



**Flora and Fauna Assessment
Dendrobium Area 3A:
Longwall 6
End of Panel Report**

May 2011

Revised June 2011

Biosis Research

**Report for
BHP Billiton - Illawarra Coal**

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Dendrobium Area 3A –
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Draft Report**

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ABBREVIATIONS

BHPBIC	BHP Billiton Illawarra Coal
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)
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 is an assessment of the post mining condition of terrestrial ecological values in the area above Longwall 6 in Area 3A of Dendrobium Colliery. The Study Area occurs to the West of Wollongong within the Lake Cordeaux catchment of the Metropolitan Special Area. The location of the Study Area in a regional context is shown in Figure 1. Mining of Longwall 6 commenced on the 9th February 2010 and was completed on 28th March 2011.

Where appropriate, this assessment will also draw on the observations and monitoring by the BHPBIC Environmental Field Team within the Study Area. These observations are reported in monitoring reports as referenced throughout this assessment.

The current assessments for Longwall 6 in Dendrobium Area 3A were undertaken on 18th March 2011. As such, some subsidence movements and effects of mining may not have been fully realised at the time this report was prepared. Any such impacts however are likely to be identified by the ongoing monitoring program and assessment for Longwall 7. The current assessment provides a comparison of the pre and post mining condition of terrestrial ecological values within the Study Area.

The Study Area incorporates the area immediately above Longwall 6 (Figure 2). The field inspection included traversing the length of the longwall and some adjoining areas to survey visible impacts and included inspections in locations of impacts identified by the BHPBIC Environmental Field Team.

2.0 SURVEY METHOD

A post mining survey was conducted for Longwall 6 on 18 March 2011. The survey included one botanist and one zoologist traversing the length of Longwall 6 at a distance of 50 – 200 metres apart inspecting for visible impacts of longwall mining focusing on areas of impacts identified by the BHPBIC Environmental Field Team. Field maps showing identified impacts were prepared and the survey focused on four main clusters of impacts occurring within the Study Area. The locations of impacts recorded by the BHPBIC Environmental Field Team are shown in Figure 2.

The one day survey covered as much area above Longwall 6 as possible within the time allowed and focused on surface features at greatest risk of subsidence effects, including ridge lines, sandstone cliffs, overhangs below ridges, valley slopes and creek lines.

Visible impacts of longwall mining to vegetation and fauna habitats were noted when observed. Flora species affected by impacts of longwall mining were recorded. The number of individual plants and area of affected vegetation was recorded. Potential impacts to fauna species were documented and incidental observations recorded. Photos were taken to represent the range of impacts observed and GPS points were recorded at these locations.

Observations made during seasonal flora monitoring of upland swamps and riparian vegetation within the Study Area of Longwall 6, as described in Section 5.1, has also been referred to in assessing potential subsidence related impacts.

3.0 PREDICTED IMPACTS

The following is a summary of the predicted impacts as reported in the *Species Impact Statement for Dendrobium Area 3* (Biosis Research 2007) and MSEC 2007 (doc 311). The implications to flora and fauna species of a modified longwall layout for Dendrobium Area 3A have been considered, the following documents have been referenced in regard to this; *Variation to Dendrobium Mine Area 3A Longwall Layout* (Biosis Research 2010), and MSEC 2010 (doc 437).

3.1 Creeks

There are numerous watercourses and drainage lines within Dendrobium Mine Area 3A. These include perennial streams Wongawilli Creek and Sandy Creek and several unnamed tributaries flowing into these creeks

Wongawilli Creek is the largest watercourse in Dendrobium Mine Area 3A and is located 110m west of Longwall 6. The creek generally flows in a northerly direction and drains into the Cordeaux River over 4 km to the north of Dendrobium Area 3.

Two tributaries flowing into Lake Cordeaux are located to the north of Longwall 6 within the Study Area and one tributary flowing into Wongawilli Creek is located above the western end of Longwall 6.

The terrestrial ecological values within the Study Area may be affected by subsidence impacts to creeks and tributaries within the Study Area.

Predicted subsidence impacts to creeks and tributaries relating to terrestrial ecology

MSEC (2007) predicted that subsidence impacts to Wongawilli and Sandy Creeks resulting from Longwall mining in Area 3A were likely to have the following impacts;

- Very localised and minor increased level of ponding or flooding within Wongawilli Creek and Sandy Creek most likely occurring at existing pools, steps and cascades;
- Minor fracturing of the beds of Wongawilli and Sandy Creeks could occur up to 400m from longwall mining in Area 3A. Both of these creeks are located within 400m of Longwall 6.

In regard to subsidence impacts to tributaries MSEC 2007 predicted;

- fracturing of the topmost bedrock, which could result in surface cracking where the bedrock is shallow or exposed;
- Fracturing of exposed bedrock along the drainage lines is predicted to result in some diversion of surface water flows into the dilated strata beneath them and the draining of any pools which exist within the drainage lines. Diverted surface water is likely to re-emerge into the catchment further downstream;
- Where predicted systemic tilts in the area of drainage lines are of a similar magnitude to the existing natural grades increased levels of ponding flooding and scouring could result (MSEC 2007).

The predicted mine subsidence movements potentially effecting creeks and tributaries resulting from the Modified Layout are similar to or less than those predicted for the SMP Layout. Therefore the predicted impacts and management strategies are unchanged for the modified layout (MSEC 2010).

With regard to impacts on terrestrial flora and fauna species, diversion of surface flow from tributaries may potentially impact adjacent vegetation dependant on these flows. As flows are predicted to re-emerge a relatively short distance downstream this impact would be localised and therefore not likely to cause significant impact to vegetation communities. Fracturing of bedrock within tributaries poses a threat of entrapment to fauna species. As these fractures are predicted to be minor this does not pose a significant impact to fauna species.

Biosis Research (2007) based the impact assessment for potentially affected threatened species of flora and fauna on the subsidence predictions summarised above and found that the predicted impacts would not have a significant effect on the threatened species assessed.

3.2 Cliffs, Natural Rock Formations and Steep Slopes

No cliffs are located directly above Longwall 6 (MSEC 2010) however two cliffs are shown within the study area occurring within 30m and 65m of the western end of Longwall 6 and one cliff 165m from the eastern end of the Longwall.

Cliffs

MSEC (2007) predicted that it is possible longwall mining will result in rock fracture along bedding planes and joints resulting in sliding and toppling type failure in cliffs directly above the longwalls. MSEC predicted cliffs outside of goaf areas would not be significantly affected by longwall mining.

The MSEC (2010) assessment of the modified longwall layout considered the modifications will have a similar impact or less impact than the original layout.

In regard to impacts on flora and fauna, cracking and failure of cliffs would not be expected to have more than a localised impact to vegetation communities and fauna species and therefore is not considered a significant impact.

Steep Slopes

Drawing MSEC 437-04 (MSEC 2010) shows steep slopes in the eastern and western ends of Longwall 6. Predicted impacts (MSEC 2007) included tension cracking at the tops of slopes and compressive ridges at the bottom of the slopes. Biosis (2010) predicted that if tension cracks occurred and were left untreated it is possible that increased soil erosion may occur in the vicinity of the cracks. This has the potential to displace vegetation and could potentially cause plant roots to become exposed and dry out. MSEC (2007) predicted that large scale slope failures and hence impacts to vegetation were unlikely.

Surface Bedrock and Soil Cracking

MSEC (2007) predicted surface bedrock and soil cracking may occur where tensile strains are greater than 0.5mm/m within the Study Area. Where jointed bedrock is exposed at the surface and coincides with high tensile strains, fractures at joints were predicted. In areas where the depth of cover is greater than 300 m soil cracking at the surface due to systemic subsidence movements was considered unlikely to exceed 50 mm.

Soil cracking has the potential to form surface water channels and cause erosion, potentially effecting vegetation communities and contributing to siltation in aquatic habitats. There is also a risk of entrapment to some fauna species. Biosis Research (2007) recommended that remediation measures be implemented in areas of potential erosion at the completion of subsidence movements. With these mitigation measures in place it is unlikely that there would be any significant impact on threatened flora and fauna species.

3.3 Wetlands and Upland Swamps

Drawing MSEC 437-03 shows the location of wetlands and upland swamps occurring in Area 3. Swamp 12 and Swamp 16 are shown to occur within the close proximity to Longwall 6. One unnamed narrow upland swamp was noted directly above Longwall 6 during the end of panel inspection. MSEC (2007) refer to upland swamps as either ‘valley infill’ (occurring along drainage lines) or ‘headwater’ (occurring on valley slopes) swamps and note the valley infill swamps are more susceptible to impacts of scouring and ponding resulting from mining. Swamps 12, 16 and the unnamed swamp are considered to be headwater

swamps. MSEC (2007) predicted that it is unlikely that fracturing of bedrock as a result of mine subsidence would have a significant impact on upland swamps in Area 3A given that upland swamps generally have a significant amount of sediment occurring above naturally weathered and fractured bedrock. Therefore subsidence impacts from Longwall 6 were not expected to impact flora and fauna within upland swamps within the Study Area.

3.4 Gas Emissions

Gas emissions may result from the liberation of gases that are trapped below the ground when fracturing or dilation of strata occurs due to subsidence. Gas emissions, in particular circumstances, may result in vegetation dieback. This phenomenon has previously been observed only once in the Southern Coalfields within the Cataract River where small patches of vegetation were impacted. Any such impacts are short lived and, in the case of the vegetation within the Cataract.

MSEC (2007) report there has been no significant gas emissions from mining the Wongawilli Seam. Mining has been undertaken in the general vicinity of Dendrobium Area 3A for many years with no vegetation dieback resulting from gas emissions observed. Based on this MSEC (2007) conclude it is unlikely there will be significant gas emissions or associated impacts resulting from mining in Area 3. Therefore subsidence impacts from Longwall 6 were not expected to impact flora as a result of gas emissions.

3.5 Native Vegetation

The Study Area for Longwall 6 supports six broad vegetation communities as mapped by NPWS (2003).

- Exposed Sandstone Scribbly-Gum Woodland;
- Sandstone Gully Peppermint Forest;
- Upland Swamps Sedgeland Heath Complex;
- Rock Plate Heath Mallee;
- Moist Gully Gum Forest;
- Tall Open Peppermint-Blue Gum; and
- Tall Open Gully Gum.

None of the plant communities that occur in the Study Area are currently listed as Endangered Ecological Communities under the TSC and/or EPBC Acts.

Vegetation communities that are dependant on groundwater, such as upland swamps may be more likely to be impacted by subsidence than those occurring on ridgetops and upper slopes.

Riparian habitats may be affected by subsidence through surface water diversions, gas emissions, the fracturing of bedrock and the cracking of soils (MSEC, 2007). These impacts, however, were predicted to be minor.

3.6 Threatened Flora

Biosis Research (2007) reported 19 threatened plant species have been recorded within the Study Area of Dendrobium Area 3. Eleven of these species are considered likely to occur within Area 3A based on potential habitat for these species being present within the Study Area. Of these 11 species possibly occurring within the Study Area Biosis (2007) determined that four species, Leafless Tongue Orchid (*Cryptostylis hunteriana*), Bearded Bush-pea (*Pultenaea aristata*), *Epacris purpurascens var purpurascens* and *Leucopogon exolasius*, had potential to be affected by the impact of mining induced subsidence. This is primarily based on the habitat for these species being within groundwater dependant ecosystems which are the areas most likely affected by subsidence. Assessments of Significance (Biosis 2007) for each of the four flora species found that the impacts of longwall mining in Dendrobium Area 3 are not considered likely to have an impact on these species.

3.7 Threatened Fauna and Habitat

On the basis of the potential impacts of subsidence to a species' habitat, the SIS reports 32 threatened fauna species may be impacted by longwall mining within Area 3A. Seven Part Tests (Assessments of Significance) were conducted for these species and concluded that the extraction of coal from Dendrobium Mine Area 3 would be likely to have a significant impact on local populations of Littlejohn's Tree Frog (*Litoria littlejohni*), Giant Burrowing Frog (*Heleioporus australiacus*), Red-crowned Toadlet (*Pseudophryne australis*), Stuttering Frog (*Mixophyes balbus*) and the Giant Dragonfly (*Petalura gigantea*).

Twenty-three threatened species have been recorded in Dendrobium Area 3 during previous assessments, ongoing monitoring programs and end of panel inspections, including the four species likely to be impacted.

In regard to habitat; the SIS reports fauna habitats within the Study Area were in good condition. Although the Study Area has been previously disturbed by vegetation loss from fire trails, power easements, seismic lines and boreholes, it is mostly intact and provides habitat resources for a wide range of species. Broadly, these habitats comprise mostly woodland and open forest with smaller

components of rainforest and heath. Finer scale habitat features include rock outcrops, caves, overhangs, tree hollows, hollow logs, riparian habitats including creeks, ephemeral drainage lines, dams and temporary ponds and soaks.

Biosis Research (2007) reported that the habitats at most risk to subsidence related impacts included creek lines, steep slopes and cliffs.

4.0 OBSERVED IMPACTS

The following section describes the observations made by Biosis Research during the post-mining surveys.

4.1 Observed Impacts on Landscape Features

Longwall 6 impacts as identified by the BHPBIC Environmental Field Team were inspected as well as a general inspection of the area above the longwall as described in Section 2. Identified impacts are clustered in four main areas (as shown in Figure 2) within the Study Area and include;

- Rock falls; observed on the southern side of the ridge at the eastern end of the Study Area and at small cliffs and rock overhangs on the steep slope at the western end of the Study Area. Plate 1 shows a rock fall observed at the eastern end of the Study Area;
- Cracking of sandstone slabs on ridges at both the eastern and western end of Longwall 6;
- Soil cracking occurring within the Study Area predominantly at the western end;
- Cracking along existing jointing in small cliff faces;
- Cracking of the sandstone creek bed and a small waterfall within tributary WC 19 at the western end of the longwall.

4.2 Observed Impacts on Plant Communities

Dieback and drying of native plants over an area of approximately 30m square including Tick Bush (*Kunzea ambigua*) and *Lepidospema limicola* due to root exposure was recorded along the edge of a rock fall to the east of Fire Road 6C (shown in Plate 2). Cracking of sandstone above the rock fall has caused a depression within this slab to drain and plants as listed above have died as a result.

Soil cracking, approximately 100mm wide at the widest point, was observed on a seismic track west of Fire Road 6F. A large root of a mature Sydney Peppermint (*Eucalyptus piperita*) was exposed as a result of the crack (shown in Plate 3). The tree appeared to be unaffected at the time of the inspection.

Much of the understorey vegetation along the edges of soil cracks appeared unaffected at the time of the inspection despite the roots being exposed.

A large rock fall in the western end of the longwall has disturbed vegetation including one mature and three small Silver Top Ash (*Eucalyptus seiberi*) and one mature Old Man Banksia (*Banksia serrata*)(shown in Plate 4).

The impacts to plant communities described above are attributed to mining induced subsidence. These impacts are localised, no impacts were observed during the field inspection that caused a significant impact to the vegetation communities within the Study Area. The vegetation communities observed throughout The Study Area during the end of panel inspection are generally in good condition.

4.3 Observed Impacts on Threatened Plant Species

No impacts or changes to potential habitat for threatened plant species were observed in the current surveys. Potential habitat for threatened plant species is unlikely to have been affected by subsidence related impacts associated with the mining of Longwall 6.

4.4 Observed Impacts on Threatened Fauna Habitats

During the post-mining survey for Longwall 6 in March 2011 fauna habitats were generally in a similar condition to pre-mining assessments.

Surface cracking, (as shown in Plate 5) rock displacement and rock fall has been observed at a number of locations within the Study Area. Damage to rock outcroppings with exfoliating rock crevices that are considered potential habitat for the endangered Broad-headed Snake *Hoplocephalus bungaroides* has been observed in the end of panel inspections to the east of Fire Road 6C, at the eastern extent of Longwall 6 and at the western extent of the longwall. Subsidence has resulted in surface cracks and rock falls with some modification of habitat, however the impact of this on habitat for the threatened snake species is not considered to be significant.

Surface cracking of the base rock of Creek WC19, at the western extent of Longwall 6, has potential to cause localised impact on the Red-crowned Toadlet *Pseudophryne australis*. This species was recorded at this location for the first time during end of panel inspections. This species was not recorded in WC19 during previous surveys. The area around WC19 contains breeding habitat and loss of shallow pools from this creek has potential to impact on the lifecycle for this species. To date observed impacts have been minimal and do not represent a significant impact to this species however water levels in WC19 should be monitored by the BHPBIC Environmental Field Team and any significant reduction in pools that may effect frog habitat should be reported to an ecologist for further consideration.

Observed surface impacts have potential to directly impact fauna species. Instability of cliffs, associated rockfalls and surface cracking have potential to result in mortality or injury to fauna. Surface cracks have the potential to form pitfalls for some species. While surface cracks are a natural formation in sandstone cliffs and ridges the cracks observed represent a rapid increase in the rate of this process.

There is no evidence that a local population of any threatened animal species which is known to occur or for which potential habitat exists within the Study Area has been significantly impacted by subsidence related impacts associated with the mining of Longwall 6. Monitoring of frog populations to date has not resulted in significant changes to frog populations within the Study Area (Biosis Research 2011). Monitoring of sensitive habitats and threatened species will continue for a number of years post mining.

4.5 Summary of Predicted and Observed Impacts

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

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

Biodiversity	Predicted Impacts	Observed Impacts
Plant Communities and Fauna Habitat	Impacts to Sandy and Wongawilli Creeks; localised increased ponding and flooding. Impacts to tributaries; minor fracturing of creek beds water diversions, possible increased ponding and scouring.	Tributary WC19 has numerous small cracks in the creek bed. No significant impacts to plant communities or fauna habitat were observed.
	Cracking of surface rock and soils on slopes. Possible compressive ridges at the bottom of slopes.	Cracking of both soil and surface rock throughout Longwall 6. Localised dieback of native vegetation. Larger cracks forming pitfalls for small fauna species.
	Possible cliff instability or rockfalls due to fracturing of bedrock	Minor rock east end of longwall. Several minor and rock falls one large rock fall in far western end of the longwall. Localised impact on native vegetation.
	Upland Swamps unlikely to be affected by changes in water levels	No impact to Upland Swamps observed.
Threatened Fauna	A significant impact upon four species: Giant Burrowing Frog, Littlejohn’s Tree Frog, Red-crowned Toadlet, the Stuttering Frog and the Giant Dragonfly	Minor cracking of the creek bed in WC19 was observed. No significant impacts to threatened fauna habitat were observed at the time of the inspection.
Threatened Flora	None	None

5.0 COMPLIANCE WITH APPROVAL

5.1 Monitoring

Section 21 of the SMP describes the monitoring program required to monitor impacts of subsidence on terrestrial ecology in area 3A. The monitoring program includes seasonal monitoring for both flora and fauna at upland swamps, ridges and Creek lines. Table 2 is a summary of the monitoring programs undertaken as part of the SMP commitments.

Table 2: Ongoing Monitoring Program

SMP Commitments	Monitoring to Date	Future Monitoring
<p>Base Line</p> <ul style="list-style-type: none"> ▪ Habitat assessment of entire Study Area prior to mining of longwalls. <p>Seasonal (autumn & spring) surveys of vegetation and frogs at potentially impacted sites within Area 3A including;</p> <ul style="list-style-type: none"> ▪ 3 creeks SC10 (Banksia Creek), SC7 (Cascade Creek) and Sandy Creek); ▪ 2 upland swamps (Swamp Den 15A and Swamp Den 15B), and ▪ One ridgeline (not determined). <p>Seasonal (autumn & spring) surveys of vegetation and frogs at control sites within areas 2 and 3 including;</p> <ul style="list-style-type: none"> ▪ 3 creeks DC4 (Don’s Castle Trib), as well as 2 new creekline sites); ▪ 3 upland swamps (Swamp Den 01B, Swamp 11 and one other) ▪ 3 ridges. <p>Targeted surveys for Littlejohns tree frog every winter</p>	<p>Base Line</p> <ul style="list-style-type: none"> ▪ Habitat assessment of entire Study Area prior to mining of longwalls <p>Seasonal (autumn & spring) surveys of vegetation, and frogs at potentially impacted sites within Area 3.</p> <ul style="list-style-type: none"> ▪ 3 creeks- SC10 (Banksia Creek), SC7 (Cascade Creek) and Sandy Creek); ▪ 2 upland swamp sites- (Den 15A and 15B) <p>Seasonal (autumn & spring) surveys of vegetation and frogs at control sites within areas 2 and 3 included</p> <ul style="list-style-type: none"> ▪ 3 creeks -DC4 (Don’s Castle Trib), 8I Creek and WC10 (Electricity Easement Creek) ▪ 3 upland swamps (Swamp Den 01B, Swamp 11 and DC1A) ▪ Ridges monitored by BHPBIC environmental team and report any impacts to Biosis Research for assessment <ul style="list-style-type: none"> ▪ Targeted surveys for Littlejohn’s Tree Frog every winter at potential impacted sites within Dendrobium 3A included, ▪ Creek S10 (Banksia Creek – 2 sites), SC7 (Cascade Creek), SC6 (Waratah Creek), SC8 (Fern Tree Creek). ▪ Reference ‘Little John’ sites include; <ul style="list-style-type: none"> ▪ DC4 (Dons Castle Trib’) 	<p>Base Line</p> <p>Continuation of monitoring program to date to collect baseline data for potential impact sites for long walls within Area 3A yet to mined below.</p>

SMP Commitments	Monitoring to Date	Future Monitoring
	<ul style="list-style-type: none"> ▪ WC11 (Swamp 33 creek) 	
<p>During Active Mining</p> <ul style="list-style-type: none"> ▪ Habitat assessment of entire Study Area prior to mining of longwalls. Seasonal (autumn & spring) surveys of vegetation and frogs at potentially impacted sites within Area 3A including; <ul style="list-style-type: none"> ▪ 3 creeks SC10 (Banksia Creek), SC7 (Cascade Creek) and Sandy Creek); ▪ 2 upland swamps (Swamp Den 15A and Swamp Den 15B), and ▪ One ridgeline (not determined). <p>Seasonal (autumn & spring) surveys of vegetation and frogs at control sites within areas 2 and 3 including;</p> <ul style="list-style-type: none"> ▪ 3 creeks DC4 (Don’s Castle Trib’, as well as 2 new creekline sites); ▪ 3 upland swamps (Swamp Den 01B, Swamp 11 and one other) ▪ 3 ridges. <ul style="list-style-type: none"> ▪ Targeted surveys for Littlejohns tree frog every winter 	<p>During Active Mining</p> <ul style="list-style-type: none"> ▪ Habitat assessment of entire Study Area prior to mining of longwalls <p>Seasonal (autumn & spring) surveys of vegetation, and frogs at potentially impacted sites within Area 3.</p> <ul style="list-style-type: none"> ▪ 3 creeks- SC10 (Banksia Creek), SC7 (Cascade Creek) and Sandy Creek); ▪ 2 upland swamp sites- (Den 15A and 15B) <p>Seasonal (autumn & spring) surveys of vegetation and frogs at control sites within areas 2 and 3 included</p> <ul style="list-style-type: none"> ▪ 3 creeks -DC4 (Don’s Castle Trib), 8I Creek and WC10 (Electricity Easement Creek) ▪ 3 upland swamps (Swamp Den 01B, Swamp 11 and DC1A) ▪ Ridges monitored by BHPBIC environmental team and report any impacts to Biosis Research for assessment. <p>Targeted surveys for Littlejohn’s Tree Frog every winter at potential impacted sites within Dendrobium 3A included,</p> <ul style="list-style-type: none"> ▪ Creek S10 (Banksia Creek – 2 sites), SC7 (Cascade Creek), SC6 (Waratah Creek), SC8 (Fern Tree Creek). <p>Reference ‘Little John’ sites include;</p> <ul style="list-style-type: none"> ▪ DC4 (Dons Castle Trib’) <p>WC11 (Swamp 33 creek</p>	

SMP Commitments	Monitoring to Date	Future Monitoring
<p>Following Mining</p> <ul style="list-style-type: none"> ▪ Post mining monitoring of vegetation fauna habitat and frogs at potentially impacted sites and control sites as undertaken in the baseline assessment ▪ Habitat based surveys at completion of each Longwall to inspect potentially impacted habitats and survey areas where surface impacts are reported from BHPBIC Environmental Field Team and other specialist consultants. ▪ Continuation of Seasonal (Autumn and Spring) monitoring program. ▪ Targeted surveys for Littlejohn’s Tree Frog in winter 	<p>Following Mining</p> <ul style="list-style-type: none"> ▪ Habitat based surveys at completion of Longwall 6 to inspect potentially impacted habitats and survey areas completed.. ▪ Continuation of seasonal flora and fauna monitoring program as conducted during active mining. ▪ Continuation of Little John’s Tree Frog targeted winter surveys. 	<p>Following Mining</p> <ul style="list-style-type: none"> ▪ Post mining monitoring at the end of each longwall. ▪ Continuation of seasonal flora and fauna monitoring program as conducted during active mining. ▪ Continuation of targeted surveys for Littlejohn’s Tree Frog in winter.

The methodology as prescribed in the SMP has been followed for all swamp and creek impact and reference sites. This seasonal monitoring program will continue for several years post mining. Ridgeline monitoring sites have not been monitored during seasonal flora and fauna monitoring as prescribed in the SMP as these sites are regularly monitored by the BHPBIC Environmental Field Team. Any recorded impacts to ridgelines, in regard to flora and fauna, are reported to Biosis Research and inspected. The ridgelines are also inspected during the end of panel field inspections.

Monitoring of Water levels in WC19 is recommended to assess potential impact to the threatened species, Red Crowned Toadlet. Monitoring by BHPBIC Environmental Field Team would be appropriate and any significant reduction in water levels that may effect pooling in WC19 should be reported to an ecologist for further consideration of impact to this species.

5.2 Trigger Action Response Plans (TARPS)

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

Table 3: Dendrobium Longwall 6 - Potential impacts, key monitoring, triggers, response & responsibilities

Key Monitoring	Triggers	Longwall 6 Effects	Action / Response	Action as a result of Longwall 6
Terrestrial Flora				
<i>During & post mining</i>				
<p>Stressed or dead veg not readily explained by natural processes. Causes may include subsidence related</p> <ul style="list-style-type: none"> - Rock / cliff falls or mass movement - Gas emissions - hydrological changes 	<p><i>Normal</i></p> <ul style="list-style-type: none"> - No sign of impact to terrestrial flora when comparing baseline to mining period and considering environmental conditions. 		<ul style="list-style-type: none"> - Continue monitoring program - Report in the EOP - Summarise all actions and monitoring in the AEMR. 	<ul style="list-style-type: none"> - No action required.

Key Monitoring	Triggers	Longwall 6 Effects	Action / Response	Action as a result of Longwall 6
	<p>Within Prediction</p> <ul style="list-style-type: none"> - Small areas (<100m²) of impacted vegetation that would begin to regenerate within 6 months. - Minor gas emissions with minor vegetation die off and evidence of regeneration. - No significant statistical difference between reference and impact sites. 	<p>Minor observed impacts including localised vegetation dieback. Areas of vegetation dieback observed are less than 100m².</p> <p>No gas emissions observed or reported by BHPIC Environmental Field Team/ No significant difference between reference and impact sites.</p>	<ul style="list-style-type: none"> - Continue monitoring program. - Report in the End of Panel Report. - Summarise all actions and monitoring in the AEMR 	-No action required
	<p>Exceeding Predicted Impact</p> <ul style="list-style-type: none"> - Large areas (>100m²) of impacted vegetation that is unlikely to naturally regenerate within 6 months - Gas emissions with extensive vegetation die off and no evidence of regeneration. - Significant statistical difference between reference and impact sites. 	<ul style="list-style-type: none"> - No large areas of impacted vegetation observed. - No gas emissions observed or recorded. - No significant difference between impact and reference sites. 	<ul style="list-style-type: none"> - Report to DPIM, DoP and resource manager/s - Notify other relevant specialists (BHPBIC) - Condition assessment to record impacts within 2 weeks. - Photographic record. - Site visit with stakeholders. - Develop site rehabilitation plan with experts and SCA - Undertake rehabilitation if required and report to resource managers - Increase monitoring frequency as appropriate (at least 6 monthly and more often if needed) 	No action required
Terrestrial Fauna				
<ul style="list-style-type: none"> - Alteration or loss of fauna habitat, habitat assessed to be degraded without a natural cause readily apparent. 	<p>Normal</p> <ul style="list-style-type: none"> - No signs of impact to terrestrial fauna or potential habitat when comparing baseline to mining period and considering environmental conditions 	<ul style="list-style-type: none"> - Potential minor impacts related to ridgetop cracking. 	<ul style="list-style-type: none"> - Continue monitoring program. - Report in the End of Panel Report. - Summarise all actions and monitoring in the AEMR 	- No action required

Key Monitoring	Triggers	Longwall 6 Effects	Action / Response	Action as a result of Longwall 6
	<p>Within Prediction</p> <ul style="list-style-type: none"> - Small areas (<100m²) of impacted vegetation that would begin to regenerate within 6 months. - Minor surface soil cracking or rock bar fracturing not resulting in loss of standing water in creeks and swamps. - Minor gas emissions with no vegetation die off. - No significant statistical difference between reference and impact sites 	<ul style="list-style-type: none"> - No impacted areas observed up to 100m². - No observed loss of standing water as a result of cracking. - No gas emissions observed or recorded. - No significant difference between impact and reference sites 	<ul style="list-style-type: none"> - Continue monitoring program. - Report in the End of Panel Report. - Summarise all actions and monitoring in the AEMR - 	<ul style="list-style-type: none"> - No action required
	<p>Exceeding Predicted Impact</p> <ul style="list-style-type: none"> - Large areas (ie. > 100 m²) of habitat altered that is unlikely to regenerate naturally within 6 months - Significant soil or rockbar cracking resulting in loss of standing water and / or significant erosion. - Gas emissions with extensive vegetation die off and no evidence of regeneration. - Significant statistical difference between reference and impact sites. 	<ul style="list-style-type: none"> - Minor impacts are less than 100m². - No observed loss of standing water as a result of cracking. - No gas emissions observed or recorded. - No significant difference between impact and reference sites 	<ul style="list-style-type: none"> - Report to DPIM, DoP and resource manager/s - Notify Specialists immediately - Condition assessment to record impacts within 2 weeks - Photographic record - Review monitoring program and modify if necessary within 1 month. - Implement increased monitoring if required. - Site visit and discussions with DPIM and resource managers - Develop CMA with experts and SCA within 2 months - Undertake rehabilitation if required and report to CMA. - Report in EOP. - Summarise all actions and monitoring in the AEMR 	<ul style="list-style-type: none"> - No action required

6.0 CONCLUSION

A post-mining habitat condition assessment of the Study Area above Longwall 6 was undertaken in March 2011 by Biosis Research. Subsidence impacts were observed during the field survey and have been described above. The minor impacts observed are within predicted levels and are not considered to have had a significant impact to flora and fauna species or plant communities. Threatened flora and fauna species assessed as being potentially effected by longwall mining within the Biosis (2007) SIS have been considered within this assessment. The mining of Longwall 6 has not impacted these species.

The threatened species Red Crowned Toadlet was recorded within WC19 during the field inspection. A recommendation is made in Sections 4.5 and 5.1 in regard to monitoring of potential impacts to Red Crowned Toadlet habitat within WC19.

Observational monitoring in this area will continue following mining and any notable changes to the natural environment will be referred to specialist consultants for further consideration with regards to the associated affect on threatened species, populations or ecological communities. Seasonal monitoring of flora and fauna as a component of the Dendrobium Colliery Ecological Monitoring Program, detailed in Biosis Research (2008c), at potentially impacted sites and control sites will continue for several years post mining.

PLATES



Plate 1: Rock fall observed within the Study Area.



Plate 2: Localised die back of vegetation resulting from surface rock cracking.



Plate 3: Soil cracking and observed exposed tree roots..

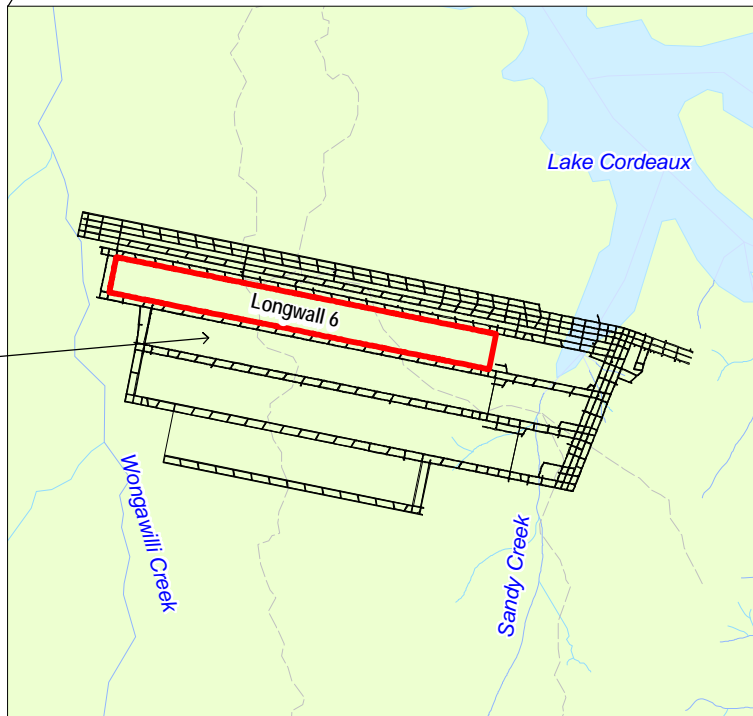


Plate 4: Rock fall at a small cliff causing localised tree fall.



Plate 5: Cracks in surface bedrock observed within the Study Area.

FIGURES



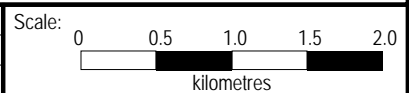
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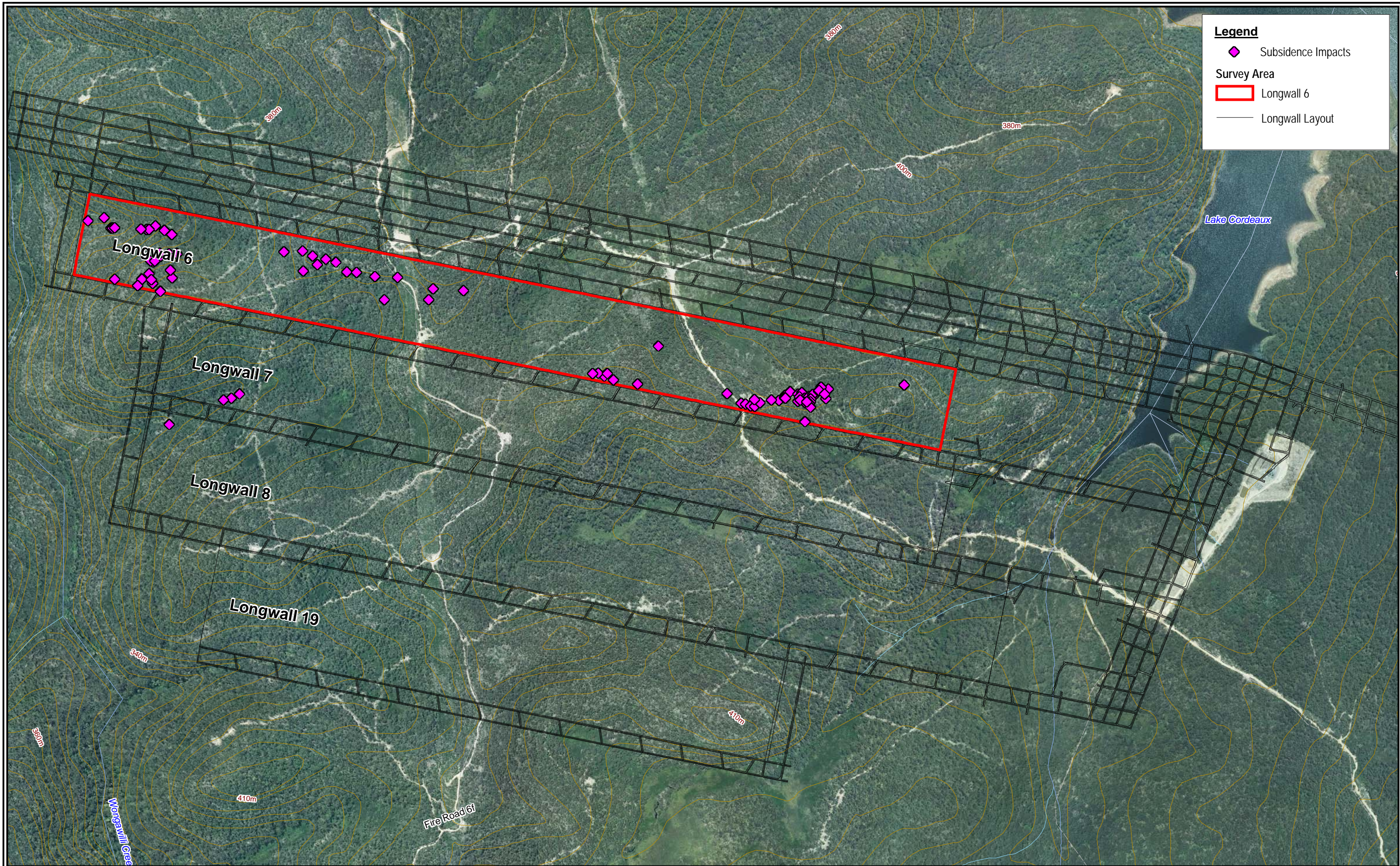


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Figure 1: Location of the Study Area in a regional context

Date: 2 May 2011	Drawn by: ANP
File number: 12958	Checked by: BC
Location: P:\12900s\12958\Mapping\12958 F1_Locality.WOR	





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Figure 2: Longwall 6 showing locations of identified subsidence impacts.

Date: 2 May 2011	Drawn by: ANP
File number: 12958	Checked by: BC
Location: ..P:\12900s\12958\Mapping\12958_F2 Subsidence Impacts.WOR	

Acknowledgements:
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0 100 200 300 400 500
 metres

Scale: 1:10,000at A3
 Map Projection: Transverse Mercator
 Horizontal Datum: Geocentric Datum of Australia 1994
 Grid: Map Grid of Australia, Zone 56

N
 W E
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Figure 2

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