Austar Coal Mine Pty Ltd

Longwalls A3 to A5
Public Safety
Subsidence Management Plan

January 2009

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Revision Status

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A0	Sep 08	New Procedure	SB	AM
Ver 2	Nov 08	Revised Contacts	SB	AM
Ver 3	Jan 09	Update Authorisation	SB	AM

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1.0 Introduction

Austar Coal Mine Pty Ltd is applying for subsidence management approval for longwall mining in the Stage 2 Mining Area (MSEC Drawing 275-08). The Stage 2 Mining Area comprises Longwall Panels A3, A4 and A5 which are located in the Greta Seam of the Austar Coal Mine, varying between 485 metres and 530 metres below the surface. Proposed longwall mining in the Stage 2 Mining Area is planned to take place over a three year period commencing in February 2009.

Subsidence management approval is required by a condition of the Mining Lease and is administered by the Department of Primary Industries – Minerals (DPI). The subsidence management application is required to be supported by a Subsidence Management Plan (SMP) for the project. The specific requirements for SMPs are described in the *Guideline for Applications for Subsidence Management Approvals – DPI, 2003*.

The SMP guideline requires the following tasks to be completed:

- longwall mining subsidence predictions;
- identification of natural and man-made features that could potentially be affected by subsidence;
- assessment of the effects of subsidence on the identified features;
- development of management and mitigation measures for significant subsidence effects; and
- consultation with relevant stakeholders, including landowners directly affected by subsidence.

This Public Safety Subsidence Management Plan addresses the management of the potential hazards to the public as a result of underground mining in Longwalls A3 to A5 in the Greta seam. This plan has been prepared in accordance with the NSW Department of Primary Industries (Mineral Resources) *Guideline for Subsidence Management Approvals* (2003).

2.0 Purpose

The purpose of this plan is to outline the management measures to be implemented to minimise surface safety risks to the public during mining of Longwalls A3 to A5 in the Greta seam. Required actions and responsibilities are defined to ensure detection and timely remediation of any potential public safety hazards from mining induced subsidence.

3.0 Scope

This plan applies to surface infrastructure, including public roads, within the Longwalls A3 to A5 SMP Application Area (SMP area), as shown in **Figure 1**. The management of private properties, powerlines, and telecommunications infrastructure are outlined in separate plans and are therefore not covered by this plan.

4.0 Mine Plan

The SMP area comprises privately-owned small rural residential properties ranging in size from 8 hectares to 44 hectares. The majority of the SMP area has been cleared and is predominantly utilised for a variety of rural activities including grazing, vineyards and olive groves. The surface of the land within the application area is generally flat to undulating with the major topological feature being a hill located above the middle of Longwalls A3 and A4 (MSEC 2007).

The depth of cover to the seam varies between approximately 485 metres at the south-western end of Longwall A3 to approximately 530 metres above the middle of Longwall A4. The seam floor within the SMP area generally dips from the north-west to the south-east. The seam thickness varies between a minimum of 4.8 metres at the south-western end of Longwall A5 to a maximum of 6.8 metres at the north-eastern end of Longwall A3. A maximum seam height of approximately 6.5 metres is proposed to be extracted, with longwall top coal caving equipment extracting the bottom three metres of the seam and recovering approximately 85% of the top of the coal seam (MSEC 2007).

First workings for the longwalls commenced in July 2007, with Longwall A3 extraction to commence in February 2009 and Longwall A5 scheduled to be completed during the first quarter of 2012.

5.0 Subsidence Definitions

Subsidence, tilt and strain are the subsidence parameters normally used to define the extent of the surface movements that will occur as mining proceeds.

Subsidence is the vertical distance (usually measured in millimetres) that the ground surface lowers as a result of mining, and depends on the depth of the coal seam, the thickness of the seam, the width of the extraction area and the characteristics of the overburden.

Tilt is calculated as the change in subsidence between two points divided by the distance between those points (i.e. change in slope of the surface landform as a result of mining). The maximum tilt, or the steepest portion of the subsidence profile, occurs approximately 50 metres from the edge of the longwall panel. Tilt is usually expressed in millimetres per metre.

Strain results from horizontal movements in the strata. Strain is determined from monitoring survey data by calculating the change in the horizontal length of a section of a subsidence profile and dividing this by the initial horizontal length of that section. If the section has been extended, the ground is in tension and the change in length and resulting strain are both positive. If the section has been shortened, the ground is in compression and the change in length and strain are both negative. Strain is usually expressed in millimetres per metre.

6.0 Potential Safety Risks

It is not expected that mining of Longwalls A3 to A5 in the Greta seam will pose a significant risk to public safety as there are no areas of shallow depth of cover (less than 80 metres).

The key potential surface safety risks identified during the Longwalls A3 to A5 risk review held on 9/9/08 were;

- surface cracking;
- public roads;
- drainage lines;
- private water pipeline;
- dam safety;
- natural vegetation;
- steep slopes;
- impacts on buildings;
- fences; and
- survey control marks.

A summary of the potential surface safety risks resulting from subsidence is provided below. Further detail regarding subsidence predictions is contained in the subsidence report prepared by MSEC (2007). The proposed management strategies for each of the identified surface safety risks are outlined in **Section 7**.

6.1 Surface Cracking

As subsidence occurs, cracks, known as rib-line fractures, can appear in the tensile strain zone. Most of the cracks will occur within a distance of approximately 50 metres of, and generally parallel to, the longwall perimeter. The incidence of cracks on the surface, due to subsidence above a longwall panel, is dependent upon the thickness and inherent plasticity of the soils that overlie the bedrock. The widths of the cracks and the frequency of occurrence of the cracks are also dependent upon the pre-existing jointing patterns in the bedrock. Noticeable cracks are less likely to occur at low levels of strain, i.e. where the strains are less than 2 mm/m, such as occurs over a longwall chain pillar.

As the depth of cover within the SMP area is generally greater than 500 metres it is unlikely that surface cracks from systematic subsidence movements would exceed 25 mm (MSEC 2007). If a reasonable thickness of soil exists above the longwalls, it is more likely that the surface would exhibit a number of narrower cracks, rather than a single larger crack (MSEC 2007).

6.2 Public Road Safety Risks

The proposed mine plan will undermine two public roads: Nash Lane and the Pelton Fire Trail. Nash Lane is an unsealed road that crosses the northern portion of Longwalls A3 and A4 (refer to **Figure 1**) (MSEC 2007). The lane provides access from the rural properties within the SMP area to Quorrobolong Road (MSEC 2007). Pelton Fire Trail is not located directly above any of the longwalls but is located within the northern portion of the SMP area. The Fire Trail is an unsealed trail used for fire fighting purposes within the Werakata State Conservation Area (MSEC 2007). There are also several private unsealed roads within the SMP area, which are detailed in the respective Property Subsidence Management Plans (PSMPs).

6.2.1 Predicted Subsidence Impacts on Nash Lane

The maximum predicted systematic tilt at Nash Lane is 7.6mm/m, which represents a change in grade of less than 1% (MSEC 2007). The predicted level of tilt is unlikely to have a significant impact on the serviceability or drainage of the road (MSEC 2007). The predicted systematic tensile strains of 0.7 mm/m could result in minor tensile cracking of the unsealed road surface (MSEC 2007). However any cracking is expected to be of a minor nature, due to the relatively low levels of predicted tensile strains and the relatively high depth of cover (MSEC 2007). The maximum width of potential surface tensile cracking is predicted to be 25 mm due to the depth of cover (MSEC 2007). It is more likely that a number of narrower cracks, rather than a single larger crack would develop in the road surface as a result of the predicted systematic tensile strains (MSEC 2007). It is possible that the predicted systematic compressive strains of 2.1 mm/m could be of a sufficient magnitude to result in the buckling of the underlying strata, resulting in tensile cracking in the unsealed road surface (MSEC 2007).

Any tensile cracking or compressive rippling of the unsealed road surface could be remediated by regrading and recompacting the surface using standard road maintenance techniques. With the implementation of standard road maintenance techniques, Nash lane can be maintained in a safe and serviceable condition during undermining (MSEC 2007).

There is one drainage culvert within the SMP area, located under a private driveway, adjacent to Nash Lane (refer to **Figure 1**) in property Lot 96, DP 755254. The predicted tilts and strains resulting from mining are unlikely to have a significant impact on the serviceability of the culvert (MSEC 2007).

6.2.2 Predicted Subsidence Impacts on Pelton Fire Trail

The Pelton Fire Trail is located outside the 20 mm subsidence contour (MSEC 2007). It is therefore unlikely that the trail would be subject to any significant impacts resulting from the extraction of the longwalls (MSEC 2007).

6.3 Drainage Lines

The Stage 2 mining area is located with the Quorrobolong Creek/Cony Creek drainage system (also known as the Quorrobolong Valley). Based on both the maximum expected and upper bound subsidence predictions set out in MSEC (2007), subsidence is unlikely to result in significant impacts on drainage lines in the Stage 2 area. The drainage assessment undertaken for the Quorrobolong Valley (Umwelt, 2007b) indicates:

- that creek bank stability is unlikely to be affected;

- no significant impact on flow velocities;
- no significant impact on flow rates;
- flood depths will be increased however there will be:
  - no changes to flood inundation on access roads to dwellings; and
  - no inundation of dwellings during the 1 in 100 year Average Recurrence Interval (ARI) storm event that were not previously inundated.

It is unlikely that any mitigation works will be required to maintain the flow or stability of the creeks that flow across the Stage 2 area.

6.4 Private Water Pipeline

There is a privately owned pipeline which follows the alignment of Nash Lane within the SMP area (refer to **Figure 1**). The pipe construction is unknown, however is likely to be a Polyvinyl-Chloride (PVC) or Polyethylene (PE) pipeline.

The pipeline is a gravity pipeline and is unlikely to be impacted by the predicted upperbound differential subsidence and tilt resulting from mining of the longwalls (MSEC 2007). The maximum upperbound systematic tensile and compressive strains at the pipeline are 0.7 mm/m and 2.0 mm/m, respectively (MSEC 2007). PVC and PE pipelines are flexible and can tolerate ground strains greater than 10 mm/m, it is therefore unlikely that the pipeline will be impacted by the predicted and upperbound systematic strains (MSEC 2007).

The pipeline may be subjected to higher strains where it is anchored to the ground by associated infrastructure or tree roots (MSEC 2007). It is possible that the pipeline could be locally impacted by mining where it is anchored to the ground, which could result in the leakage of water (MSEC 2007).

6.5 Natural Vegetation

The vegetation of the SMP area largely comprises cleared land supporting Derived Grassland vegetation (Umwelt 2007). The riparian and floodplain areas support Riparian Swamp Oak – Rough-barked Apple Open Forest, while small remnants of Spotted Gum – Ironbark Forest occur on ridgelines in the north of the SMP area (Umwelt 2007). The predicted levels of subsidence and associated changes to hydrology are not expected to significantly impact on the natural vegetation (Umwelt 2007). The northern portion of the SMP area is located within the Werakata State Conservation Area (SCA) (MSEC 2007). The SCA is located outside of the 20 mm subsidence contour, therefore any potential subsidence impacts are expected to be minimal.

6.6 Steep Slopes

A steep slope has been defined as an area of land having a gradient between 1 in 3 and 2 in 1 (MSEC 2007). Steep slopes are identified as areas where the existing ground slopes are considered to be marginally stable (MSEC 2007). However the stability of natural slopes varies depending on soil or rock type and natural slopes can be stable at gradients much higher than 1 in 3 (MSEC 2007).

There are two areas identified as having steep slopes within the SMP area (refer to **Figure 2**) (MSEC 2007). The steep slopes are located on the southern side of the hill above Longwalls A3 and A4, and on the south-eastern side of the hill of Longwall A3 (MSEC 2007).

The steep slopes are more likely to be impacted by ground strains than tilt, as the maximum upperbound tilt of 7.9 mm/m represents a change in surface gradient of 0.8%, which is very small compared to the natural gradients of the steep slopes (MSEC 2007). Surface tensile cracking has generally not been observed in the past where the tensile strains have been less than 0.5 mm/m (MSEC 2007). The maximum predicted upperbound tensile strain of 1mm/m is likely therefore to result in some minor tensile surface cracking (MSEC 2007). Any surface cracking is expected to be of a minor nature, due to the relatively low levels of predicted and upperbound systematic tensile strains, and due to the relatively high depth of cover (MSEC 2007). Surface tensile cracking is generally limited to the top few metres of the surface soils (MSEC 2007).

The depth of cover at the steep slopes is generally greater than 500 metres and, therefore, the maximum predicted crack width resulting from the extraction of the longwalls is 25 mm (MSEC 2007). Minor surface tensile cracking can be remediated naturally during rain events (MSEC 2007). Any significant cracking may require remediation works (e.g. infilling) (MSEC 2007).

The buckling of underlying structure has generally not been observed in the past where compressive strains have been less than 2 mm/m (MSEC 2007). The predicted and upperbound compressive strains at the steep slopes are both less than 2 mm/m and are therefore unlikely to result in compressive buckling of underlying strata (MSEC 2007).

As the steep slopes within the SMP area have natural gradients of less than 1 in 2 and a depth of cover greater than 500 metres, it is unlikely that the predicted and upperbound magnitudes of systematic strain would result in the slippage of soils down the steep slopes (MSEC 2007). If movement of the surface soils were to occur during mining, minor tension cracks at the top of slopes and minor compression ridges at the bottoms of slopes may form which may require remediation works (including infilling of cracks and regrading or recompacting of compression bumps) (MSEC 2007).

6.7 Impacts on Buildings

There are seven houses located within the SMP area (refer to **Figure 2**):

- AS Morphett (A01a) house;
- TA Duckworth (A02a) house;
- SJ and CL Duff (A03a) house;
- J Reid (A04a) house;
- TA Duckworth (A06a) house;
- BD Murray (A11a) house; and
- BD Murray (A11c) house.

There are also 16 rural building structures within the SMP area, which includes garages, sheds and other non-residential structures (MSEC 2007). A Property Subsidence Management Plan (PSMP), outlining the management of subsidence impacts, has been

developed for each of the above listed houses (and associated non-residential structures), and will be provided prior to subsidence impact.

6.8 Fences

A number of fences are located within the SMP area, the majority of which are constructed from timber or steel posts with fencing wire or timber railings (MSEC 2007). The fences are located throughout the SMP area and are likely to be subject to the full range of subsidence movements (MSEC 2007). Wire fences are generally flexible in construction and can usually tolerate tilts of up to 10 mm/m and strains of up to 5mm/m without any significant impact (MSEC 2007).

The maximum upperbound systematic tilt within the SMP area is 10.9 mm/m above Longwall A3, this level of tilt could impact on fences (MSEC 2007). It is also possible that the fences above Longwalls A4 and A5 could be impacted by the upperbound systematic tilts, where the fence posts have high existing tilts (MSEC 2007). The maximum upperbound systematic tensile and compressive strains within the SMP area are 1.2 mm/m and 3.7 mm/m, respectively (MSEC 2007). These levels of strain are unlikely to significantly impact on the fences (MSEC 2007).

6.9 Survey Control Marks

There are no survey control marks within the SMP area (MSEC 2007). There are however, a number of survey control marks located just outside the SMP area (refer to **Figure 1**). The survey control marks adjacent to the SMP area could be subjected to small amounts of subsidence or some small regional horizontal movements, up to three kilometres away from the SMP area (MSEC 2007).

7.0 Management Controls

The predicted subsidence levels from mining are expected to pose minimal risk to public safety. The management of public safety will largely be controlled by programmed and targeted inspections, in addition to reviewing predicted subsidence against actual subsidence.

7.1 Notifications

In accordance with the requirements of the development consent conditions and s138 approval conditions, a number of agencies and organisations will be notified of the date of commencement of extraction and the expected duration of the subsidence resulting from mining of Longwalls A3 to A5. The organisations to be notified include the Department of Planning (DoP), Department of Primary Industries (DPI), Department of Water and Energy (DWE), Department of Environment and Climate Change (DECC), Department of Lands (DoL), Cessnock City Council and the Mine Subsidence Board (MSB). Landholders within the SMP area will also be informed about current and future mining activities.

The DECC, DoL and DPI will be notified of:

- the commencement of mining of each longwall in the SMP area; and

- the completion of mining of Longwall A5.

The notification of these three agencies will include subsidence and inspection results, any public safety issues identified (and proposed remediation works) and mining completion

7.2 Proposed Controls

The management controls required for each potential surface safety risk are listed in **Table 7.1** below. All inspections outlined in **Table 7.1** will be documented and photos taken where appropriate. In addition to the controls outlined in **Table 7.1**, subsidence monitoring lines will be established in accordance with the Subsidence Monitoring Strategy, which has been developed and agreed upon with the Principal Subsidence Engineer of the NSW DPI (attached as **Appendix 1**).

Table 7.1 – Surface Safety Management Controls

Surface Safety Risk	Action	Person Responsible
Surface Cracking	Regular inspections of the zone defined as being 500 metres behind and 100 metres in front of the current face position will include inspection of surface cracking (refer to Subsidence Inspection Checklist attached as Appendix 2).	Technical Services Manager or delegate
	Undertake surface remediation works as required. Any remediation works required will be determined in consultation with the relevant stakeholders. Possible remediation techniques for soil cracking may involve infilling, local re-grading or re-compacting.	Technical Services Manager or delegate
Public Roads	Nash Lane will be included in the regular inspections of the zone defined as being 500 metres behind and 100 metres in front of the current face position.	Technical Services Manager or delegate
	Signs will be erected on Nash Lane at the extent of the 20mm subsidence contour requesting caution and indicating that users are entering a subsidence affected area.	Technical Services Manager or delegate
	Remediation works (if required) will be determined in consultation between the Cessnock City Council and the MSB.	Technical Services Manager or delegate; Cessnock City Council Representative; MSB Representative
Drainage Lines	Undertake visual monitoring of drainage lines as a part of the Ecology Monitoring Program.	Environmental Co-ordinator
Water Pipeline	Provide written notification of the likely commencement of subsidence to the Singleton Office of the MSB.	Technical Services Manager or delegate
	Monitor the impact of subsidence on the pipeline in consultation with the owner. Should any damage occur, the MSB will be notified.	Technical Services Manager or delegate
	Lodgement of a MSB claim form requesting repair of any mine subsidence damage in accordance with MSB procedures.	Technical Services Manager or delegate in consultation with Pipeline owner
	MSB to coordinate and engage suitable contractors to complete repair works.	MSB Representative
	In addition to any repairs conducted by the MSB, provide temporary equivalent water supply or compensation for any loss of water supply due to mine subsidence damage.	Technical Services Manager or delegate

Table 7.1 – Surface Safety Management Controls (cont)

Surface Safety Risk	Action	Person Responsible
Natural Vegetation	Monitoring of natural vegetation will be undertaken in accordance with the *Ecology Monitoring Programme*.	Environmental Co-ordinator
Steep Slopes	Regular inspections of the zone defined as being 500 metres behind and 100 metres in front of the current face position will include inspection of surface cracking and compression ridges on steep slopes (refer to Subsidence Inspection Checklist attached as Appendix 2).	Technical Services Manager or delegate
	Undertake surface remediation works as required. Any remediation works required will be determined in consultation with the private landholders. Possible remediation techniques for soil cracking and compression ridges may involve infilling, local regrading or recompacting.	Technical Services Manager or delegate
Buildings	Buildings and associated non-residential infrastructure will be managed in accordance with the relevant Property Subsidence Management Plans.	Technical Services Manager or delegate
Fences	Regular inspections of the zone defined as being 500 metres behind and 100 metres in front of the current face position will include inspection of fences (refer to Subsidence Inspection Checklist attached as Appendix 2).	Technical Services Manager or delegate
	MSB to replace or repair fences as required by re-tensioning wire/straightening posts to maintain the integrity of the fences.	MSB Representative
Survey Control Marks	At the completion of mining re-establish survey control marks where required in consultation with the Department of Lands.	Technical Services Manager or delegate

At the completion of mining in a longwall panel, a full surface inspection will be conducted.

Actual subsidence levels will be assessed against predicted levels. If there is found to be a significant difference between predicted and actual subsidence levels, this plan will be reviewed and the required changes to management measures implemented.

8.0 Remedial Actions

8.1 Public Safety Issues requiring Immediate Remediation

If any public safety issue is identified during inspections that requires immediate remedial works to ensure public safety, the person that identified the issue shall:

- immediately notify the Stakeholder (or responsible person) of the issue;
- take actions to remediate the issue;
- erect 'NO ACCESS' tape and warning signs if remediation is not possible;
- notify the Technical Services Manager; and
- notify the District Inspector of Coal Mines.

8.2 Other Public Safety Issues

If any public safety issues are identified during inspections that are not able to be remedied immediately or other public safety issues are identified during assessment of monitoring or inspection results, the person who identifies the potential issue shall:

- notify the Technical Services Manager;
- notify the landholder or infrastructure owner of the potential issue;
- arrange for remediation works in consultation with the landholder (and MSB if required); and
- arrange for the erection of 'NO ACCESS' tape and warning signs if required.

Persons accredited under the DPI 'Forest, Soil and Water Training System' are approved to carry out works on access tracks.

Any remediation works in the State Conservation Area will require approval from the DECC prior to the commencement of works.

9.0 Responsibilities

Table 9.1 outlines the responsibilities of personnel to ensure the efficient implementation of this Public Safety Subsidence Management Plan.

Table 9.1 – Responsibilities of Personnel

Staff Member	Responsibilities
Austar Coal Mine Technical Services Manager	Authorise the Plan and any amendments thereto.
	Promptly notify the District Inspector of Coal Mines of any identified public safety issue.
	Ensure that the requisite personnel and equipment are provided to enable this Plan to be implemented effectively.
	Inform the Mine Manager of public safety issues that the DPI should be notified of.
	Liaise with officers of public utility providers, government departments, remediation consultants and contractors as required.
	Ensure that this Plan is reviewed at the end of each longwall, or if any changes to the mine plan occur, levels of subsidence are greater than predicted, or an incident occurs.
	Review and assess subsidence monitoring results and inspection checklists.
Mine Surveyor	Ensure that subsidence inspections are undertaken in accordance with the schedule.
	Ensure that persons conducting the inspection are appropriately trained, understand their obligations and the specific requirements of this plan.
	Review and assess subsidence monitoring results and inspection checklists.
	Promptly notify the Technical Services Manager of any identified public safety issue.
	Ensure all notifications required under Section 7.1 are carried out.
Austar Coal Mine Technical Services Manager delegate	Conduct the subsidence inspection within the applicable subsidence zone to the standard required and using the Subsidence Inspection Checklist.
	Take actions to remediate any public safety issue identified during inspections.
	Where actions are beyond their capabilities immediately attempt to notify the landowner and Technical Services Manager.
Environmental Coordinator	Inform the Technical Services Manager of environment and community issues that the DPI should be notified of.
	Liaise with officers of public utility providers, government departments, remediation consultants and contractors as required.

10.0 Training

All personnel who conduct inspections will be trained in the requirements of this Public Safety Subsidence Management Plan. Training will be conducted on the identification of the various subsidence impacts and the associated public safety risks.

11.0 Reporting

The results of inspections will be documented. The effectiveness of the Longwalls A3 to A5 Public Safety Subsidence Management Plan in managing public safety risks will be reported where relevant in the AEMR.

12.0 Review

This plan is to be reviewed after the completion of each longwall. The plan will also be reviewed as a result of an incident, if subsidence levels are significantly higher than predicted, or if any changes to the mine plan occur.

13.0 Contact Details

Position	Name	Phone
Austar General Manager	Frank Fulham	4993 7356
Austar Environmental Coordinator	Sarah Harvey	4993 7334
Austar Mine Surveyor	Daryl Jolliffe	4993 7206
Austar Technical Services Manager	Adrian Moodie	4993 7293
Austar After Hours	Control Room	4993 7220
MSB District Manager	Garry Moore	6572 4344
Cessnock City Council Roads, Bridges & Drainage Manager	John Booth	0401 107 422
Cessnock City Council Civil Maintenance Manager	Bryce Jamieson	0401 107 410

14.0 References

Mine Subsidence Engineering Consultants 2007. *The Prediction of Subsidence Parameters and the Assessment of Mine Subsidence Impacts on Natural Features and Surface Infrastructure resulting from the Extraction of Proposed Austar Longwalls A3 to A5 in Support of a SMP Application. Report Number MSEC275, Revision C*.

Umwelt (Australia) Pty Limited 2007a. *Austar Stage 2 Subsidence Management Plan – Environmental Attributes, Impacts and Controls*.

Umwelt (Australia) Pty Limited 2007b. Flooding Assessment: Longwalls A3, A4 and A5.

APPENDIX 1 : Subsidence Monitoring Program

Proposed Subsidence Monitoring Strategy - Longwall Panels A3 – A5

Stage 2 Longwall mining consists of LW Panels A3 to A5 inclusive and is due to commence at Austar Coalmine in January 2009.

The proposed layout and monitoring details of the grid are outlined below (and on attached plan SUB 0702). The extraction area is beneath a rural area with privately owned lots ranging from 10 to 40 hectares and placement of subsidence marks will have to be in agreement with Land Owners with regard to minimising disturbance to their properties.

Proposed Subsidence Monitoring Program

1) Longitudinal Subsidence monitoring lines to be established along the central part of each of the three longwalls with survey mark spacing at nominal 25m intervals. (Lines A3-A5 on attached plan). Final line positioning to cause minimum disturbance to land owners.

2) A Cross line, with survey marks at 25m centres, located as centrally as possible over the combined area of Longwalls A3-A5 but positioned to cause minimum disturbance to land owners. (Cross line 1)

    - The grids will be, established using “Feno” survey marks at nominal 25m intervals.
    - The grids will be monitored using Total Station techniques to measure full three dimensional movement.
    - Data will be supplied using an excel spreadsheet and the updated subsidence plan (dwg format).
    - The subsidence plan will show the face positions at the time of each survey.
    - Longwall extraction heights will be estimated with regard to LTCC extraction reports.
    - The surface area consists mainly of privately owned rural land. The extent of the proposed monitoring lines does cross some Austar Coal Mine owned land and extends 100 metres into Aberdare State Forest on the northern end of Line A3.
    - Depth of cover ranges between 485m – 535m.
    - At least 4 Residential dwellings over the subsidence area are to be monitored for subsidence.
    - Monitoring frequency as per attached table

Proposed Monitoring Program for Dwellings

Monitoring

A survey monitoring grid consisting of levelled marks at selected suitable locations around the 4 dwellings listed below is to be installed.

The Monitoring grid to be surveyed:

- Prior to mining – initial survey to be completed before Longwall Extraction is within 300 metres of dwelling based on extraction of the panel that is predicted to subside the dwelling by a total greater than 500mm based on the upperbound predictions.
- At completion of mining – by agreement with landholder.

- At other times following mining – as required by the Landholder or the Principal Subsidence Engineer.

Inspection

A pre-mining building inspection will be conducted by a suitably qualified Structural Engineer. The inspection to be completed:

- Prior to Longwall Extraction coming within 300 metres of the dwelling.
- At completion of mining – by agreement with Landholder.

Communication

When mining is within the "Active" subsidence zone Austar Coal Mine will contact the occupier of the dwelling affected by mining on a daily, or other agreed schedule, to:

- Advise of mining progress.
- Determine the extent of any damage.
- Arrange rectification or remediation works as necessary.

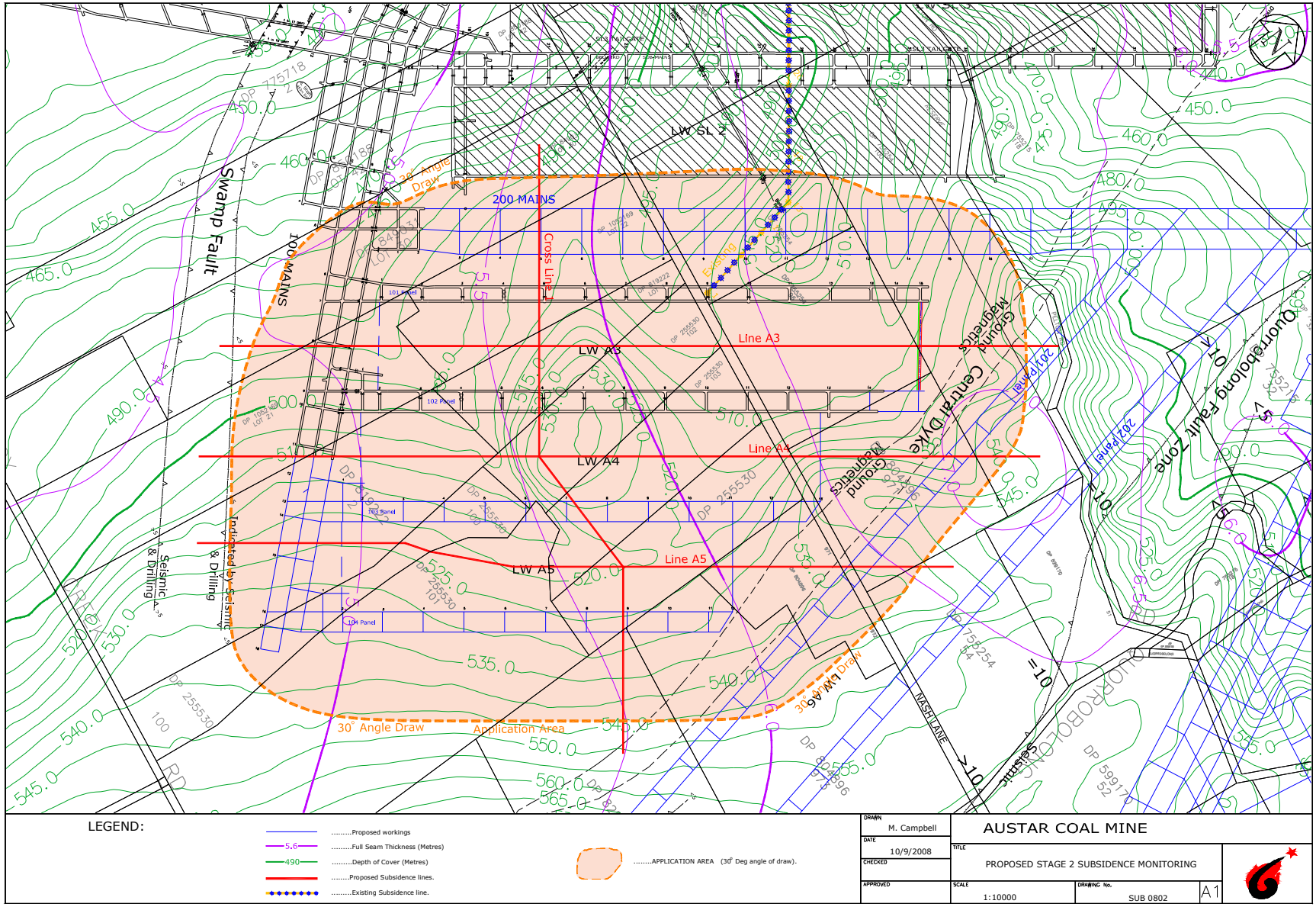
Following mining in the "Active" subsidence zone, communication will be agreed with the occupier.

The "Active" subsidence zone is defined as (0.5 x Depth Cover) in advance of the Longwall Face & (1.0 x Depth Cover) behind the Longwall face.

The 4 dwellings listed for Subsidence Monitoring are:

- Lot 96 DP 755254 Owner: B Murray
- Lot 100 DP 255530 Owner: Miss A. Morphett
- Lot 102 DP 255530 Owner: Mr J Reid.
- Lot 104 DP 255530 Owner: Mr S. J. & Mrs C.L. Duff

Subsidence Line	Location	Purpose	Survey Marks	Mark Spacing	Monitoring Frequency
Line A3	Longitudinal line located as centrally over A3 Longwall as the surface improvements will allow.	Measure the development of the A3 subsidence then capture the combined subsidence effect of the adjacent longwall blocks.	Feno marks with 600mm spike if no rock.	25 metres	Monthly for the duration of Longwalls A3 & A4. Possible reduction to Quarterly for the duration of Stage 2 longwall extraction. Additional monitoring as requested by PSE
Line A4	Longitudinal line located as centrally over A4 Longwall as the surface improvements will allow.	Measure the development of the A4 subsidence then capture the combined subsidence effect of the adjacent longwall blocks.	Feno marks with 600mm spike if no rock.	25 metres	Monthly for the duration of Longwalls A4 & A5. Reduction to quarterly for 12 months after completion of Stage 2 extraction or till subsidence is complete. Additional monitoring as requested by PSE
Line A5	Longitudinal line located as centrally over A5 Longwall as the surface improvements will allow.	Measure the development of the A5 subsidence & capture the combined subsidence effect of the adjacent longwall blocks.	Feno marks with 600mm spike if no rock.	25 metres	Monthly for the duration of Longwall A5 & for a further 3 months. Reduction to quarterly for 12 months after completion of Stage 2 extraction or till subsidence is complete. Additional monitoring as requested by PSE
Cross Line 1	With due regard to minimum disturbance to Land Owners. A Cross line to the 3 longwalls	To capture the subsidence profile across the combined Area 2 extraction including Max Subsidence.	Feno marks with 600mm spike if no rock.	25 metres	Pre mining and the completion of each Longwall panel. Following the completion of Stage 2 extraction, Quarterly monitoring is to continue for 12 months or until Subsidence is complete.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Line A4
LW A4
Line A5
LW A5
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Ground Magnetics
Quorrobolong Fault Zone
Indicated by Seismic & Drilling
30° Angle Draw
Application Area
NASH LANE
Existing
101 Panel
102 Panel
103 Panel
104 Panel
201 Panel
202 Panel
LEGEND:
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5.6 .....Full Seam Thickness (Metres)
490 .....Depth of Cover (Metres)
.....Proposed Subsidence lines.
.....Existing Subsidence line.
.....APPLICATION AREA (30° Deg angle of draw).
DRAWN M. Campbell
DATE 10/9/2008
CHECKED
APPROVED
AUSTAR COAL MINE
TITLE PROPOSED STAGE 2 SUBSIDENCE MONITORING
SCALE 1:10000
DRAWING No. SUB 0802
A1

APPENDIX 2 : Subsidence Inspection Checklist

SUBSIDENCE INSPECTION CHECKLIST	
Date	
Name of Inspection	
Longwall Number	
Face Position (chainage)	
Inspection Zone Start (Face chainage -500m)	
Inspection Zone End (Face chainage +100m)	

INSPECTION ITEM	CHECKED	COMMENTS
Surface cracking		
Surface humps (compression)		
Step change in land surface		
Unstable slopes, boulders or trees		
SURFACE SLUMPING, EROSION		
CHANGES TO STREAMS, PONDING, SEDIMENT LOAD		
Other		

SUBSIDENCE INSPECTION CHECKLIST

Where to Inspect

500 metres behind and 100 metres in front of the current face position.

Cover the full subsidence bowl out to the 30° angle of draw.

What to look for

- Surface cracking - edges of extraction void and start and travelling abutments particularly in rock outcrop areas and topographic high;
- Surface humps (compression) - near centre of extracted panels, the travelling abutment and topographic lows if adjacent to steep terrain;
- Step change in land surface - associated with cracking;
- Serviceability of access tracks; and
- Slope, boulder and tree instability.

Actions if there is a public safety risk

- Immediately notify the landholder of the findings;
- Take actions to remediate the issue;
- Erect "NO ROAD" tape and warning signs if remediation is not possible; and
- Notify the Mine Manager.