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Report for Minmi Link Road - Minmi Retail/Commercial Development - Structural Options

November 2011

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Appendix A

1. Introduction

GHD was commissioned by Coal & Allied to undertake a desk top review of the potential mine subsidence issues for a proposed Retail/Commercial Precinct within a new development at Minmi.

Current planning for a concept plan including 3300 dwellings and an appropriate rezoning to allow a town centre is underway. The land is owned by Coal and Allied and the mine subsidence issues are required to be addressed so the assessment of the proposal can proceed.

GHD's review was limited to the Retail/Commercial area in which a proposed village centre would be located. The village centre will include a supermarket and the current environmental assessment advises that the area is constrained in terms of height, construction material and building footprint size.

We understand that the above constraints will limit the building construction to single storey.

This report outlines the mine subsidence issues for the area proposed for the town centre and focuses on the proposed 80m x 40m building footprint for the supermarket.

2. Mine Subsidence Issues

David Sparkes of GHD met with Will Wight of Douglas Partners to gain an understanding of the site constraints with respect to mine subsidence. GHD was also provided with a copy of the Douglas Partners report 39663107 dated February 2011, which formed part of the environmental report.

The report details the investigation and engineering work carried out by Douglas Partners for the whole development proposed and provides constraints due to potential mine subsidence for various areas within the development boundaries. Subsidence parameters and building constraints are summarized in the Douglas Partners report for pot hole risk and for limited, moderate and high subsidence risk areas.

The proposed town centre precinct is located in the high risk subsidence area, shown as yellow on drawing 1 in Appendix A.

Development in this area is subject to the following constraints:

- ▶ Subsidence predicted will be higher than acceptable for brick veneer construction.
- ▶ Buildings should be of flexible construction and light weight (non-brittle) clad construction.
- ▶ Stiffened raft slabs with limited footprint should be adopted.

Discussions with Douglas Partners indicated that the footprint of the buildings in this area would be limited to 15m.

It is understood that the potential residual tilts in the high subsidence risk areas would be in the order of 14mm/ m with no grouting of the coal seam. The proposed strategy of limiting residential building foot prints to 15m is to limit possible tilts of the building slabs to approximately 220mm over the length (or width) of the building. It is envisaged the stiffened raft slabs can then be re-levelled following a mine subsidence event using pressure grouting techniques of the ground below the slabs.

The Retail and commercial buildings within the town centre generally, and a supermarket in particular, are likely to have footprints greater than 15m. The structural issues for these building types are discussed below.

3. Discussion

It is understood that the buildings within the village centre subject to the high subsidence issues would also be of single storey light weight construction. While the configuration of the buildings, location, and orientation has not been determined at this early stage of planning, it is understood that the supermarket building footprint will be in the order of 80m x 40m and as such is well outside the footprint constraints outlined in Douglas Partners report.

The mine subsidence parameters that effect the building performance are the residual tilts, strains and the radius of curvature of the ground profile following a subsidence event. The modelling carried out by Douglas Partners indicate that these values are as follows:

Radius of curvature:	5000m
Tilts:	14mm/m
Strains:	6mm/m (compression or tension)

The results given by Douglas Partners due to a mine subsidence event are likely maximum values. What also needs to be considered however, is the extent of the subsidence within the footprint of the building. For example if a subsidence event due to a pillar run is such that the extent of the subsidence continues well outside the building area then this will result in different ground profiles than if a pillar run was to stop under, or at, the building site.

Under the first scenario with the predicted tilts in the order of 14mm/m, the building could result in an out of level floor of up to 1.3m across its diagonal length. Tilts of this magnitude are very high with respect to building structures and re-levelling such building with large footprints, whilst technically feasible, would be difficult and most likely cost prohibitive. Further, the building would need to be vacated whilst the work was carried out as there would be considerable damage to building fabric and services due to such ground movements.

Under the second scenario where the full tilt may not be realised over the entire footprint, further damage would occur to the wall and roof structure above the ground floor.

For a building with such a large footprint a stiffened raft concrete slab would not provide a solution such as that proposed for the residential buildings with limited footprints. Therefore either the building footprint has to be limited or the predicted ground movements reduced. Limiting the building footprint for a supermarket would not suit the business requirements and therefore minimising the ground movements by grouting the coal seam prior to construction appears to be the better solution.

Additional modelling on grouting options would be appropriate to determine how much of the seam requires grouting to achieve reasonable structural design parameters. Maximum tilts in the order of 4mm/m, which are similar ground movements to a highly reactive clay soil, would be required to enable the construction of large footprint buildings.

Whilst the Mine Subsidence Board is yet to be consulted, their minimum requirement is that building structures subject to mine subsidence are to be safe, serviceable and repairable. They define these parameters as follows:

Safe: No threat to human life and that the building does not collapse

Serviceable: The occupant does not have to vacate the building or business and repair can be carried out reasonably easily

Repairable: The structure is repairable as a reasonable cost.

4. Conclusion

A review of the predicted mine subsidence issues for the Village Centre precinct to accommodate a building footprint in the order of 80m x 40m revealed predicted ground movements with tilts of up to 14mm/m.

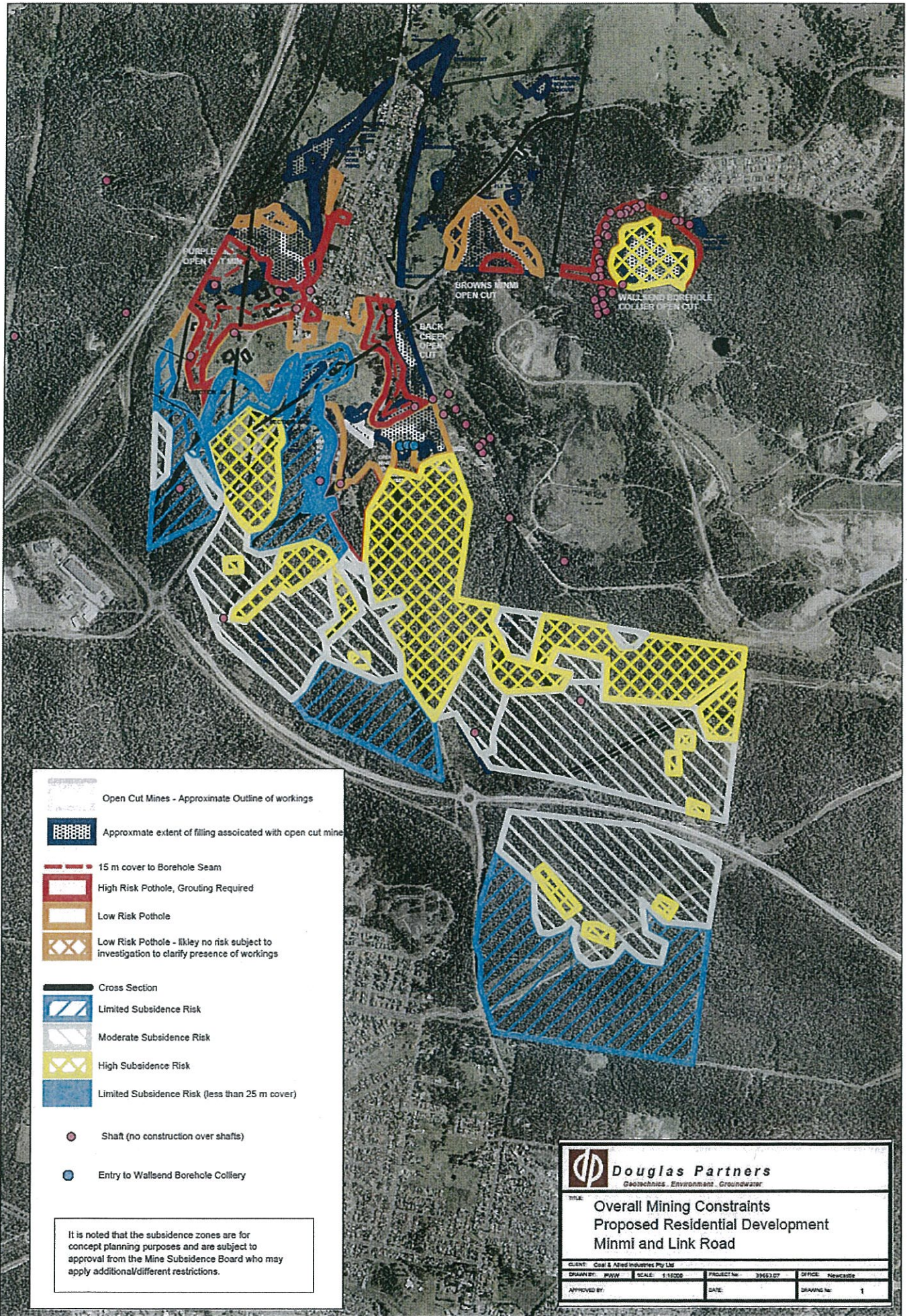
Such tilts are considered very high with respect to building structures and it would not be feasible (if technically possibly) to construct a building to absorb such ground movements and maintain it to be safe, serviceable and repairable.

Two possible options are available for the building structures in the high subsidence areas and these are:

- 1) Limit the building footprint to minimise the tilt to which the building is subject .
- 2) Provide grouting or partial grouting of the coal seam(s) to reduce the ground movements due to mine subsidence to levels that can be accommodated economically in the building construction.

Given these two alternatives, and the size of the footprint required for the normal operation of a supermarket, then grouting or partial grouting of the coal seam(s) will be the better option.

Appendix A



Open Cut Mines - Approximate Outline of workings

Approximate extent of filling associated with open cut mine

15 m cover to Borehole Seam

High Risk Pothole, Grouting Required

Low Risk Pothole

Low Risk Pothole - likely no risk subject to investigation to clarify presence of workings

Cross Section

Limited Subsidence Risk

Moderate Subsidence Risk

High Subsidence Risk

Limited Subsidence Risk (less than 25 m cover)

Shaft (no construction over shafts)

Entry to Wallend Borehole Colliery

It is noted that the subsidence zones are for concept planning purposes and are subject to approval from the Mine Subsidence Board who may apply additional/different restrictions.

Douglas Partners
 Geotechnics, Environment, Groundwater

**Overall Mining Constraints
 Proposed Residential Development
 Minmi and Link Road**

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Document Status

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