2.1.2 Tributary Creeks

There are a number of small tributaries that flow into the Nepean River, within or in close proximity to the Study Area. The majority of these are very small and have not been directly mined beneath by Longwall 703. Elladale Creek is the largest tributary creek within the proximity of the Study Area. This creek is closest to the previously mined Longwall 701 and is located over 500m from Longwall 702 and over 1.5km from Longwall 703. As such impacts to this creek were predicted to be minor. Subsidence predictions indicated that there would be no impacts on other creeks located beyond the Study Area (including Ousedale, Mallaty and Harris Creeks).

Potential for Ponding, Flooding and Desiccation

- The distance of Elladale Creek from any longwall goaf means that subsidence impacts within this creek were considered unlikely to result in a significant change to ponding, flooding or desiccation.

- The remaining smaller, unnamed tributaries within the Study Area were found to be ephemeral, likely to flow in periods of heavy rain and only for a short period of time. The grades of these watercourses were considered to be potentially slightly reduced as a result of the predicted subsidence movements.

Potential for Fracturing and Surface Flow Diversions in the Creeks

- Elladale Creek is situated approximately 500m from the Longwall 701 goaf and is over 1.5km from Longwall 703. It was therefore predicted to only be subject to valley closure or far field effects, which are unlikely to result in fracturing or water loss.
- Smaller, unnamed tributaries were predicted to experience some cracking. These systems are ephemeral and are likely to flow only in periods of high rainfall, in which case MSEC (2006) predicted that the majority of the runoff would flow over the beds of these watercourses and would not divert into the dilated strata.

2.2 Dams

MSEC (2006) predicted that the extraction of Longwalls 701-704 would be unlikely to result in significant impacts to farm dams and that if, for example, leaks were observed they would be repaired in consultation with the owner.

2.3 Cliffs

None of the cliffs in the Study Area would be directly mined beneath. MSEC (2006) assessed the risk of cliff instabilities as very low and noted that all previously recorded rock falls have occurred directly above extracted longwalls.

2.4 Steep Slopes

While steep slopes occur within the Nepean River gorge, the MSEC report predicted that any tension cracks or soil slumping associated with subsidence in the Study Area was unlikely to result in significant environmental impact.

Large scale slope failure was considered to be unlikely, as these impacts have never been observed beyond goaf areas in the Southern Coalfields.

2.5 Rock Shelves – Overhangs

Rock shelves and overhang structures that may provide habitat for a range of terrestrial fauna are located within the Nepean River gorge. MSEC (2006) predicted that overhangs and rock shelves, would be unlikely to be impacted by the extraction of Longwalls 701 to 704. As such it was

considered unlikely that the proposal would have a significant impact on potential habitat provided by these structures.

2.6 Gas Emissions

MSEC (2006) predicted that any gas emissions within the Nepean River and Elladale Creek were likely to be isolated and minor and would be unlikely to significantly impact water quality.

The MSEC report predicted that it was possible, but unlikely, that gas emissions would result in vegetation dieback in the Nepean River gorge due to the extraction of the proposed longwalls. In the unlikely event that vegetation dieback was observed, it was predicted that these areas would be isolated and relatively small in size. Therefore the risk of dieback from potential gas emission does not represent a significant impact to terrestrial flora and fauna within the Study Area.

2.7 Native Vegetation

At the time of the 2006 survey, Biosis Research reported that the native plant communities in the broader area encompassing Longwalls 701-704 were considered to range from good to poor condition, with many areas impacted from clearing, grazing and weed invasion:

- Shale Sandstone Transition Forest – Good condition despite impacts from grazing.
- River-flat Eucalypt Forest – Poor condition due to impacts from weed invasion.
- Western Sandstone Gully Forest – Good condition, despite minor weed invasion.
- Sydney Sandstone Gully Forest – Closed Forest – Good condition, despite threats of weed invasion and uncontrolled stock access.

Biosis (2006) predicted it was unlikely that the proposed longwall mining activities and the associated subsidence impacts would have a significant impact on any plant community within the Study Area. Potential surface fracturing and gas emissions were considered unlikely to result in the broad scale alteration of species composition or distribution of plant communities within the Study Area.

2.8 Threatened Flora

No threatened plant species were recorded in the Study Area. However, three threatened plant species Camden White Gum *Eucalyptus benthamii*, Rufous Pomaderris *Pomaderris brunnea* and Sydney Plains Greenhood *Pterostylis saxicola* were considered to have potential habitat within the Study Area that could potentially be impacted by the mechanisms of subsidence (Biosis Research 2006).

Impact assessments under the TSC and/or EPBC Act were conducted for these three threatened plant species in Biosis Research (2006). It was concluded that it was unlikely that any of the threatened flora listed pursuant to the TSC Act or EPBC Act or any other significant flora that have been recorded or have potential habitat within the Study Area would be significantly impacted by subsidence resulting from the proposed mining (Biosis Research 2006).

2.9 Threatened Fauna and Fauna Habitat

Biosis (2006) reported potential subsidence impacts to fauna habitats within the area potentially impacted by Longwalls 701 – 704 are;

- Changed water conditions such as effects to pools and streams;
- Impacts to steep slopes and and cliffs;
- Impacts of gas emissions on water quality and riparian vegetation.

Biosis (2006) reported the Study Area for Longwalls 701 – 704 supports habitat for 41 threatened or migratory species. The report found four of these species if present are likely to be dependant on habitat of the Nepean River. This included three species of frogs; Giant Burrowing Frog; Little John's Tree Frog; and the Red Crowned Toadlet as well as on species of Bat; the Large Footed Myotis. Biosis concluded that predicted subsidence impacts on the Nepean River were unlikely to have a significant impact on these species.

Biosis (2006) concluded that threatened species dependant on caves and crevices within cliffs and steep slopes, including the Spotted Tailed Quoll and several microchiropteran bats were unlikely to be significantly impacted by predicted subsidence to these habitats.

The remaining threatened fauna species known to occur or with potential habitat within the Study Area are unlikely to be significantly impacted by subsidence as habitat for these species occurs within woodland, or other habitats that are unlikely to be impacted by subsidence.

2.10 Implications of the Modified Longwall Layout

The modifications to the original longwall layout included an additional 15m to the eastern end and 50m to the western end of Longwall 703 and an additional 25m to the eastern end and 55m to the western end of Longwall 704. MSEC (2009) assessed the implications of the proposed changes compared with the predictions from the 2006 report.

MSEC concluded the impact on landscape features is not significantly changed by the modified longwall layout. The impact assessment and management strategies from the MSEC 2006 report for each of these factors remain unchanged. Based on these findings the potential impact to flora and fauna habit remains unchanged as a result of the modified longwall layout.

3.0 METHODS

This report compares predicted impacts of Appin Area 7 Longwall mining with any impacts recorded by the IC Environmental Field Team during the monitoring program and observations made during the end of panel field inspection by Biosis Research.

The end of panel field inspection was conducted on the 8th of April 2011 by a botanist and zoologist from Biosis Research. The focus of the inspection was to assess the impacts of Longwall 703 as well as the cumulative impacts of Longwalls 701 and 702 with regard to flora and fauna. Impacts observed by the IC Environmental Field Team during routine monitoring were also assessed.

Property access during end of panel field inspections was limited to two properties. Other areas were assessed from property boundaries and roadsides. An inspection of the Nepean River and adjacent vegetation and habitat was conducted by boat focussing on areas of previously identified impacts. Elladale Creek was accessed by boat and part of the tributary was walked.

4.0 OBSERVED IMPACTS

The following section describes the observations made during routine monitoring and the end of panel field inspection.

4.1 Observed Impacts on Landscape Features

4.1.1 Nepean River

- Previously recorded gas zones were inspected along the Nepean River as part of the end of panel field inspections. Some of these still showed a small amount of bubbling indicating continued gas release. No effect on vegetation as a result of gas release was observed at these locations.
- Some dieback of vegetation along the banks of the Nepean River was noted. This was primarily Balloon Vine *Cardiospermum grandiflorum*. Native vegetation including Saw sedge *Gahnia* sp. and Swamp Oak *Casuarina glauca* occurring with the Balloon Vine was in good condition with no dieback. The dieback of Balloon Vine is assessed as being caused by recent high water flows and is not considered to be related to gas release caused by longwall mining.
- No iron staining was observed within the Nepean River. No new iron stain zones were identified during or after the extraction of Longwall 703.
- There have been no significant changes to water levels recorded by the IC Environmental Field Team during routine inspections.

4.1.2 Tributary Creeks

- Iron staining in Elladale Creek was observed during the Longwall 703 end of panel field inspection (shown in Plate 1). This staining has been a feature of Elladale Creek since the monitoring of Longwall 20 of the Tower Colliery. Post mining surveys from May 2009 report a reduction in iron staining from this area (IC 2009a).
- Iron staining was observed floating below the surface in Elladale Creek / Nepean River backwater (shown in Plate 2). IC Field Staff have reported this staining appears periodically. This is likely to be caused by the cumulative effects of mining at the Tower Colliery and Appin. Some aquatic vegetation growing within the cloudy water has died off. Woody weeds and exotic grasses growing on the edge of the pool appeared unaffected.

4.1.3 Dams

Monitoring within the Study Area of Longwall 703 has not recorded any impact on dams. No impacts to dams were observed during the end of panel field inspection. Therefore no impact to flora and fauna species dependant on the habitat provided by dams has been recorded.

4.1.4 Cliffs, Steep Slopes and Rock Shelves

There have been no reported impacts to cliffs, steep slopes or rock shelves as a result of mining of Longwall 702 and Longwall 703. No impacts were observed during the field inspection. No impact to flora and fauna species dependant on the habitat provided by these landscape features has been recorded.

4.1.5 Gas Emissions

The IC Environmental Field Team have recorded gas zones in relation to Longwalls 701, 702 and 703 within the Nepean River and adjoining tributaries during routine monitoring. The locations of these are shown in Figure 2. There are no reported impacts from regular monitoring by the IC Environmental Field Team to adjacent vegetation at any of the identified gas release zones. No impacts of gas release on vegetation were noted during the field inspection.

4.2 Observed Impacts on Plant Communities

Dieback in the canopy of *Eucalyptus* sp. along the Nepean River was observed from the boat during the field inspection. This was observed over an area of approximately 50m² above the bank of the Nepean River adjacent to gas zone 12 and approximately 200m to the east of Longwall 703. This area is within the Endangered Ecological Community (EEC) River Flat Eucalyptus Forest. Surrounding vegetation including a weedy understory as well as native vegetation is in good condition and does not show any impacts that can be attributed to mining. The dieback is relatively

minor and could be attributed to a variety of factors unrelated to longwall mining. Similar dieback was observed in *Eucalyptus spp* along the Nepean River upstream and downstream of areas potentially impacted by mining. Given the intermittent and minor gas release at gas zone 12 and that levels of dieback observed within the Study Area are no greater than those observed along the Nepean River it is unlikely this dieback is a result of mining related gas release. No rehabilitation is required however, monitoring of this area is recommended in Section 5.2 of this report.

Minor dieback of aquatic vegetation within iron staining in Elladale Creek observed during the field inspection was highly localised and is not considered a significant impact, surrounding vegetation was in good condition. No other mining related impacts to plant communities within the Study Area were observed during the field inspection.

4.3 Observed Impacts on Threatened Plant Species

The minor observed dieback of *Eucalyptus sp.* (Section 4.2) occurs within the EEC River Flat Eucalyptus Forest. This area also provides potential habitat for the threatened species Camden White Gum *Eucalyptus benthamii*. No other potential impacts or changes to suitable habitat for threatened plant species were noted during the field inspection.

4.4 Observed Impacts on Threatened Fauna and Fauna Habitats

Subsidence related impacts on landscape features have the potential to impact threatened fauna habitats. To date there is no evidence of any such impacts associated with the mining of Longwall 703. Landscape changes which may be associated with subsidence (such as localised gas release and iron staining) have thus far been minor and temporary in nature and have not resulted in any reported fauna mortality as would be expected if gas release and iron staining had any significant ecological impacts to the Nepean River or its tributaries.

Some impacts to the Nepean River (gas emissions) and Elladale Creek (iron staining) have been observed. Native fish were observed swimming in Elladale Creek and were observed swimming within the iron stain described in Section 4.1.2.

Farm dams within the Study Area provide potential habitat for a range of fauna such as waterfowl, amphibians and invertebrates, especially those dams retaining aquatic or riparian vegetation. Threatened amphibians that have potential habitat within the Study Area are considered unlikely to use farm dams for breeding. To date there is no evidence of any impacts to farm dams associated with the mining of Longwall 703.

Threatened animal species with potential habitat in the Study Area are unlikely to have been affected by subsidence related impacts associated with the mining of Longwall 703.

4.5 Summary of Predicted and Observed Impacts

Table 1 is a summary comparison between the predicted and observed impacts of mining on general habitat features and threatened flora and fauna.

Table 1: Predicted and Observed Impacts of mining on General Habitat and Threatened Flora and Fauna

Ecological Values	Predicted Impact	Observed Impact
Plant Communities and Fauna Habitat	Minor impacts to riparian habitats through change in water levels, surface water diversions, gas emissions, fracturing of bedrock and the cracking of soils.	Iron staining observed in Elladale Creek. Die off of aquatic plants within the stain. No impact noted to adjacent riparian vegetation. No impact to native fauna noted.
		Gas bubbling observed in the Nepean river and Elladale Creek with no observable impacts to aquatic plant communities or fauna habitats.
	Tension cracks or soil slumping on steep slopes possible but unlikely to result in significant environmental impact. Large scale slope failures were considered unlikely.	No observed or reported impacts to flora and fauna species associated with steep slopes as a result of mining Longwall 703.
	Cliff stability unlikely to be affected.	No reported impacts to cliffs or associated flora and fauna species as a result of mining Longwall 703.
	Rock shelves and overhang structures unlikely to be impacted.	No reported impacts to overhang structures or associated flora and fauna species as a result of mining Longwall 703.
	Unlikely that the proposed longwall mining activities and the associated subsidence impacts would have a significant impact on any plant community within the Study Area.	The mining of Longwall 703 was not observed to have significantly impacted any plant communities. Monitoring is recommended for an area with minor canopy dieback along the Nepean River, although similar dieback has been noted upstream and downstream along the Nepean River.
Threatened Fauna	Unlikely that any threatened or otherwise significant fauna would be significantly impacted by subsidence resulting from the proposed mining.	The mining of Longwall 703 is unlikely to have significantly impacted any threatened animal species. No potential habitat has been severely altered or damaged.
Threatened Flora	Unlikely that any threatened or significant flora would be	Minor dieback within eucalyptus canopy is unlikely to be related to

Ecological Values	Predicted Impact	Observed Impact
	significantly impacted by subsidence resulting from the proposed mining.	mining impacts and is unlikely to significantly impact any threatened flora species or potential habitat for threatened flora.

5.0 COMPLIANCE WITH APPROVAL

5.1 Conditions of Approval

Appin Area 7 SMP Approval Condition 17 states:

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 program to monitor the effectiveness of the rehabilitation*

A Vegetation Management Plan (VMP) for River-flat Eucalypt Forest (Biosis Research 2007) was prepared to address this condition. Table 2 is a summary of the proposed management actions in the VMP (Biosis Research 2007) and any actions that were required as a result of impacts from subsidence associated with mining of Longwall 703.

Table 2: Summary of Proposed Management Actions in the VMP

Impact	Management Activities	Action required due to Longwall 703 impacts
Surface Cracking		
Soil disturbance & erosion associated with exposed surface cracks.	Large cracks backfilled to surface level with locally available alluvial soils or imported inert and weed free material (crushed sandstone or similar).	Nil
	Silt fencing and erosion controls erected around cracks that are likely to be subject to erosive forces (water, vehicular traffic or livestock access).	Nil
	Brush matting employed at areas where cracking persists at the cessations of subsidence and where surface soils are subject to erosion, to establish a ground cover and promote revegetation of the impacted areas.	Nil
	Rehabilitated sites monitored at six and twelve months. Where brush-matting is unsuccessful or where further work is required, re-planting of affected sites to be undertaken using provenance sourced seedlings and monitored until revegetation is successful.	Nil

Impact	Management Activities	Action required due to Longwall 703 impacts
Flooding of the Banks of the Nepean River and Tributaries		
Prolonged flooding may cause some permanently submerged vegetation to die	Regular monitoring of the river to identify areas that become flooded.	Monitoring undertaken as part of IC Environmental Field Team inspections – no change in water levels detected as a result of mining of Longwall 703.
	Where flooding occurs, and at the cessation of subsidence, a suitably qualified ecologist will investigate the impact on RFEF.	Nil
	Where vegetation has been temporarily flooded it will be monitored after the water recedes to ensure that natural regeneration occurs.	Nil
	Where required, the management strategies outlined in the VMP or any other specific actions to rehabilitate affected areas of RFEF will be employed.	Nil
Desiccation of the Banks of the Nepean River and Tributaries		
Localised dieback due to drying of the substrate of alluvial soils	Regular monitoring of the river to identify areas of dieback.	Continued.
	Where dieback occurs, and at the cessation of subsidence, a suitably qualified ecologist will investigate the impact on RFEF.	Minor dieback of <i>Eucalyptus</i> sp. This has been observed by a suitably qualified ecologist. While this is unlikely to be related to mining, ongoing routine monitoring will be conducted.
	Where required the management strategies outlined in the VMP or any other specific actions to rehabilitate affected areas of RFEF will be employed.	Nil at this time.
Mass Movement		
Any impacts associated with this mechanism are 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.	Regular monitoring of the river, riparian areas, steep slopes and cliffs to identify areas where mass movement has occurred.	No mass movement observed in the current field inspection or by IC Environmental Field Team inspections.
	Where mass movement occurs, and at the cessation of subsidence, a suitably qualified ecologist will investigate the impact on RFEF.	Nil
	Where required, the management strategies outlined in the VMP and any other specific actions recommended to rehabilitate impacted areas of RFEF will be implemented.	Nil
Gas Emissions		

Impact	Management Activities	Action required due to Longwall 703 impacts
There is some potential for localised dieback due to the impact of the anaerobic conditions created by gas emissions in the soil profile.	Regular monitoring of the river to identify areas that exhibit dieback.	Continued.
	Where dieback occurs, and at the cessation of subsidence and associated gas emissions, a suitably qualified ecologist will investigate the impact on RFEF.	While unlikely to be mining related. Minor dieback of <i>Eucalyptus</i> sp. observed has been inspected by a suitably qualified ecologist.
	Where required, management strategies outlined in the VMP and any other specific actions recommended to rehabilitate impacted areas of RFEF will be implemented.	Nil at this time.

5.2 Monitoring

The following commitments to monitoring of flora and fauna and their habitats were made in the SMP (BHP Billiton 2006; Biosis Research 2006):

- Monthly observational monitoring of riparian vegetation will be undertaken in conjunction with monitoring of water quality and flow and river morphology;
- End of panel flora and fauna assessment.

IC Environmental Field Team have conducted weekly inspections of the Nepean River within the Study Area of Longwall 703. Observational monitoring of riparian vegetation is undertaken as part of these weekly inspections. This monitoring has recorded minor gas release zones and iron staining within the Nepean River and Elladale Creek. No vegetation dieback or erosion greater than background levels has been reported by the IC Environmental Field Team. Furthermore, there have been no records of changes in water levels of the Nepean River in response to mining.

Dieback in the canopy of *Eucalyptus* sp. within an area of the endangered ecological community River Flat Eucalyptus Forest was observed by Biosis Research staff during the current field inspection. As discussed in Section 4.2 this could be caused by factors unrelated to mining. Given the minor nature of the gas release the good condition of surrounding vegetation and that similar dieback has been observed along the Nepean River outside of potentially impacted areas, it is considered unlikely this dieback is mining related. As detailed in the 2007 Biosis Research VMP, vegetation dieback potentially resulting from longwall mining should be investigated by a suitably qualified ecologist to assess the impact and determine whether remediation is required. Further investigation is recommended. Any dieback observed within the Study Area should be compared with similar vegetation along the Nepean River outside of the potentially impacted area. This monitoring should aim to determine whether the dieback is mining related and whether remediation is required.

Table 3 provides a summary of the monitoring programs undertaken as part of the SMP commitments.

Table 3: Monitoring undertaken as part of the SMP commitments

SMP Commitments	Monitoring to Date	Future Monitoring
Monthly observational monitoring of riparian vegetation, including extent and recovery of any gas release related vegetation die-off.	Regular monitoring undertaken by IC Environmental Field Team as part of water quality and flow and river morphology. No gas release related vegetation die-off has been observed by the IC Environmental Field Team.	Investigation of <i>Eucalyptus</i> sp. dieback to be conducted by IC Environmental Field Team.
End of panel flora and fauna assessment Longwall 703.	Conducted by Biosis Research 8th April 2011.	

Monitoring will continue for up to 12 months after the completion of mining of Longwall 703 and as part of the monitoring of subsidence impacts of Longwall 704.

5.3 Trigger Action Response Plan

The Trigger Action Response Plan (TARP) for Appin Area 7 has been used throughout the mining of Longwall 703 to identify and address any issues as they have arisen. The TARPS for terrestrial ecology are detailed in Table 4 below. None of the TARPS were triggered for Longwall 6 therefore no action was required, as detailed in Table 3.

Table 4: River Flat Eucalyptus Forest Management Plan TARP for Longwall 703

Aspect	Trigger	Longwall 703 Effects	Action / Response	Timing	Action Post Longwall 703
Vegetation					
Surface Cracking	Localised and minor soil disturbance and erosion associated with exposed surface cracks.	No soil disturbance or erosion observed due to mining of Longwall 703	Large cracks to 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 to 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 to 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.	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.	No management action required.
Flooding of Banks of the Nepean River and Tributaries	Localised and minor prolonged flooding may cause some permanently submerged vegetation to die.	No flooding observed due to mining of Longwall 703.	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	It is anticipated that successful regeneration of sites that have been affected by temporary inundation should not require greater than 12 months management and	No management action required.

			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.	monitoring from the time that waters recede.	
Desiccation of Banks of the Nepean River and Tributaries	Localised and minor dieback due to drying of the substrate of alluvial soils.	No dieback observed due desiccation of banks related to mining of Longwall 703.	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.	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.	No management action required.
Mass Movement	Localised and minor 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.	No soil or rock movement identified as a result of mining of Longwall 703.	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.	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.	No management action required. .
Gas Emissions	Localised and minor dieback due to the impact of the anaerobic conditions created by gas emissions in the soil profile.	Minor dieback observed unlikely to be due to mining of Longwall 703.	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.	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.	Ongoing monitoring to assess the impact and determine whether remediation is required.

6.0 CONCLUSION

Weekly inspections of the Study Area have been undertaken by the IC Environmental Field Team since the commencement of mining in the SMP area. During these inspections gas zones have been recorded within the Study Area in the Nepean River and continued iron staining has been recorded within Elladale Creek. This iron staining was initially recorded prior to the commencement of Longwall 703. The IC Environmental Field Team monitoring has not recorded any significant impacts to flora and fauna in relation to gas release or iron staining. No other impacts relating to Longwall 703 have been recorded during IC Environmental Field Team inspections or during the end of panel field inspection.

The Biosis Research end of panel field inspection for Longwall 703 recorded dieback of *Eucalyptus* sp. Along the Nepean River, including an area of the endangered ecological community River Flat Eucalyptus Forest. The cause of this dieback has not been established and as discussed in Section 4.2 is unlikely to be related to impacts of longwall mining. The 2007 VMP prepared by Biosis Research as part of the Appin Area 7 SMP approval conditions states vegetation dieback potentially resulting from longwall mining should be investigated by a suitably qualified ecologist to assess the impact and determine whether remediation is required. Section 5.2 above recommends further investigation to be conducted to determine whether the dieback is mining related and whether remediation is required. No further significant impacts in relation to flora and fauna were recorded during the end of panel 703 field inspections.

PLATES

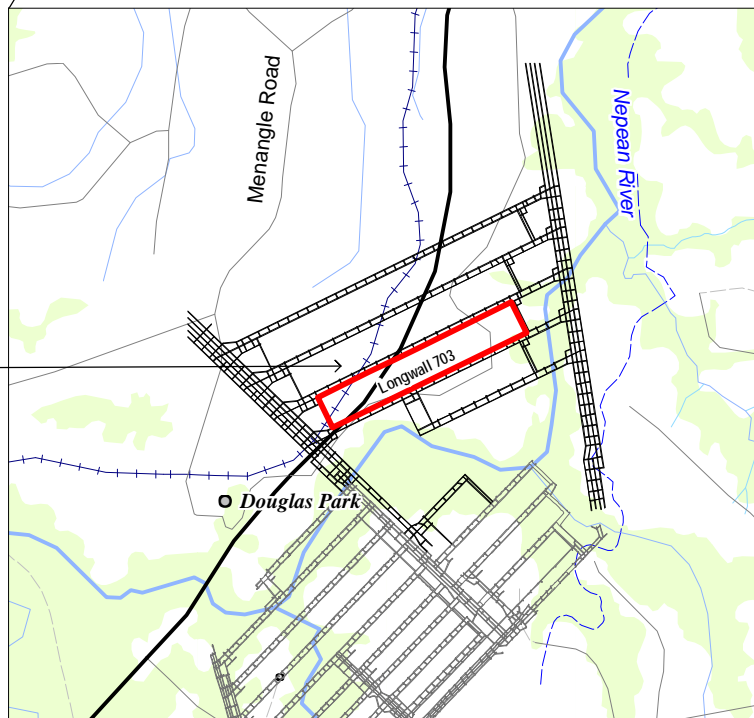


Plate 1: Iron straining within Elladale Creek River



Plate 2: Iron Stain Cloud within Elladale Creek

FIGURES



Study area

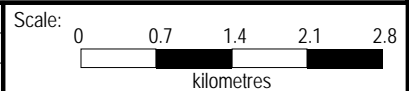
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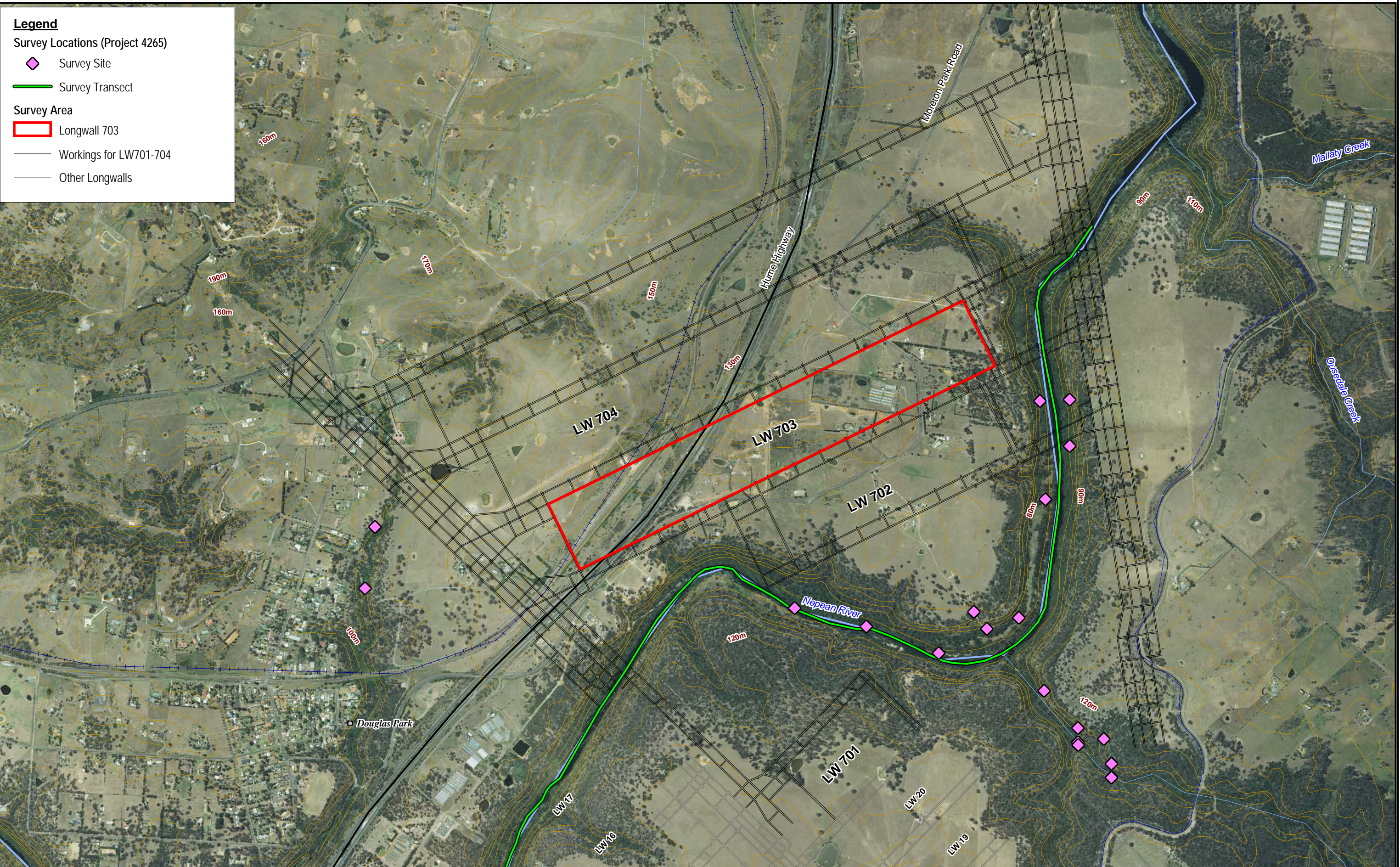


BIOSIS RESEARCH Pty. Ltd.
8 Tate Street
Wollongong
NEW SOUTH WALES 2500

Figure 1: Location of the Study Area in a regional context

Date: 2 May 2011	Drawn by: ANP
File number: 12959	Checked by: BC
Location: P:\12900s\12959\Mapping\12959 F1_Locality.WOR	





Legend

Survey Locations (Project 4265)

- Survey Site
- Survey Transect

Survey Area

- Longwall 703
- Workings for LW701-704
- Other Longwalls

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 8 Tate Street
 Wollongong
 NEW SOUTH WALES 2500

Figure 2: Longwall 703 with identified subsistence impacts.

Date: 2 May 2011	Drawn by: ANP
File number: 12959	Checked by: BC
Location: ..P:\12900s\12961\Mapping\12959 F2_Subsidence Impacts.WOR	

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0 0.15 0.3 0.45 0.6 0.75
 kilometres

Scale: 1:15,000 at A3
 Map Projection: Transverse Mercator
 Horizontal Datum: Geocentric Datum of Australia 1994
 Grid: Map Grid of Australia, Zone 56

Figure 2

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