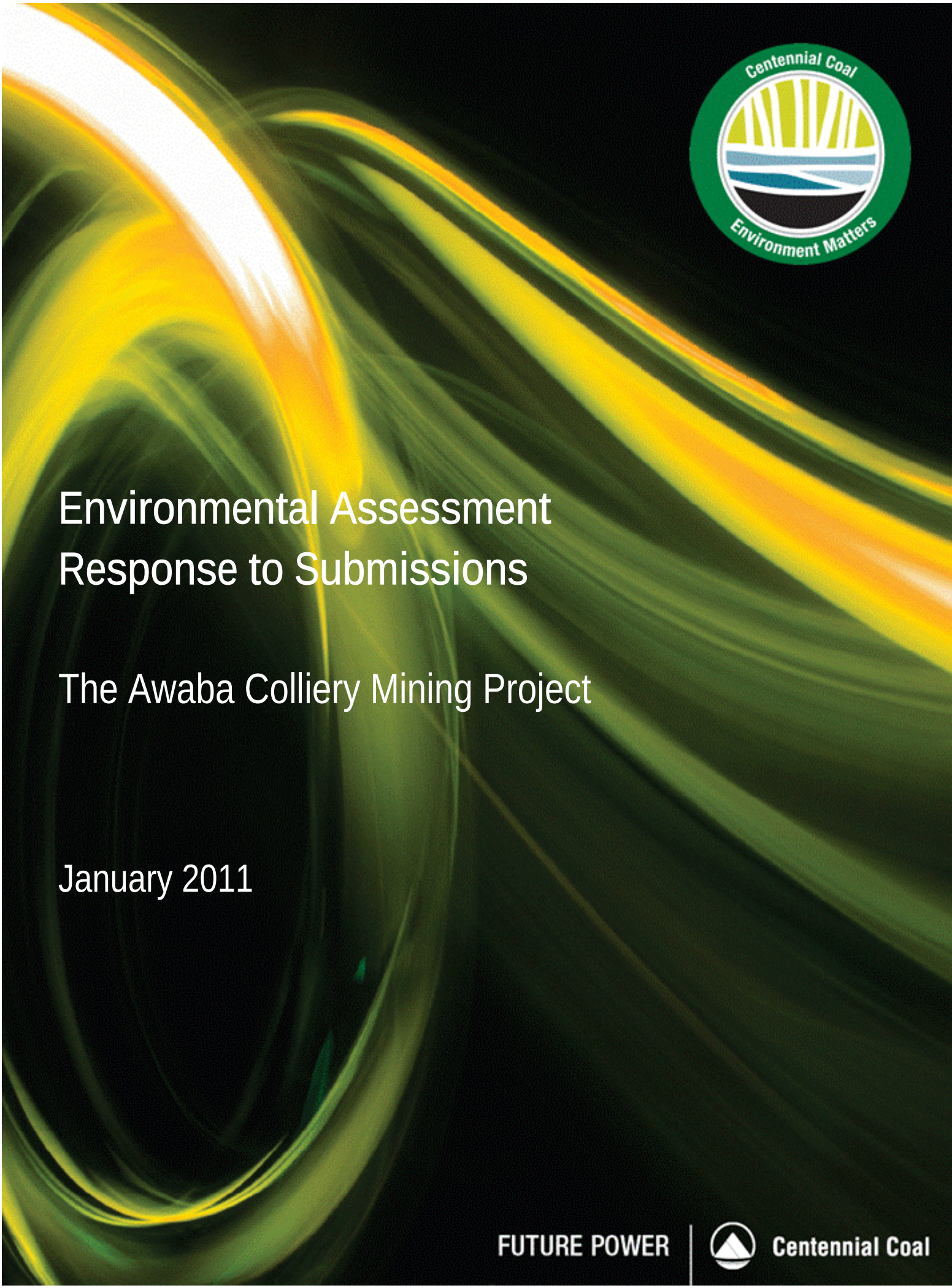

Environmental Assessment Response to Submissions

The Awaba Colliery Mining Project

January 2011

FUTURE POWER | Centennial Coal

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EXECUTIVE SUMMARY

Awaba Colliery submitted an Environmental Assessment to the New South Wales Department of Planning in September 2010 seeking approval to allow ongoing and extended underground mining and associated surface operations. The Environmental Assessment was prepared in accordance with the provisions of Part 3A of the Environmental Planning and Assessment Act 1979 and specifically with reference to the Director General Requirements (DGR's) issued by the Department of Planning. The Environmental Assessment was publically exhibited for comment from Tuesday 5 October 2010 to Thursday 4 November 2010.

This document responds to submissions submitted to the Department of Planning. The document is an appendage to the Environmental Assessment and should be read in conjunction with the Environmental Assessment.

1. INTRODUCTION

Awaba Colliery is a small underground coal mine operated by Centennial Newstan Pty Ltd (Newstan), a wholly owned subsidiary of Centennial Coal Company Ltd (Centennial). The mine is located within the Newcastle coalfield, south of the Awaba village on the western side of Lake Macquarie, near Newcastle NSW. Mining operations commenced at the Awaba Colliery in 1947, prior to the commencement of any planning controls, and have continued without abandonment since that time. Consequently, the Awaba Colliery presently operates pursuant to section 109(1) of the NSW Environmental Planning and Assessment Act 1979 (EP&A Act) and clause 6B(1) of the State Environmental Planning Policy (Major Development) 2005.

Awaba Colliery is seeking an approval from the Minister of Planning under the provisions of Part 3A of the EP&A Act to:

- Continue bord and pillar development and pillar extraction by continuous miners within the "Main South Area" (being the remaining sections of Stage 2 and Revised Stage 3);
- Extend bord and pillar development and pillar extraction by continuous miners into the "East B" Area;
- Produce, handle and distribute up to 880,000 tonnes of Run of Mine coal per annum (financial year) using existing surface facilities;
- Continue the use of existing ancillary surface facilities;
- Expand the existing Pollution Control Dam;
- Continue the delivery of coal to the Newstan Colliery and/or the Eraring Power Station using the existing private haul road/transport facilities.

No significant changes to existing coal handling are proposed by the Project. Minimal changes are proposed to existing surface operations, with a proposed new surface disturbance relating to increased Pollution Control Dam (PCD) capacity. All existing surface and underground infrastructure at Awaba Colliery, including previous surrounding workings (for ongoing ventilation and access), will continue to be relied upon.

While the Project does not involve any significant change to employment, and only a slight increase in the coal production rate, it has been anticipated that the operations will extend the mine life for approximately five years. This will in turn secure employment and associated flow on effects for the life of the project.

The potential environmental impacts of the Project have been kept to a minimum through:

- Negligible surface disturbance (the only construction proposed is an expansion to the existing Pollution Control Dam (PCD) which is located in an existing previously disturbed area);
- A dedicated mine design with a successful and proven history in previously mined areas (including the recent 3 North Area and mined sections of Main South Stage 2) to eliminate or minimise potential surface subsidence impacts. This includes the following conservative measures in design:

- Providing for pillar supports to remain in place under surface infrastructure which occurs in Revised Stage 3 Area and the remaining Stage 2 Area (no infrastructure in East B Area);
- No secondary extraction (buffer zones established) under creeks of 2nd order or higher;
- Providing minimum depths of cover exceeding 20m (first workings) and 25m (secondary workings) to avoid potential for surface impacts such as significant cracking or sink holes;
- Specialist subsidence assessment by Seedsman Geotechnics for the proposed mine designs
- A risk-based approach to subsidence impact assessment and management including specialist environmental studies for key environmental aspects as outlined below.

- Obtaining a detailed understanding of the issues and potential impacts for the Project using a risk-based approach to appropriately identify and assess relevant environmental aspects. The multi-disciplinary assessment and consultation has been to a level of detail commensurate with the scale of the Project, industry standards and the legislative framework under which the Project is permitted;
- Implementation of the existing proactive strategies and management plans employed at the Awaba Colliery to avoid, minimise, mitigate, offset or manage potential impacts, with commitment to update those or develop new plans where required (including development of a dedicated Aboriginal and Cultural Heritage Management Plan for Awaba Colliery);
- Implementation of the Statement of Commitments.

Table 1 presents the component stages of the overall approvals process for the proposed approval under Part 3A of the Environmental Planning and Assessment Act 1979. Table 1 has been revised for timing, as presented in Table 1.2 Section 1.7 Project Approval Process and Indicative Timeline of the Environmental Assessment.

Table 1 Revised Approvals Process for a Major Project and Centennial's Indicative Timeline

Stage		Action	Indicative Timing
1.	⇨	Submit Preliminary Environmental Assessment to Department of Planning	23 March 2010
2.	⇨	Receive Environmental Assessment Requirements	22 April 2010
3.	⇨	Submit Environmental Assessment for adequacy review (21 days)	9 September 2010
4.	⇨	Exhibit EA and invite public submissions (minimum 30 days)	5 October to 4 November 2010
5.	⇨	Initial response to submissions	6 December 2010
		First revision of the response to submissions document	15 December 2010
		Second revision of the response to submission document	6 January 2011
6.	⇨	Department of Planning assessment and Planning Assessment Commission (PAC) determination (90 days)	March 2011

2. SCOPE

This document responds to submissions made in relation to information presented in the Environmental Assessment. This document is an appendix to the Environmental Assessment for Awaba Colliery Mining Project. The document builds on information presented in the Environmental Assessment and is to be read in conjunction with the Environmental Assessment.

Additional information to be presented in this document is:

- Section 3 Key project amendments in response to the submissions received
- Section 4 Public submissions received summary and common concerns
- Section 5 Community consultation undertaken since submission of the Environmental Assessment
- Section 6 Revised Statement of Commitments

3. KEY PROJECT AMENDMENTS

Project amendments provided in this document and the Statement of Commitments (Tables 4 and 5) are:

- A commitment to complete a groundwater monitoring program for inclusion in the existing Water Management Plan for the Stony Creek shallow and alluvial aquifers.

4. PUBLIC SUBMISSIONS

Seven submissions were received by the Department of Planning following public display of the Environmental Assessment. A further submission was received by Awaba Colliery via email on 10 November 2010. Submissions were lodged by an individual, community organisation, union, Local and State Government. Table 2 illustrates the number of submissions received by category of submitter.

Table 2 Category of Submitters

Category of Submitter	Number of Submissions Received
Individual	1
Community Organisation	1
Union	1
State Government Department	4
Local Council	1
Member of Parliament	0
Total	7

Of the eight submissions received, five had no objections to the Project and required no further actions. Table 3 outlines the key concerns raised in the additional three submissions and the section within this response which addresses these concerns.

Table 3 Key Concerns Raised in Submissions

Key Concerns	Section in which concern is addressed
1. The management and mitigation measures and timeframes for heritage conservation be confirmed and reworded as part of the consent conditions.	Section 6 point 1, Statement of Commitments points 4.1, 6.1 & 8.1.
2. Reconsideration of the care and maintenance phase, with future operational and final land use assessments including consultation with relevant stakeholders should be undertaken prior to mine closure.	Section 6 point 1, Statement of Commitments points 4.1, 6.1 & 8.1.
3. Request for further detail to be included in the Subsidence Monitoring Program, and to make the monitoring results publicly available.	Section 6 point 2, Statement of Commitments points 7.1 & 7.2
4. Additional measures be considered if mitigation strategies do not enable Total Suspended Solids levels to fall below ANZECC guidelines at LDP009.	Statement of Commitments point 3.2
5. Inadequate threatened species and biodiversity sections in the Environmental Assessment, including surveys and assessments not being undertaken in accordance with appropriate guidelines.	Section 5.2, Section 6 points 3, 4, 5,
6. Request for previous ecological reports and survey details.	Section 5.2, Section 6 point 6
7. In the absence of suitable survey information and an appropriate detailed threatened species assessment the Project was considered to potentially significantly impact on a variety of threatened species and their habitats. As such the proposal would require appropriate offsets to compensate the loss of threatened species, ecological communities and/or their habitats.	Section 5.2, Section 6 point 3, 4 & 7
8. Lack of detail in the EA regarding the monitoring of shallow or alluvial aquifers in the area in regard to potential groundwater depressurization.	Section 3, Section 5.2, Section 6 point 8, Statement of Commitments point 3.3
9. Hydraulic connection to Newstan Colliery and mine dewatering including requirements for water licences.	Section 6 point 10, Statement of Commitments point 3.4
10. Concerns regarding the inadequacy of groundwater investigations of alluvium connected to the Stony Creek due to the occurrence of plug collapses. The development of alluvial groundwater monitoring was suggested.	Section 3, Section 5.2, Section 6 point 8, Statement of Commitments point 3.3 Attachment 3
11. Reporting of water balances to NOW comparing predicted and actual take of water.	Statement of Commitments point 3.6
12. The EA identified 2 groundwater dependant ecosystems	Section 6 point 3, 4, 7, 8, 9 and Statement

(GDE's), immediately downstream of the mining area, two of which are Endangered Ecological Communities (EEC's), and a monitoring program should be formulated to confirm the assessment outcomes and check for unexpected adverse impacts.	of Commitments point 3.3.
13. As the shallowest depths of cover exist where the mine workings encroach closest to Stony Creek and tributaries, the proposal is considered to have a significant risk of substantial loss of water from Stony Creek should further pillar failures and consequential chimney collapse occur.	Section 6, point 3, 4, 8, 9, Statement of Commitments point 3.3
14. Outstanding ground and surface water information required includes: (a) Mapping of stream corridor and connected alluvium overlaid on mine layouts to avoid risk of saturation-led pillar failure and chimney collapse beneath watercourses and alluvium. (b) Geomorphic description of streams and rivers within and downstream of the project site (i.e. river style, geomorphic energy regime to bankfull discharge). (c) Mitigation measures to prevent / limit incision and subsequent degradation of stream channels for each panel room and the cumulative subsidence envelope.	Section 6, points 8 and 11. Attachment 3. Section 6, point 12. Section 6 points 3,4,8,9 and 11.
15. Recommended approval conditions for the Centennial Awaba Coal Project.	Section 6, point 13.

5. CONSULTATION

This section outlines the additional consultation which has occurred since the submission of the Environmental Assessment in September 2010, and as outlined in Section 6 of the Environmental Assessment.

5.1 Community

Community consultation undertaken was in accordance with the Department of Planning Director General's Requirements for the Environmental Assessment. The Environmental Assessment was publically exhibited from Tuesday 5 October 2010 to Thursday 4 November 2010.

Two submissions were received from the community;

- A submission was received from a resident of Edgeworth NSW in support of the Project;
- A further submission was received from the No Open Cut Mine For Awaba (NOCMFA) group. A representative of

the group enquired as to what was involved in relation to the proposed surface works and informed Awaba Colliery that Awaba residents do not receive any free newspapers and therefore felt that including Project advertisements in the Lakes Mail Newspaper as a form of consultation with Awaba residents was not valid.

5.2 Department of Environment, Climate Change and Water

A request was received from the Department of Environment, Climate Change and Water (DECCW) on 7 October 2010 for a report referenced in the Awaba Environmental Assessment. A copy of the AGEC Report *Definition of Limit of Stony Creek Alluvium* was supplied to DECCW on 8 October 2010 and is included as Attachment 3.

A meeting was held with DECCW on 19 November 2010 and a presentation was undertaken by Awaba personnel to address the issues raised in DECCW's submission. The presentation is included as Attachment 1 Awaba Colliery Mining Project Presentation. In addition key points from this meeting are presented in Sections 6 and 7 Response to Submissions. Following the presentation by Awaba personnel, DECCW stated that an additional response would be provided to the Department of Planning. As of 6 January 2011, Awaba Colliery has not received an additional response from DECCW.

A second meeting was held with DECCW regional operations officers, and a presentation was given with a project overview, followed by a site inspection on 29 November 2010.

5.3 Industry and Investment

The Awaba Colliery Mine Manager has had several discussions and provided additional information to the Industry & Investment (I&I) Inspector and with other I&I personnel regarding the Project. Furthermore, I&I were contacted by Awaba Colliery on 25 November 2010 regarding a submission on the Awaba Mining Project.

A submission was received from I&I on 20 December 2010.

5.4 NSW Office of Water

A submission was received from the NSW Office of Water (NOW) on 6 December 2010. A meeting was held with NOW on 17 December 2010 and a presentation was undertaken by Awaba personnel to address the issues raised in NOW's submission. The presentation is included as Attachment 4 Awaba Colliery Mining Project Presentation (17 December 2010). In addition key points from this meeting are presented in Sections 6 and 7 of this document. At this meeting NOW requested a copy of this document. Awaba Colliery will provide a copy of this document to NOW once it is made publically available on the Department of Planning's website.

6. RESPONSE TO SUBMISSIONS

In response to the submissions and key points raised in Section 4, Awaba Colliery has provided an updated Statement of Commitments in Table 4 & 5. The presentation titled Awaba Colliery Mining Project Presentation which was delivered to the Department of Environment, Climate Change and Water on 19 November 2010 is also included as Attachment 1 and the presentation titled Awaba Colliery Mining Project Presentation which was delivered to the NSW Office of Water on 17 December 2010 is also included as Attachment 4.

Awaba Colliery provides the following specific responses to the key points listed in Section 4:

1. Awaba Colliery has committed to the management and mitigation measures for Aboriginal Cultural Heritage as detailed in section 9.5.6 of the Environmental Assessment. In addition, the updated Statement of Commitments includes amendments to sections 4.1, 6.1 and 8.1 with regards to Aboriginal and European Heritage management at Awaba Colliery.

2. Awaba Colliery is currently operating in accordance with a Subsidence Management Plan (SMP) approval for the Main South Stage 2 Area, which was approved by Industry & Investment (formerly the Department of Primary Industries) in September 2008. An SMP Application for the Revised Stage 3 Area was submitted to Industry & Investment in December 2009. Awaba Colliery has committed to the development of a Subsidence Management Plan, or equivalent for the East B Area in consultation with the Department of Planning in section 7.1 of the Statement of Commitments. Awaba Colliery has proposed to include section 7.2 in the Statement of Commitments to include the requirement to display subsidence monitoring results on the Awaba Colliery website.

3. A new mine design was formulated to minimise the potential for significant subsidence events to occur. This current mining method was developed in consultation with I&I and has successfully been used at Awaba Colliery without incident since mid 2007 (Seedsman, 2010). Further detail is included in Attachment 1. The development of the current mine design allows Awaba Colliery to conservatively exclude secondary extraction from potentially sensitive areas. These secondary extraction exclusion areas are shown on Figure 7.2 of the EA (Attachment 2).

   The ***maximum*** vertical subsidence experienced at Awaba Colliery with the current mining method of extraction is around 125 millimetres. The subsidence predictions for areas using this mining method have been verified by subsidence monitoring surveys undertaken in accordance with the existing Subsidence Monitoring Program. In general, subsidence levels of approximately 100mm are predicted above the pillars with an additional 100mm above the extraction panels. ***The predicted maximum subsidence is 200mm*** and the associated tilts and strains will not be measurable with standard survey tools.

   Not withstanding this, a 'worst case' scenario (not predicted) is also assessed for a plug failure, which has a ***negligible*** likelihood of developing and is conservatively provided as the basis for risk assessment. Mine design has addressed the risk of 'plug failure' by using a proven mining method and designing the layout in accordance with the preventative hierarchy of subsidence management control measures.

4. Risk ***elimination and substitution*** are primary controls specifically employed in mine planning and design to avoid risk or minimise potential risks. Awaba Colliery has ***eliminated*** the risk under the haul roads and other infrastructure and the identified water courses, by eliminating pillar extraction in these areas. Further detail is included in Attachment 1. Attachment 2, figure 7.2 of the EA outlines the specific Secondary Extraction Exclusion Areas.

5. The Ecological Assessment report prepared for the EA (2010) was prepared in accordance with:

    a. *DECC & DOP, 2005, 'Draft Guidelines for Threatened Species Assessments under Part 3A of the EP&A Act, 1979',* as specified by the DGRs issued by DoP in April 2010*.*

    b. DECC 2008, '*Vegetation of the Cessnock-Kurri Region, Survey, Classification and Mapping'* which established a survey 'ground-truthing' methodology recognised by DECC. Colin Driscoll and Steven Bell wrote this report in 2007 for DECC. This has also been used in previously approved SMP applications that have also been submitted to DECC through DPI's SMP inter-agency committee process

6. Previous Surveys and Reports by Hunter Eco at Awaba Colliery (all were supplied to the DECCW on 19 November 2010) include the following:

    a. 'Awaba East Exploratory Drilling Program REF, Ecology', June 2008. This included vegetation community mapping that included the EA project area using ground-truthing methods in DECC 2008, and is referenced in the ecology report for the EA (2010).

    b. 'Awaba Revised Stage 3 SMP Ecology Assessment', December 2009. The SMP is currently with I&I NSW awaiting approval via Inter Agency Committee review, and covers part of Study Area 2 (northern part) of the EA (2010). It included 7 part tests.

    c. Main South Area SMP, September 2005 *'Ecological Assessment of the surface area subject to subsidence resulting from outbye pillar extraction process planned by Centennial Coal for the Awaba Colliery'.* This SMP was approved by DPI-MR via the SMP Inter Agency Committee process, and covers part of Study Area 2 (southern and central part) of the EA (2010).

    d. *'Awaba Underground mine 3 North Outbye Project SMP: Ecology Assessment'*, November 2008. This is not part of the current EA project area (2010), however it is adjacent to Study Area 3 (East B Area) using the same current mining method.

7. The potential ecological impacts were assessed for two possible subsidence scenarios. The first scenario is the predicted case (maximum subsidence of 200mm) and the other is for the unlikely (and not predicted) worst case 'plug failure' scenario, noting however that the mine plan has been specifically designed to eliminate or significantly reduce the possibility of such an event. Overall, there were no significant impacts identified on vegetation communities (including the downstream Ecologically Endangered Community), threatened flora and fauna, or to the connectivity of habitats for the Project. As no impacts on threatened species or their habitats were identified, this Project does not trigger a requirement for offsets.

8. Groundwater systems in the area were described in a groundwater study commissioned by Awaba Colliery to determine the extent of the Stony Creek Alluvium which was undertaken by Australasian Groundwater and Environmental Consultants (AGEC), in 2008 and supplied to the DECCW on 8 October 2010. This study determined that there were three main hydrogeological units (aquifers) in the Stony Creek / Awaba Colliery area: the Alluvial Aquifers, Shallow Weathered Zone Aquifers, and the Triassic & Permian Strata Aquifers.

There is no regional aquifer located above the Great Northern Seam. These aquifers were assessed in the Water Management Assessment included in Appendix 6 of the Environmental Assessment.

As there is no regional aquifer located above the Great Northern Seam, and mine design has incorporated barriers around 2nd and 3rd order streams (and their potential alluvial aquifers), there were no potential impacts upon the aquifers identified for the Project.

Groundwater expert Dr Stuart Gray of GHD has provided further clarification as follows below regarding DECCW queries on information regarding shallow alluvial or perched aquifers and their connectivity to watercourses in the area:

- Given the competent nature of the Teralba Conglomerate it is unlikely that vertical cracking will occur to the extent where localised groundwater aquifers would be impacted should they be present (e.g. perched local water table located in depressions of the conglomerate);
- The likelihood of development of fractures above the conglomerate and into the alluvium occurring causing a reduction in alluvial groundwater levels is very low (GHD, 2010);
- The majority of the alluvium in the vicinity of the proposed mining area is along a thin channel adjacent to Stony Creek, generally extending no more than 50-100 m from the creek. GHD have undertaken alluvial mapping of the area as part of another project.

However, Awaba Colliery will develop a groundwater monitoring program for the Stony Creek alluvial aquifers for inclusion in the Water Management Plan in consultation with DECCW and NOW (see Table 5 Revised Statement of Commitments Point 3.3).

9. Five vegetation communities were mapped across the mined area with one being a listed Endangered Ecological Community (EEC). The EEC, *Swamp Sclerophyll Forest on Coastal Floodplains,* would also be classed as a groundwater dependent ecosystem (GDE). As detailed by Hunter Eco in *Appendix 11 – Ecology Impact Assessment* within the Environmental Assessment document GDE's and riparian vegetation can be impacted to varying degrees by subsidence where stream flow is altered through bed cracking or ponding. Downstream (off site) impacts should also be considered as GDE's develop as a result of the cumulative increase in groundwater water availability. Hunter Eco have concluded that "*the overall slopes on the subject site are such that subsidence of the range predicted would not result in any diversion of water from the existing drainage lines meaning that there would be no impact on downstream GDE's*."

The mining plan has been designed to take into account both past experience and sensitive areas. Buffers have been provided along 2nd and 3rd order creeks to eliminate the possibility of subsidence of any magnitude impacting directly on the flow in these creeks. Although it is unlikely (and not predicted) the worst case 'plug failure' scenario, noting however that the mine plan has been specifically designed to eliminate or significantly reduce the possibility of such an event was still assessed to determine the ecological consequences. This assessment found that the void which would have the greatest impact on flow in Stony Creek would result in the loss of 4% of flow into the downstream EEC (*Swamp Sclerophyll Forest on Coastal Floodplains*); there

would be no impact on the smaller upstream patch of EEC. The preceding information shows that the maximum impact of a sustained failure would be low both on the hydrology and ecology of the affected areas. In fact a failure would need to be remediated (primarily for safety reasons) and therefore would not result in a sustained impact.

10. Awaba Colliery does not currently hold any (Part 5) water licences for the dewatering of its underground workings. As included in the Statement of Commitments (Point 3.3), any additional groundwater licences required for the project will be sought within three months of Project Approval, including 10 South Bore. This is also in accordance with discussions at a meeting regarding the Project held between NOW and Awaba Colliery in May 2010. Newstan Colliery (Newstan) water licences are not associated with the Awaba Colliery workings, and the dewatering of these workings. Separate water licence applications were applied for by Newstan Colliery on 9 July 2010.

    Barnes Dam (LDP005) at Awaba Colliery is currently not in use, however may be required for de-watering of underground workings in future. As stated in the Environmental Assessment, the "*discharges through LDP005 have **temporarily** ceased, and currently the 10 South de-watering bore is used to de-water the underground workings*". The water management assessment completed for the Environmental Assessment addressed mine de-watering through LDP005 and the 10 South Bore. As detailed in the water balance assessment completed by GHD:

    a. *Underground water make into Barnes Dam (pre March 2010 conditions) ranges from approximately 0.03 ML/day to 0.3 ML/Day.*
    b. *Underground water make into 10 South Dam (pre March 2010 conditions) ranges from approximately 0.04 ML/day to 0.12 ML/day.*

11. Australasian Groundwater & Environmental Consultants conducted a survey of the Stony Creek Alluvium (AGEC, 2008) titled *Definition of Stony Creek Alluvium*. This report is included as Attachment 3 to this document. The edge of the Stony Creek alluvium was defined by investigations involving test pitting along traverses and lithological logging of the strata. Furthermore, a baseline ecological assessment of riparian vegetation along Stony Creek (and establishment of 5 monitoring transects) in the Main South Area was undertaken by Hunter Wetlands Research Pty Ltd (HWR) in accordance with Condition 12 of the Awaba Main South Area approval in May 2008. These investigations were undertaken in consultation with NOW during the Stage 2 SMP approval process, and provided the scientific basis for establishing appropriate offset/buffer zones for alluvial areas of Stony Creek. This process has been successfully demonstrated during existing mining in the Main South Area to date without detrimental impact to the alluvium and associated vegetation. For example, a follow-up survey of riparian vegetation in Stony Creek completed by HWR in December 2009 identified no evident changes in vegetation that may be attributed to extraction operations and subsidence. As a result, Awaba Colliery has proposed to continue this successful and conservative approach in mine planning for the current EA as mining continues within the Main South Area and the Stony Creek catchment.

12. Awaba Colliery will include an updated geomorphic description for Stony Creek in the site Water Management Plan in consultation with DECCW and NOW (see Table 5 Revised Statement of Commitments Point 3.3).

13. The following points address NOW's recommended approval conditions for the Centennial Awaba Coal Project.

    a. Adaptive Mine Layout – As a result of difficulties experience in historical mining methods, a new adaptive mine plan was formulated which minimises potential for significant subsidence events to occur. This current mining method was developed in consultation with I&I and has been used successfully at Awaba Colliery since mid 2007. The development of the current mine design allows the Awaba Colliery to conservatively exclude secondary extraction from potentially sensitive areas. These secondary extraction exclusion areas (shown in Figure 7.2, Attachment 2) include protection barriers for second and third order streams (20m barriers for second order streams and 50m barriers for third order streams).

    b. Surface Water Investigation – Refer to Table 2 key concerns items 14(a), 14(b) and 14(c) which have been addressed in Section 6 of this document.

    c. Water Management Plan – This item is included in the Statement of Commitments points 3.1 and 3.3.

    d. Groundwater Impacts Report – Refer to point 8 of Section 6 for detail regarding groundwater impacts.

       As described in the Environmental Assessment, historical mining at Awaba Collliery has resulted in the depressurisation of the main aquifers (coal seams) since mining began in 1947. As a result limited groundwater inflows have been observed into mine workings and current areas of underground mining at Awaba Colliery are considered to essentially be a "dry" mine operation with respect to natural groundwater.

    e. Preliminary Groundwater Dependent Ecosystem Monitoring - Awaba Colliery is currently operating in accordance with a Subsidence Management Plan (SMP) approval for the Main South Stage 2 Area, which was approved by Industry & Investment (formerly the Department of Primary Industries) in consultation with the N0W in September 2008. An SMP Application for the Revised Stage 3 Area was submitted to Industry & Investment in December 2009.

       A Watercourse Management Plan has been developed in accordance with a condition of SMP approval for the Main South Stage 2 Area which details monitoring, inspection and reporting programs for Stony Creek.

7. REVISED STATEMENT OF COMMITMENTS

Centennial Newstan is committed to the appropriate identification, mitigation and management of potential risks from the continued operations of Awaba Colliery. The Statement of Commitments in Tables 4 & 5 below is updated from the Statement within the Environmental Assessment, and replaces Tables 10.2 & 10.3.

Tables 4 and 5 detail the Statement of Commitments for the project that Awaba Colliery is willing to adopt for implementation throughout the project development phase and through to the end of mine life respectively, should approval be granted under Part 3A of the EP&A Act.

Table 4 Proposed Construction (Pollution Control Dam) – Statement of Commitments

Desired Outcome	Action
1. Pollution Control Dam	
All construction operations associated with the PCD are appropriately undertaken to minimise potential impacts to the environment and potential noise receptors.	1.1 Throughout the construction period of the Project, construction works will be limited to Monday to Friday: 7am to 6pm, Saturday: 8am to 1pm, No work Sundays or public holidays. 1.2 Appropriate erosion and sediment control measures required for construction of the PCD will be installed prior to commencement of disturbance activities, generally in accordance with the guidelines '*Managing Urban Stormwater – Soils and Construction, Volume 2E: Mines and Quarries'* (DECC 2008)..

Table 5 Mining Operations – Statement of Commitments

Desired Outcome	Action
1. General	
All operations are undertaken in a manner that will minimise the environmental impacts associated with the Project.	1.1 Mining at the Awaba Colliery will be undertaken generally in accordance with the description provided in the environmental assessment dated September 2010.
2. Hours of Operation	
All operations are undertaken within the approved operating hours.	2.1 Mining and associated operations may be undertaken 24 hours a day 7 days a week.
3. Groundwater and Surface Water	
All surface water and groundwater managed such that water-related impacts are minimised to the greatest extent practicable.	**Surface Water:** 3.1 Within six months of Project Approval, the existing Water Management Plan will be updated to include erosion and sediment control measures required and a geomorphic description of Stony Creek. 3.2 Within three months of Project Approval, a variation to EPL443 will be sought that incorporates a Pollution Reduction Program (PRP) for water quality monitoring for Awaba Colliery in accordance with ANZECC requirements. **Groundwater:** 3.3 Within six months of Project Approval a groundwater monitoring program for the 10 south bore and for the Stony Creek alluvial aquifers will be developed in consultation with DECCW, NOW and DoP and continued in accordance with the existing Water Management Plan. 3.4 Any additional groundwater licenses required for the Project will be sought within three months of Project Approval, including 10 South bore. 3.5 Within three months of Project Approval, a variation to the existing

Desired Outcome	Action
	Environment Protection License (EPL443) will be sought to include the 10 South bore. 3.6 A water balance (including a comparison of predicted and actual take of water) will be included in the Annual Environmental Management Report (AEMR)
4. Aboriginal Heritage Management	
Ensure that identified and unidentified Aboriginal sites are appropriately managed.	4.1 Within six months of Project Approval, an Aboriginal Cultural Heritage Management Plan (ACHMP) will be incorporated as part of the ongoing management of heritage within Awaba Colliery in consultation with DECCW & LMCC. The ACHMP will include strategies which address the identified areas of archaeological sensitivity within the Application Area, as well as, contingency strategies for any additional heritage issues which may arise.
5. Traffic and Transport Management	
Project-related impacts on transportation and the road network surrounding the Awaba Colliery are limited.	5.1 Signage on Wilton Road approaching the Awaba Colliery will be improved within six months of Project Approval (as shown on **Figure 9.10**) in order to provide advanced warning to traffic of potential turning traffic in consultation with the LMCC.
6. Life of Mine Rehabilitation	
	6.1 All works associated with the decommissioning and rehabilitation of the Awaba Colliery is to be undertaken as prescribed in the approved Life of Mine Plan.
7. Subsidence Management	
Surface subsidence levels managed in accordance with predicted maximum levels	7.1 A 'Subsidence Management Plan', or equivalent document, which takes into account the existing information presented in this Environmental Assessment, will be developed for the proposed East B Area (Study Area 3) in consultation with the Department of Planning prior to expansion in East B Area. 7.2 Subsidence monitoring results will be made publically available on the Centennial Coal website.
8. European Heritage Management	
Ensure that identified and unidentified Archaeological sites are appropriately managed.	8.1 Prior to the decommissioning of any pit top buildings at the Awaba Colliery and in consultation with the LMCC, all buildings will be subject to a heritage assessment of significance.

ATTACHMENT 1 AWABA COLLIERY MINING PROJECT PRESENTATION 19 NOVEMBER 2010

Centennial Coal

The Awaba Colliery Mining Project

19 November 2010

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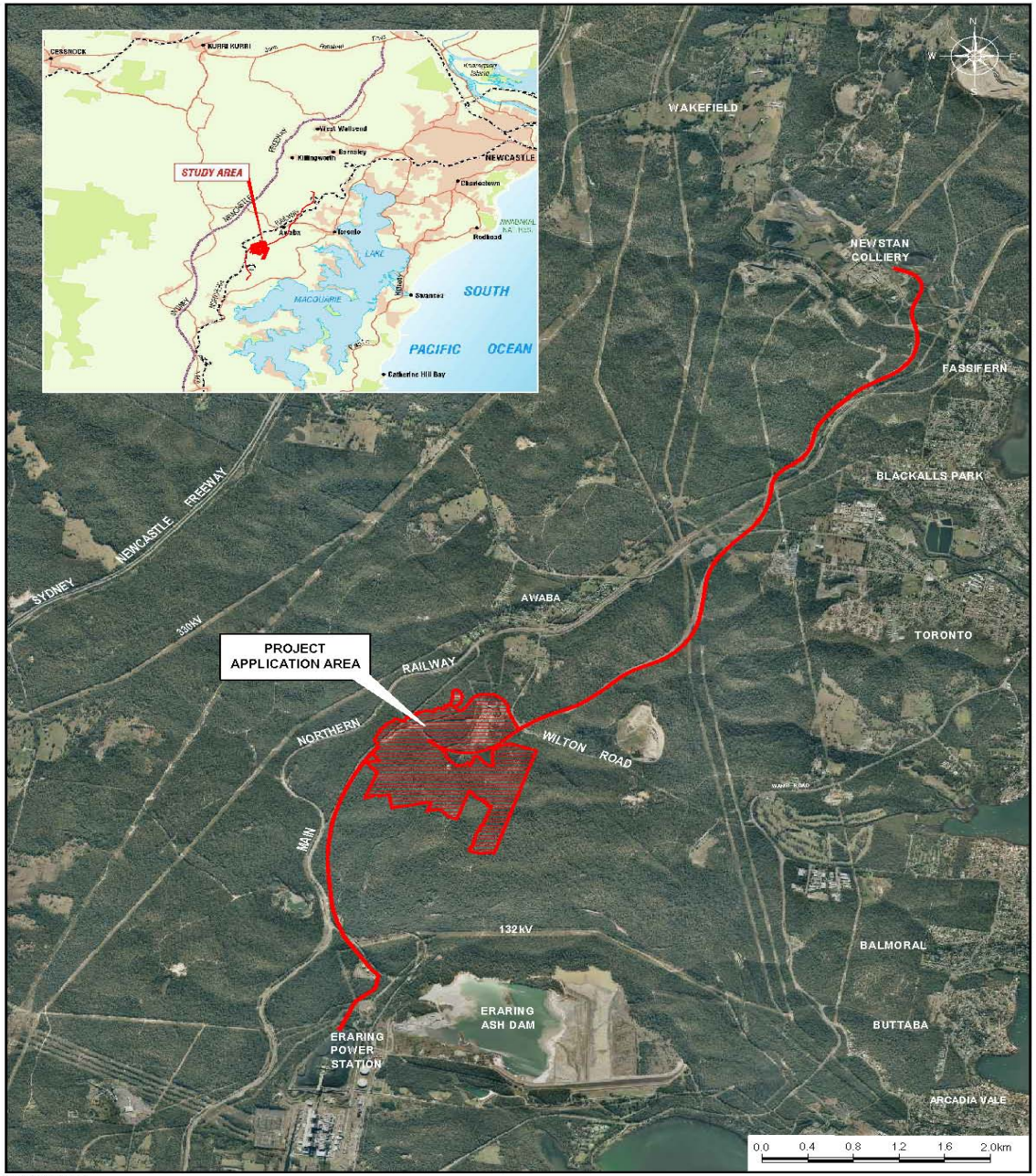
Background

- Awaba Colliery is operated by Centennial Newstan Pty Ltd, a wholly owned subsidiary of Centennial Coal Company Pty Ltd.
- Operating since 1947, Awaba has 100 employees and has historically produced up to 850,000 tonnes of coal annually.
- An application for a Part 3A Project Approval was lodged in March 2010 with the Department of Planning, to allow ongoing and extended underground mining and associated surface operations.
- The Project will extend the mine life of the Awaba Colliery by up to five years (until 2015) and will recover approximately 2.0 million tonnes of coal.

Project Description

- Awaba Colliery is seeking an approval from the Minister for Planning under the provisions of Part 3A of the EP&A Act to:

  - Continue bord and pillar development and pillar extraction by continuous miners within the “Main South Area”;
  - Extend bord and pillar development and pillar extraction by continuous miners into the “East B” Area;
  - Produce, handle and distribute up to 880,000 tonnes of Run of Mine coal per annum (financial year) using existing surface facilities;
  - Continue the use of existing surface facilities;
  - Expand the existing Pollution Control Dam;
  - Continue the delivery of coal to the Newstan Colliery and/or the Eraring Power Station using the existing private haul road/transport facilities.



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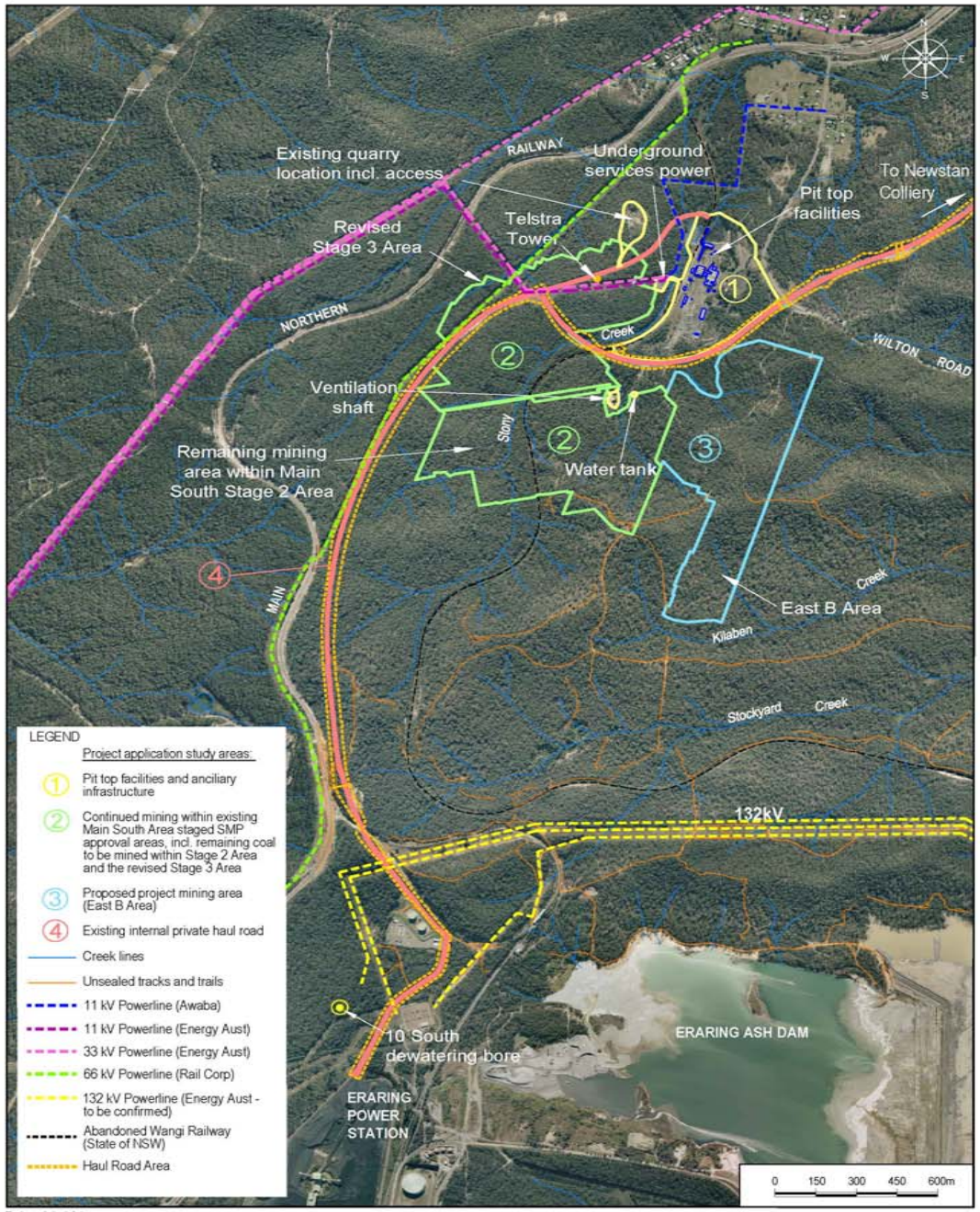
Location Plan
Figure 1.1

Project Application Study Areas

Four study areas were assessed as part of the EA.

- Study Area 1 – includes surface facilities and ancillary infrastructure.
- Study Area 2 – continued mining within the existing main south area (SMP approved areas).
- Study Area 3 – proposed project mining areas (East B area).
- Study Area 4 – existing internal private haul road.



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Project Application Study Areas Detailed

Figure 2.1b

Mine Subsidence – Geotechnical Conditions

- Roof Characteristics
  - The stratigraphic unit above the Great Northern Seam (GNS) is the Teralba Conglomerate.
  - The ability of the Teralba Conglomerate (TC) to maintain unsupported roof spans, following mining, has been a key design factor for the current mining method. TC has the ability to span voids above extraction panels up to 150 metres wide, at depths of cover in excess of 30 metres.
  - Awaba's extraction panel widths are less than 100 metres with a depth of cover in excess of 25 metres.

- Floor Characteristics
  - Immediately underlying the GNS at Awaba Colliery is the Awaba Tuff, which is composed of low strength tuffaceous siltstone and sandstone beds.
  - Floor materials with less than 0.5 megapascal strengths have probably been associated with pillar collapse at Awaba Colliery (Seedsman, 2010).
  - Accordingly secondary extraction does not commence until floor coring and geotechnical review is undertaken to meet design criteria.

Previous Subsidence & History of Mine Planning & Design at Awaba

- Prior to development of the current mining method, historical subsidence events had occurred caused by mining in areas of very low depth of cover (<20m) and or multiple pillar collapse or creeps. The latter events occurred in areas with high factor of safety pillars and it was concluded that a failure in the Awaba Tuff floor was more likely than a coal pillar failure (Seedsman, 2010).
- As a result of these subsidence events, a new mine design was formulated to minimise the potential for significant subsidence events to occur.
- This current mining method was developed in consultation with I&I and has successfully been used at Awaba Colliery without incident since mid 2007 (Seedsman, 2010).
- The current mine design utilises the spanning capabilities of the strong Teralba Conglomerate roof, and is referred to as the “bridging layout”.
- A key aspect of the layout is that floor failure does not result in rapid and uncontrolled collapse of the strata above the extraction panels. Potential for floor failure due to very low strength material is managed by testing the floor prior to extraction.

Current Mine Planning & Design

- The development of the current mine design allows the Awaba Colliery to exclude secondary extraction from potentially sensitive areas. These secondary extraction exclusion areas include:
  - Areas where depth of cover to the GNS is less than 25 metres;
  - Protection barriers for second and third order watercourses;
  - Protection barriers for surface infrastructure including the Newstan – Eraring private haul road, Telstra tower and power poles;
  - The main northern railway protection zone.

- In general, the amount of subsidence is a function of the sag of the conglomerate and the compression of the pillar system. Experience from adjacent panels has recorded subsidence in the order of 10 to 100 millimetres (sag of the conglomerate) and 50 -100 millimetres (compression of the pillar system) (Seedsman, 2010).

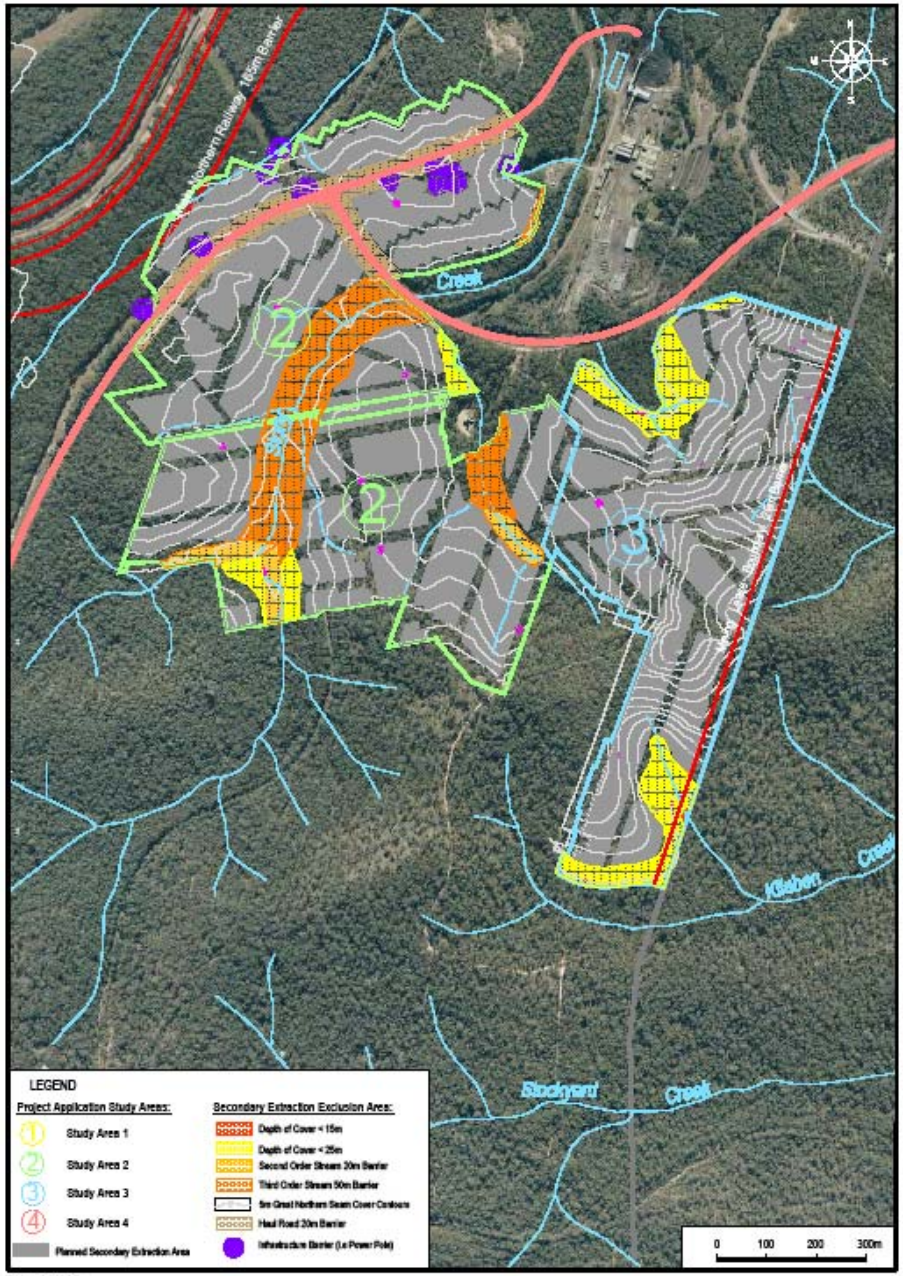
- The maximum vertical subsidence associated with this current mining method measured to date has been around 125 millimetres (Seedsman, 2010). This has been well within conservative subsidence predictions.

Current Mine Planning & Design

- The *maximum* predicted subsidence for the Project mining areas is 200mm (Seedsman, 2010).
- Whilst *not* provided as a prediction (Seedsman, 2010), as a risk-based measure a conservative 'worst case' scenario was also prudently considered.
- The worst case scenario is if the entire thickness of Teralba Conglomerate roof within a panel failed, referred to as a 'plug failure'. It is noted that this has never occurred using the current mining method at Awaba. The failure of the entire roof of a panel would result in approximately 2m vertical subsidence.
- Risk *elimination and substitution* are primary controls specifically employed in mine planning and design to avoid risk or minimise potential risks, as outlined in the following table.

Hierarchy of Subsidence Management Control Measures

Management Control		Study Area	
		2	3
Elimination – pillar extraction has been eliminated from the following areas	Within a nominal 125 metre from the Rail boundary	✓	n/a
	Under the haul roads and other infrastructure or the identified water courses	✓	n/a
	At depths of cover less than 25 metres	✓	✓
Substitution	The layout adopted has significantly lower subsidence than the alternatives. The proposed mining method is a continuation of the existing mining that has been implemented successfully since 2007 after being developed in consultation with I&I.	✓	✓
Engineering Controls	Factor of safety for pillar failure	1.4-1.7	>1.6
	Factor of safety for compressive failure of the spanning Teralba Conglomerate	Not specified	2.0
Administrative Controls – The following will be undertaken to monitor and ensure mine design prevents subsidence levels above those predicted.	Progressive coring or other testing of the floor in extraction areas and adjacent to rail prior to second workings	✓	✓
	Regular inspections of any water courses especially after heavy rainfall.	✓	✓
	Subsidence cross line(s) to confirm pillar compression and sag predictions.	✓	✓



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Awaba Colliery Mine Design
Secondary Extraction Exclusion Areas

Figure 7.2

Flora & Fauna Surveys / Threatened Species Assessment

- Ecological assessments have been ongoing at Awaba Colliery for both exploration and mining SMP projects for a number of years.
- Ecological assessments have been undertaken by Colin Driscoll of Hunter Eco, who is also a recognised leading expert in *Tetratheca juncea* which occurs within the mining areas.
- The report prepared for the EA (2010) was prepared in accordance with:
  - *DECC & DOP, 2005, 'Draft Guidelines for Threatened Species Assessments under Part 3A of the EP&A Act, 1979',* as specified by the DGRs issued by DoP in April 2010.
  - DECC 2008, '*Vegetation of the Cessnock-Kurri Region, Survey, Classification and Mapping'* which established a survey 'ground-truthing' methodology recognised by DECC. Colin Driscoll and Steven Bell wrote this report in 2007 for DECC. This has also been used in previously approved SMP applications that have also been submitted to DECC through DPI's SMP inter-agency committee process.

Flora & Fauna Surveys / Threatened Species Assessment

Previous Surveys and Reports by Hunter Eco at Awaba Colliery:

- *'Awaba East Exploratory Drilling Program REF, Ecology'* , June 2008. This included vegetation community mapping that included the EA project area using ground-truthing methods in DECC 2008, and is referenced in the ecology report for the EA (2010). Centennial will provide a copy of this report to DECCW;
- *'Awaba Revised Stage 3 SMP Ecology Assessment'*, December 2009. The SMP is currently with I&I NSW awaiting approval via Inter Agency Committee review, and covers part of Study Area 2 (northern part) of the EA (2010). It included 7 part tests.
- Main South Area SMP, September 2005 *'Ecological Assessment of the surface area subject to subsidence resulting from outbye pillar extraction process planned by Centennial Coal for the Awaba Colliery'.* This SMP was approved by DPI-MR via the SMP Inter Agency Committee process, and covers part of Study Area 2 (southern and central part) of the EA (2010).
- *'Awaba Underground mine 3 North Outbye Project SMP: Ecology Assessment',* November 2008. This is <u>not</u> part of the current EA project area (2010), however it is adjacent to Study Area 3 (East B Area) using the same current mining method.

Provision of Offsets / Compensatory Habitat

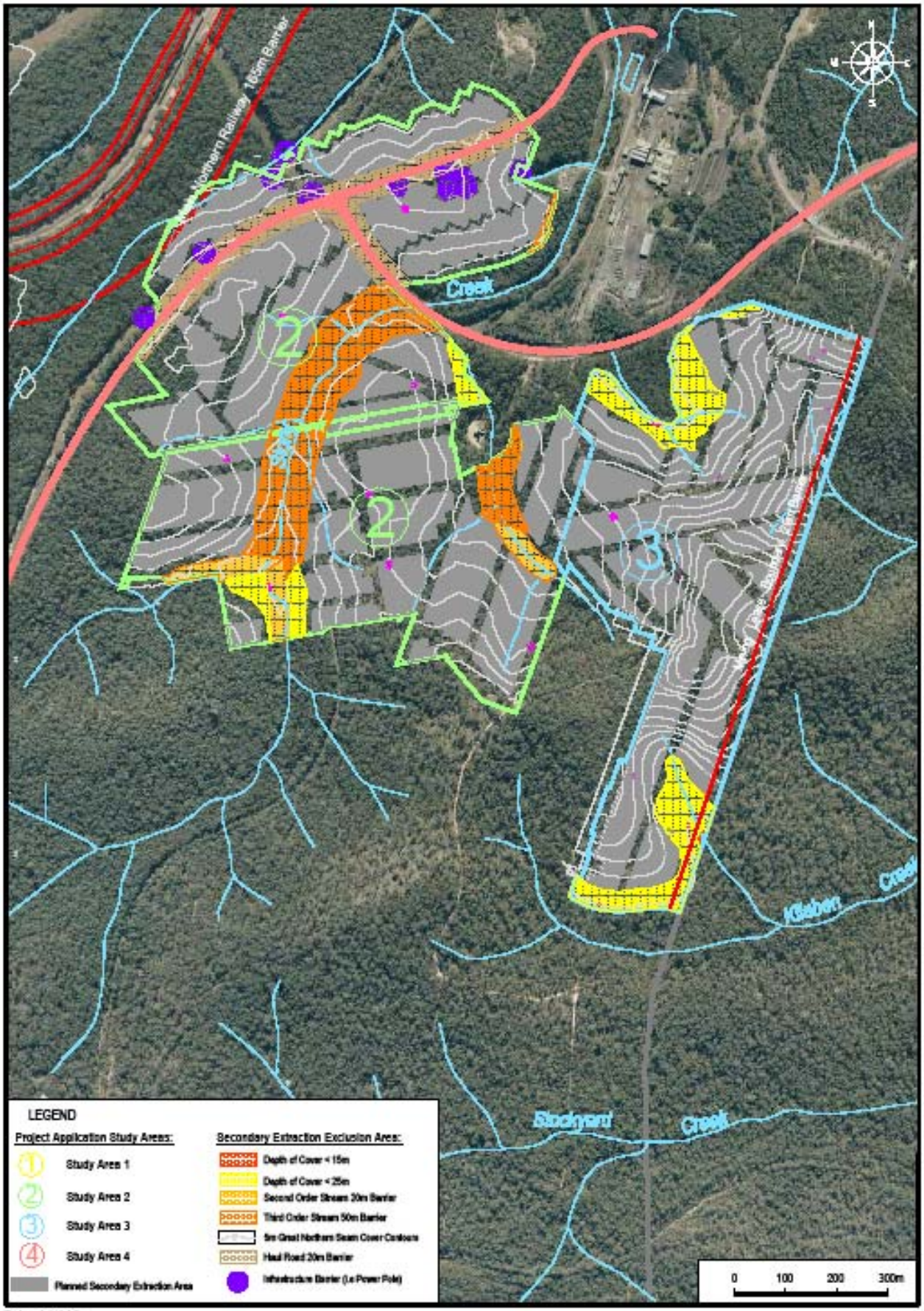
- There were no significant impacts identified on vegetation communities (including downstream EEC), threatened flora and fauna, or to the connectivity of habitats for the Project.
- Therefore, no impacts on threatened species or their habitats does not trigger a requirement for offsets for this Project.

Surface and Ground Waters

- Groundwater expert Dr Stuart Gray of GHD has provided further clarification as follows below regarding DECCW queries on information regarding shallow alluvial or perched aquifers and their connectivity to watercourses in the area. A copy of emails with this information can be provided to DECCW if required.
  - Given the competent nature of the Teralba Conglomerate it is unlikely that vertical cracking will occur to the extent where localised groundwater aquifers would be impacted should they be present (e.g. perched local water table located in depressions of the conglomerate)
  - The likelihood of development of fractures above the conglomerate and into the alluvium occurring causing a reduction in alluvial groundwater levels is very low (GHD, 2010).
  - The depth of cover determines the mine design.

Questions

ATTACHMENT 2 FIGURE 7.2 SECONDARY EXTRACTION EXCLUSION AREAS



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Awaba Colliery Mine Design
Secondary Extraction Exclusion Areas

Figure 7.2

ATTACHMENT 3 AUSTRALASIAN GROUNDWATER & ENVIRONMENTAL CONSULTANTS REPORT - "DEFINITION OF LIMIT OF STONY CREEK ALLUVIUM" MAY 2008.

Australasian Groundwater & Environmental Consultants Pty Ltd

REPORT on

DEFINITION OF LIMIT OF THE STONEY CREEK ALLUVIUM

AWABA COLLIERY

prepared for
CENTENNIAL NEWSTAN PTY LIMITED

Project No. G1427
May 2008

ABN:64 080 238 642

Australasian
Groundwater & Environmental
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REPORT on

DEFINITION OF LIMIT OF THE STONEY CREEK ALLUVIUM

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BRISBANE (Head Office)

36 Jeays Street
Bowen Hills Qld 4006
Ph (+617) 3257 2055
Fax (+617) 3257 2088
Email: brisbane@ageconsultants.com.au

A.B.N 64 080 238 642

NORTH QUEENSLAND

3/17 Edith Street, (PO Box 788)
Innisfail, Qld 4860
Ph (+617) 4061 3103
Fax (+617) 4061 8094
Email: nthqld@ageconsultants.com.au

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Drawing No. 2 – Extent of Alluvium, Second & Third Order Creeks

Appendix 1 – Test Pit Lithology and Photographs

DWI/ae (Awaba)
Project No. G1427
May 2008

REPORT ON

DEFINITION OF LIMIT OF THE STONEY CREEK ALLUVIUM AWABA COLLIERY

1.0 INTRODUCTION

Centennial Newstan Pty Limited, a subsidiary of Centennial Coal Company Ltd, (Centennial Coal) operates the Awaba Colliery which is located in the Newcastle Coalfields at Awaba, near Toronto NSW. Coal extraction at the underground operation is by bord and pillar mining using continuous miner and auger methodologies. Further mining of the existing workings are proposed which will include pillar stripping (secondary extraction) and some primary extraction of the coal seam beneath Stoney Creek. Resultant ground subsidence and approval of the Subsidence Management Plan (SMP) by the NSW Department of Primary Industries (DPI) for these works is subject to specific conditions that are required to:

- *ensure optimal mineral resource recovery;*
- *prevent, minimise, manage and/or offset adverse impacts;*
- *provide for the ongoing environmental management of the project;*
- *ensure the area disturbed by mining is appropriately rehabilitated.*

Schedule 2 of the Subsidence Management Plan Approval[1] lists the conditions to achieve the above, which include, but are not limited to, a program of subsidence, underground and environmental monitoring, as well as specifying barriers that restrict underground workings proximal to Stoney Creek. Specific conditions state that Centennial Coal:

- *must ensure that no secondary extraction or any additional first workings occur within a barrier along Stoney Creek 50m either side of the centre line of the permanent ponds and third order reach and 20m either side of the centre line of the second order reach.*
- *is to provide justification to the satisfaction of the Director Environmental Sustainability…if extraction is to occur within this barrier.*

In order to address the above, Centennial Coal commissioned Australasian Groundwater and Environmental Consultants Pty Ltd (AGE) to undertake an investigation of the extent of alluvium along the Stoney Creek alignment upstream of the Newstan-Eraring Private Coal Road. This report describes the work undertaken by AGE with the objective being to define the limits of the Stoney Creek alluvium and the presence and characteristics of the shallow aquifer contained within the alluvium, and hence justification for reducing the barriers along the creek specified in the Approval.

[1] NSW Department of Primary Industries, (2007), *"Subsidence Management Plan Approval – Awaba Mine SMP for Pillar Stripping",* dated 3 Sept. 2007.

2.0 SCOPE OF WORK

The scope of work undertaken to define the limit of the alluvium and identify the presence and characteristics of the aquifer contained within the alluvium consisted of the following:

- development of a field program to define the edge of the alluvium to within ±5m;
- investigations involving test pitting along traverses and lithological logging of the strata.

3.0 SITE DESCRIPTION

The underground mine at Awaba Colliery is located within lease CCL746 of the Newcastle Coalfields of the central coast of NSW and is about 4km west to south-west of Toronto. The mine infrastructure is located on the eastern side of Stoney Creek which drains to the north-west into Fennell Bay along the western edge of Lake Macquarie. The undulating topography within the study area ranges in elevation from a high of about RL100m to around RL20m Australian Height Datum (AHD) where Stoney Creek drains to the north-west.

The regional climate is temperate and is influenced by coastal weather patterns. Rainfall is summer/autumn dominated (January to June) and averages 1112mm per annum (for Maryville, Site No. 061223).

State forest dominates the region north to north-west of the mine. The study area is thickly vegetated and is dominated by wet sclerophyll woodland and melaleuca woodland along Stoney Creek.

4.0 GEOLOGY

The stratigraphic sequence across the site comprises three distinct units, viz:

- Upper Permian Newcastle Coal Measures, a sandstone/coal sequence with lesser siltstone;
- The overlying Clifton Sub-group which is the basal unit of the Triassic Narrabean Group; and
- Quaternary to recent alluvial sediments.

The Quaternary to recent alluvial sediments consist of sand, gravel, clay and silt of varying content that have been unconformably deposited in an eroded, valley-fill environment.

The coal deposits are contained within the Late Permian aged Newcastle Coal Measures, which together with the Clifton Sub-group form a regular, layered sedimentary sequence. The prime seams of economic significance which are mined in the area are the Great Northern, Fassifern and West Borehole Seams.

Structurally, the coal seams reflect the regions location on the western limb of the southerly plunging Macquarie Syncline dipping at grades that are generally less than 1 in 20 (3°) to the east and southeast. Localized steeper grades and variations to this regional trend do occur and have resulted in structural and depositional features of the sediments in the basin.

5.0 HYDROGEOLOGICAL REGIME

Previous studies by AGE in 2006[2] described a conceptual model of the hydrogeological regime as comprising three aquifer systems, which included:

- Alluvial aquifer;
- Shallow weathered zone aquifer; and
- Triassic/Permian formation aquifer(s).

These aquifer systems are discussed separately below.

5.1 Alluvial Aquifer

The alluvium principally occurs along drainage alignments and within the study area would be associated with the Stoney Creek alluvial sediments, that is, sands and gravels. The water table within the alluvium varies depending on the presence or otherwise of the more porous sandy and gravely sediments, and of permanent to semi permanent water holes within the creek alignment. Generally water holes occur where the creeks have incised 1m to 2m into the floodplain and probably exist as "windows" in the water table. Water holes were observed mainly within the northern portion of the section of Stoney Creek investigated for this report.

Recharge of the alluvial aquifers occurs from surface flow in the creeks within the catchment area, where upper clayey sediments have been incised by erosion, and probably from lateral seepage in the weathered more sandy profiles of the Triassic and Permian rocks that from the valley sides in which the alluvium is contained.

5.2 Shallow Weathered Zone Aquifer

The shallow weathered zone aquifers comprise surficial soils and weathered bedrock. The depth of the aquifer is likely to be variable and depends on factors such as:

- depth of weathering; and
- extent of frequency of permeable fracture systems.

It is likely to include perched aquifers at the interface between the soils and bedrock, and zones of locally increased permeabilities due to bedrock weathering. It would appear that the aquifer is localized and not laterally extensive. Recharge is by direct infiltration of rainfall.

5.3 Triassic and Permian (Bedrock) Aquifers

The Triassic and Permian strata may be categorised into the following hydrogeological units:

- hydrogeologically "tight" and hence low permeability to essentially dry sandstone and lesser siltstone and shale that make up the majority of the interburden/overburden; and

[2] Australasian Groundwater and Environmental Consultants Pty Ltd, (2006),*"Newstan-Awaba Mines Extension Project – Environmental Assessment, Groundwater"*, (April 2006), Project Nos. G1289/G1306.

- low to moderately permeable coal seams which are the prime water bearing strata within the Permian sequences.

Groundwater storage is predominantly associated with the coal seams within their interconnected cleats and joint pattern. The Newcastle Coal Measures overburden and interburden are typically of very low permeability with groundwater only occurring in localised areas due to secondary or fractured permeability. Recharge of the aquifers probably occurs from rainfall infiltration in areas of subcrop or via vertical seepage from the shallow weathered zone aquifer(s).

6.0 ALLUVIAL BOUNDARY INVESTIGATION

6.1 Method of Investigation

The investigation of the extent of alluvium was undertaken from 7 to 9 April 2008. It involved excavation of test pits along traverses approximately perpendicular to the creek alignment. The traverses were located about 200m apart and were generally coincident with the vegetation survey transects undertaken for the project. The objective as stated was to define the edge of the alluvium within the Stoney Creek drainage alignment extending from the lower slopes across the creek line. The test pits were dug with a rubber tracked 3 tonne Kobelco SK30SR excavator chosen for the machine's ability to access the heavily wooded study area, while minimizing impact on the environment. The maximum reach of the excavator is 2.5m.

The alluvial limit was determined by excavating 27 test pits to a maximum depth of 2.5m along 6 traverses. The location of each test pit was recorded using a hand held GPS. The six (6) traverses are prefixed T1 to T6 and the test pits numbered from SCTP1 to SCTP27. After the test pits were excavated and lithologically logged, they were backfilled with the spoil generally in the order in which it was removed from the pit. The backfill was compacted with the excavator bucket and the spoil left slightly mounded over the pit to allow for settlement.

The soil profiles intersected within each test pit were lithologically logged by a hydrogeologist from AGE.

The location of each test pit and the traverses are shown on Drawing No. 1. Lithological logs and photographs of each test pit profile and spoil are provided in Appendix 1.

6.2 Discussion of Results of Investigation

The test pitting intersected two general soil profiles, these being:

- residual soils located along the lower slopes of the open valley making up the sides of the Stoney Creek alignment; and
- alluvium associated with the creek alignment and located along the base of the valley.

Descriptions of the soil profiles encountered are provided in more detail below.

6.2.1 Soils Description

A description of the soils intersected for each of the profiles outlined above is summarised in Table 1.

Table 1: SUMMARY DESCRIPTION OF SOIL PROFILES INTERSECTED

Soil Profile	Thickness/Depth Range	Soil Description
Residual Soils	Between 0.1m and 0.25m thickness	Topsoil cover comprising dark grey to black, sandy gravelly clay of medium plasticity, with fine to medium sand and rounded gravel, and being slightly moist to moist.
	Between 0.15m and 0.6m thickness	Colluvium layer comprising light brown to yellow brown sandy gravelly clay of low to medium plasticity, with fine to medium sand and rounded to sub-angular gravel, and being slightly moist to moist.
	From 0.2m to 0.75m depth	Underlying residual soil comprising red to orange brown, stiff sandy gravelly clay/sandy clay of high plasticity, with fine to medium sand and rounded gravel and being slightly moist.
Alluvial Soils	Between 0.1m and 0.2m thickness	Topsoil cover comprising dark grey to black, sandy gravelly clay/sandy clay of medium plasticity, with fine to medium sand and rounded gravel, and being slightly moist to moist. The horizon was sometime not present.
	Varying between 0.2m and 0.5m (and possibly as much as 1.0m) thickness	Interbedded alluvium comprising grey clayey sand, grey sandy clayey gravel and brown gravelly sand which were mostly wet (i.e., intersected groundwater). Groundwater was intersected within these alluvial soil in transects T1 (SCTP27, 1.9-2.4m), T2 (SCTP26, 1.5m), T3 (SCTP12, 0.9m), T5 (SCTP19, 0.55-1.75m) & T6 (SCTP24, 0.65m).
	Measured at transect T1 to 2.4m deep	Alluvium ranging from sandy gravel clay to sandy clay comprising grey to grey brown with yellow and sometimes orange mottling, medium to high plasticity, fine to medium sand and rounded gravel, and being slightly moist to moist.

For the purpose of this interpretation the colluvial deposits are slope wash which have been deposited in a low energy environment. As such the material comprised a poorly sorted mixture of clays, sands and gravels which ranged from well rounded to sub-angular. In contrast the alluvial deposits generally comprised distinct layers varying from sands and gravels to clays, typically deposited due to a higher energy environment.

Based on the soils encountered, the lateral limits of the alluvium were clearly identifiable by the change in slope from the generally flat creek floor to the presence of the lower slopes (generally between 10% and 20%), that make up the base of the open valley of the Stoney Creek alignment. The extent of the Stoney Creek alluvial flood/deposition plain within the study area and between Transects T1 and T6 is shown in Drawing No. 2.

The thickness of the alluvium was only positively identified in one test pit (SCTP27) located along Transect T1 where weathered conglomerate was intersected at the base of the test pit at 2.4m. Elsewhere, the base of the alluvium was less well defined, and possibly graded into a residual soil where soil colour had been affected by fluctuating groundwater levels, thereby resembling the generally grey mottled alluvial soils.

6.2.2 Groundwater Occurrence

Groundwater was intersected in alluvial soils in Transects T1 (SCTP27), T2 (SCTP26), T3 (SCTP12), T5 (SCTP19) & T6 (SCTP24). Typically groundwater was associated with the more porous saturated soils encountered, such as sandy gravels and gravely sands and was more significant in Transects T2 and T6 within a notable sand and gravel layer within the alluvium. Elsewhere the groundwater inflows were minor within thin gravel or sand bands.

Based on these intersected saturated soils, it can be inferred that a shallow unconfined groundwater aquifer exists within the interbedded more sandy and gravelly alluvial soils. Aquifer properties for permeability (hydraulic conductivity) and storativity (aquifer storage potential) would be a function of primary porosity, that is, inter-granular pore spaces established at the time of deposition, in conjunction with the lateral and vertical extent and interconnection of these more porous sand and gravel sediments. Recharge to this aquifer would be from direct infiltration of rainfall via the more porous sand and gravel sediments within the creek alignment, and by direct infiltration into these porous soil layers during periods of creek flow.

In spite of this aquifer being intersected in each transect with the exception of transect T3, the continuity and hence interconnection of this aquifer along the length of the alluvium appears to be restricted by interbedded clayey (less permeable) sequences, with the only portion of the creek where the aquifer appeared well defined being between transects T2 and T6.

6.3 Steam and Aquifer Guidelines

Guidelines outlining the requirements of the coal mining industry in relation to management of impact on stream and aquifer systems in the Hunter Region are provided in the Stream/Aquifer Guidelines published by then Department of Infrastructure, Planning and Natural Resources (DIPNR, 2005)[3]. This guideline provides an assessment of the importance of streams and associated alluvial groundwaters in the Hunter Region, the objective being to ensure minimal adverse impact on stream flows and groundwater availability due to mining activities. It uses the Strahler system for defining stream orders, commencing with first order streams that start at the top of the catchment watershed, viz:

- First order watercourse – any watercourse draining from a catchment divide or which has no other watercourse flowing into it.
- Second order watercourse – commences where two first order watercourses join.
- Third order watercourse – commences where two or more second order watercourses join.
- Fourth order watercourse – commences where one third order watercourse is joined by another third order watercourse.

Barriers restricting the extent of underground working proximal to the Stoney Creek watercourse are defined in Schedule 2, Condition 13 of the Subsidence Management Plan Approval[1], and depend on the order of the watercourse along specific reaches. The Condition states that no secondary pillar extraction or any additional first workings are to occur within:

[3] Department of Infrastructure, Planning and Natural Resources, (April 2005), *"Stream/Aquifer Guidelines – Management of Stream/Aquifer Systems in Coal Mining Developments, Hunter Region"*, Version 1.

- 50m either side of the centre line of the permanent ponds and third order reach; and
- 20m either side of the centre line of the second order reach.

Based on the Strahler system, it is assessed that within the section of creek investigated the reach of Stoney Creek upstream of traverse T2 (Drawing No. 2), is a second order watercourse and downstream of T2 it becomes a third order watercourse.

Having defined the second and third order watercourses, a comparison was then made of the lateral extent of alluvium defined from the test pitting and the barriers that would apply, as shown on Drawing No. 2.

The comparison indicates that:

- the 50m barrier either side of the centre line specified in Condition 13 for the third order watercourse downstream of traverse T2, is considerably wider than the extent of the alluvium and could be reduced to say a 30m wide barrier either side of the centreline;
- the alluvium between T2 and T6 is about 10m wide and therefore it is considered that the barrier could be reduced from 20m either side of the centreline to about 6m either side of the centreline in this area;
- the alluvium is approximately 40m wide between traverses T2 and T4, the same as the barrier width specified for this second order watercourse. However the Condition that the barrier should be 20m either side of the stream centreline should not apply within this portion of Stoney Creek as this puts the barrier boundary to the west of extent of the alluvium and into the residual soils. As such, the western barrier boundary between T2 and T4 could be moved approximately 15m to the east over much of this length of the stream, to coincide with the edge of the alluvium;
- the alluvium upstream of traverse T4 is about 22m wide and therefore the barrier could be reduced from 20m to 12m either side of the centreline of the watercourse.

7.0 SUMMARY AND CONCLUSIONS

The investigation undertaken has defined the margins of the alluvium associated with Stoney Creek. The boundary defined corresponds generally with the change in slope from the generally flat creek floor/narrow alluvial deposition plain, to the presence of the lower slopes that make up the base of the open valley of the Stoney Creek alignment.

The full thickness of the alluvium was only determined at one location where weathered conglomerate was intersected at 2.4m. As this was located in the most downstream transect where alluvial thickness would be assumed to be at it greatest, it could be inferred that this represents the maximum thickness of the alluvium within the portion of Stoney Creek investigated.

Although the investigation has shown that alluvium occurs along the length of Stoney Creek investigated, the continuity/interconnection of aquifer material (sand/gravel) along the length of the alluvium appears to be restricted by interbedded clayey (less permeable) sequences, with the only portion of the creek where the aquifer appeared well defined being between transects T2 and T6.

Guidelines outlining the requirements of the coal mining industry in relation to management of the impact of mining on stream and aquifer systems in the Hunter Region use the Strahler system for defining stream orders, beginning with first order streams that start at the top of the catchment

watershed. It is assessed that the portion of Stoney Creek investigated consists of second and third order watercourse. Schedule 2, Condition 13 of the Subsidence Management Plan Approval specifies no secondary pillar extraction or any additional first workings can occur within:

- 50m either side of the centre line of the permanent ponds and third order reach; and
- 20m either side of the centre line of the second order reach;

unless justification is provided that extraction can occur within this barrier.

Comparison of the lateral extent of alluvium defined by this investigation and the barrier specified in the Approval, as shown on Drawing No. 2 indicates that the barriers can be reduced from that specified in Condition 13 over different reaches of Stoney Creek, while ensuring that mining does not occur beneath the alluvium, viz:

- downstream of traverse T2 – reduce barrier from 50m to 30m either side of the centreline of the watercourse;
- between T2 and T6 – reduce barrier from 20m to 6m either side of the centreline;
- between T2 and T4 – move western barrier boundary 15m to east;
- upstream of T4 – reduce barrier from 20m to 12m either side of the centreline.

AUSTRALASIAN GROUNDWATER AND ENVIRONMENTAL CONSULTANTS PTY LTD

Reviewed by:

DUNCAN W. IRVINE
Senior Hydrogeologist

ERROL H. BRIESE
Principal Hydrogeologist/Managing Director

LIMITATIONS OF REPORT

Australasian Groundwater and Environmental Consultants Pty Ltd (AGE) has prepared this report for the use of Centennial Newstan Pty Limited in accordance with the usual care and thoroughness of the consulting profession. It is based on generally accepted practices and standards at the time it was prepared. No other warranty, expressed or implied, is made as to the professional advice included in this report. It is prepared in accordance with the scope of work and for the purpose outlined in the Email dated 19 March 2008.

The methodology adopted and sources of information used by AGE are outlined in this report. AGE has made no independent verification of this information beyond the agreed scope of works and AGE assumes no responsibility for any inaccuracies or omissions. No indications were found during our investigations that information contained in this report as provided to AGE was false.

This study was undertaken between 7 April 2008 and 21 May 2008 and is based on the conditions encountered and the information available at the time of preparation of the report. AGE disclaims responsibility for any changes that may occurred after this time.

This report should be read in full. No responsibility is accepted for use of any part of this report in any other context or for any other purpose or by third parties. It may not contain sufficient information for the purposes of other parties or other users. This report does not purport to give legal advice. Legal advice can only be given by qualified legal practitioners.

This report contains information obtained by inspection, sampling, testing and other means of investigation. This information is directly relevant only to the points in the ground where they were obtained at the time of the assessment. Where borehole logs are provided they indicate the inferred ground conditions only at the specific locations tested. The precision with which conditions are indicated depends largely on the frequency and method of sampling, and the uniformity of the site, as constrained by the project budget limitations. The behaviour of groundwater is complex. Our conclusions are based upon the analytical data presented in this report and our experience.

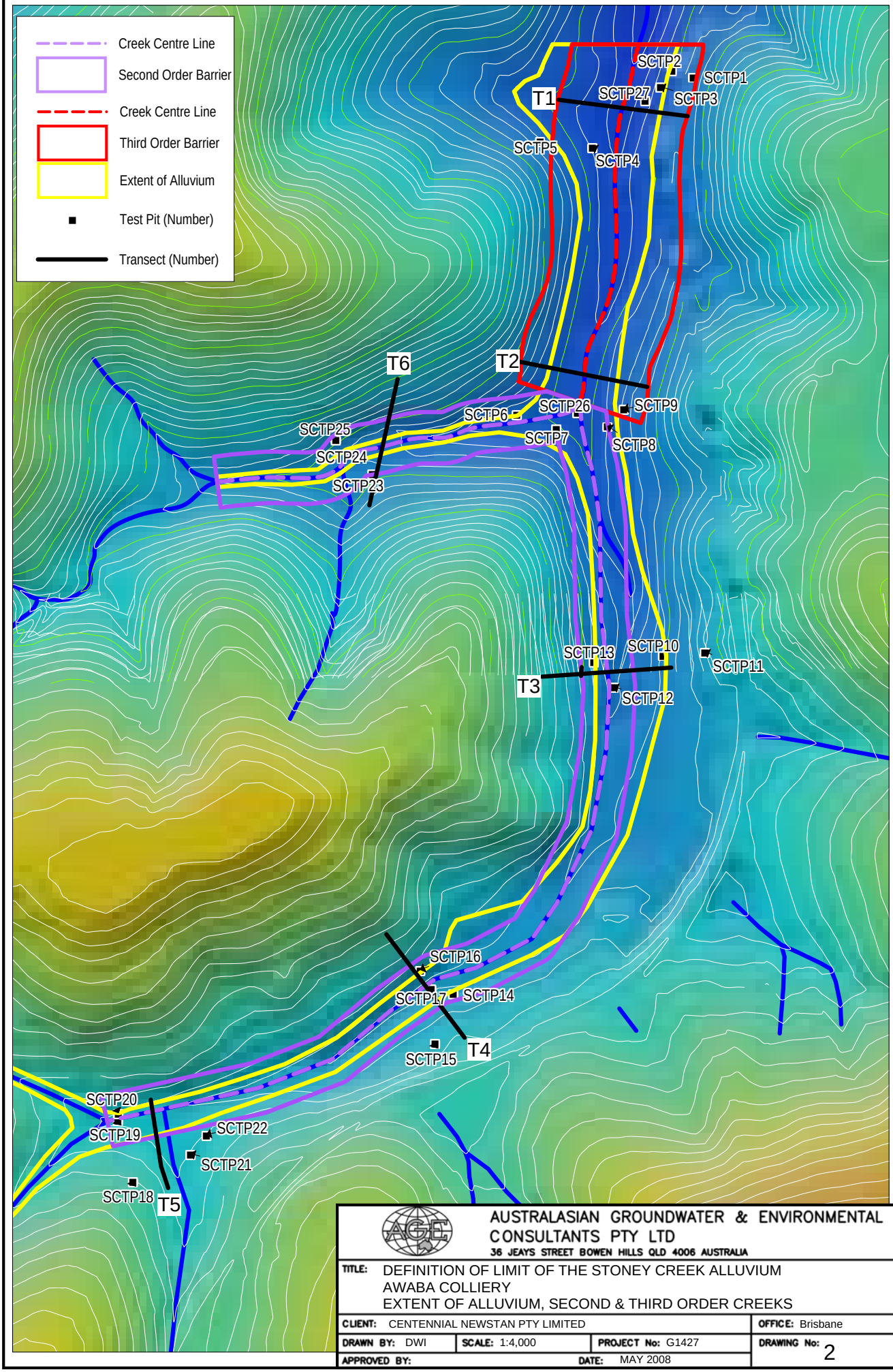
Where conditions encountered at the site are subsequently found to differ significantly from those anticipated in this report, AGE must be notified of any such findings and be provided with an opportunity to review the recommendations of this report.

Whilst to the best of our knowledge, information contained in this report is accurate at the date of issue, subsurface conditions, including groundwater levels can change in a limited time. Therefore this document and the information contained herein should only be regarded as valid at the time of the investigation unless otherwise explicitly stated in this report.

AUSTRALASIAN GROUNDWATER & ENVIRONMENTAL CONSULTANTS PTY LTD
36 JEAYS STREET BOWEN HILLS QLD 4006 AUSTRALIA

TITLE: DEFINITION OF LIMIT OF THE STONEY CREEK ALLUVIUM
AWABA COLLIERY
TEST PIT AND TRANSECT LOCALITY PLAN

CLIENT: CENTENNIAL NEWSTAN PTY LIMITED			OFFICE: Brisbane
DRAWN BY: DWI	SCALE: 1:4,000	PROJECT No: G1427	DRAWING No: 1
APPROVED BY:		DATE: MAY 2008	



AUSTRALASIAN GROUNDWATER & ENVIRONMENTAL CONSULTANTS PTY LTD
36 JEAYS STREET BOWEN HILLS QLD 4006 AUSTRALIA

TITLE: DEFINITION OF LIMIT OF THE STONEY CREEK ALLUVIUM
AWABA COLLIERY
EXTENT OF ALLUVIUM, SECOND & THIRD ORDER CREEKS

CLIENT: CENTENNIAL NEWSTAN PTY LIMITED			OFFICE: Brisbane
DRAWN BY: DWI	SCALE: 1:4,000	PROJECT No: G1427	DRAWING No: 2
APPROVED BY:		DATE: MAY 2008	

Appendix 1

TEST PIT LITHOLOGY AND PHOTOGRAPHS

Project:	**Stoney Creek Alluvial Aquifer Mapping**		
Client:	Centennial Newstan Pty Limited – Awaba Colliery	Date Excavated:	7/04/2008
Test Pit No.:	**SCTP1** **Transect T1**	Excavation Method:	Excavator Kobelco SK30SR
Location:	362 690m E 6 344 857m N		

Depth (m)	Test Pit Log	Observations
0.0-0.25	Sandy Gravelly CLAY, medium plasticity, dark grey, fine to medium sand, fine to medium rounded gravel, slightly moist.	Topsoil
0.25-0.7	Sandy Gravelly CLAY, high plasticity, red/orange brown, fine to medium sand, fine to medium rounded gravel, stiff, slightly moist.	Residual soil
0.7	End of Test Pit.	

SCTP1 – View of pit profile

SCTP1 – View of spoil material

Project:	**Stoney Creek Alluvial Aquifer Mapping**		
Client:	Centennial Newstan Pty Limited – Awaba Colliery	Date Excavated:	7/04/2008
Test Pit No.:	**SCTP2** **Transect T1**	Excavation Method:	Excavator Kobelco SK30SR
Location:	362 674m E 6 344 862m N		

Depth (m)	Test Pit Log	Observations
0.0-0.25	Sandy Gravelly CLAY, medium plasticity, dark grey, fine to medium sand, fine to medium rounded gravel, slightly moist.	Topsoil
0.25-0.7	Sandy Gravelly CLAY, high plasticity, red/orange brown, fine to medium sand, fine to medium rounded gravel, stiff, slightly moist.	Residual soil
0.7	End of Test Pit.	

SCTP2 – View of pit profile

SCTP2 – View of spoil material

Project: **Stoney Creek Alluvial Aquifer Mapping**

Client: Centennial Newstan Pty Limited – Awaba Colliery Date Excavated: 7/04/2008

Test Pit No.: **SCTP3** **Transect 1** Excavation Method: Excavator Kobelco SK30SR

Location: 362 665m E
6 344 849m N

Depth (m)	Test Pit Log	Observations
0.0-0.25	Sandy Gravelly CLAY, medium plasticity, dark grey, fine to medium sand, fine to medium rounded gravel, slightly moist.	Topsoil
0.25-1.0	Sandy Gravelly CLAY, high plasticity, grey to yellow brown with red brown mottling, fine to medium sand, fine to medium rounded gravel, firm, moist.	Alluvium
1.0	End of Test Pit.	

SCTP3 – View of pit profile

SCTP3 – View of spoil material

Project:	**Stoney Creek Alluvial Aquifer Mapping**		
Client:	Centennial Newstan Pty Limited – Awaba Colliery	Date Excavated:	7/04/2008
Test Pit No.:	**SCTP4** **Transect 1**	Excavation Method:	Excavator Kobelco SK30SR
Location:	362 612m E 6 344 802m N		

Depth (m)	Test Pit Log	Observations
0.0-0.2	Sandy Gravelly CLAY, medium plasticity, dark grey, fine to medium sand, fine to medium rounded gravel, slightly moist.	Topsoil
0.2-1.1	Sandy Gravelly CLAY, medium to high plasticity, grey with yellow brown mottling, fine to medium sand, fine rounded gravel, firm, slightly moist. Becoming more Gravelly at 1.0m.	Alluvium
1.1	End of Test Pit.	

SCTP4 – View of pit profile

SCTP4 – View of spoil material

Project:	**Stoney Creek Alluvial Aquifer Mapping**			
Client:	Centennial Newstan Pty Limited – Awaba Colliery		Date Excavated:	7/04/2008
Test Pit No.:	**SCTP5**	**Transect T1**	Excavation Method:	Excavator Kobelco SK30SR
Location:	362 571m E 6 344 806m N			

Depth (m)	Test Pit Log	Observations
0.0-0.15	Sandy Gravelly CLAY, medium plasticity, dark grey, fine to medium sand, fine to medium rounded gravel, slightly moist.	Topsoil
0.15-0.35	Sandy Gravelly CLAY, low plasticity, light brown to yellow brown, fine to medium sand, fine to medium rounded/sub-angular gravel, soft, slightly moist.	Colluvium
0.35-0.55	Sandy Gravelly CLAY, high plasticity, red/orange brown, fine to medium sand, fine to medium rounded gravel, stiff, slightly moist.	Residual soil
0.55	End of Test Pit.	

SCTP5 – View of pit profile

SCTP5 – View of spoil material

Project:	**Stoney Creek Alluvial Aquifer Mapping**			
Client:	Centennial Newstan Pty Limited – Awaba Colliery		Date Excavated:	7/04/2008
Test Pit No.:	**SCTP6**	**Transect T2**	Excavation Method:	Excavator Kobelco SK30SR
Location:	362 535m E 6 344 607m N			

Depth (m)	Test Pit Log	Observations
0.0-0.15	Sandy Gravelly CLAY, medium plasticity, dark grey, fine to medium sand, fine to medium rounded gravel, slightly moist.	Topsoil
0.15-0.4	Sandy Gravelly CLAY, low plasticity, light brown to yellow brown, fine to medium sand, fine to medium rounded/sub-angular gravel, soft, slightly moist.	Colluvium
0.4-0.6	Sandy Gravelly CLAY, high plasticity, red/orange brown, fine to medium sand, fine to medium rounded gravel, stiff, slightly moist.	Residual soil
0.6	End of Test Pit.	

SCTP6 – View of pit profile

SCTP6 – View of spoil material

Project: **Stoney Creek Alluvial Aquifer Mapping**

Client: Centennial Newstan Pty Limited – Awaba Colliery

Date Excavated: 7/04/2008

Test Pit No.: **SCTP7** **Transect T2**

Excavation Method: Excavator Kobelco SK30SR

Location: 362 567m E
6 344 575m N

Depth (m)	Test Pit Log	Observations
0.0-0.15	Sandy Gravelly CLAY, medium plasticity, dark grey, fine to medium sand, fine to medium rounded gravel, slightly moist.	Topsoil
0.15-0.4	Sandy CLAY, low to medium plasticity, light brown, fine to medium sand, soft to firm, slightly moist.	Alluvium
0.4-0.6	Sandy CLAY, medium plasticity, light brown with yellow mottling, fine to medium sand, firm, slightly moist.	Alluvium
0.6	End of Test Pit.	

SCTP7 – View of pit profile

SCTP7 – View of spoil material

Project:	**Stoney Creek Alluvial Aquifer Mapping**		
Client:	Centennial Newstan Pty Limited – Awaba Colliery	Date Excavated:	7/04/2008
Test Pit No.:	**SCTP8** **Transect T2**	Excavation Method:	Excavator Kobelco SK30SR
Location:	362 631m E 6 344 586m N		

Depth (m)	Test Pit Log	Observations
0.0-0.15	Sandy Gravelly CLAY, medium plasticity, dark grey, fine to medium sand, fine to medium rounded gravel, slightly moist.	Topsoil
0.15-0.6	Sandy CLAY, low to medium plasticity, grey to dark grey, medium sand, firm, slightly moist to moist.	Alluvium
0.6-1.25	Sandy CLAY, medium to high plasticity, light grey brown with yellow mottling, medium sand, firm to stiff, moist.	Alluvium
1.25	End of Test Pit.	

SCTP8 – View of pit profile

SCTP8 – View of spoil material

Project:	**Stoney Creek Alluvial Aquifer Mapping**		
Client:	Centennial Newstan Pty Limited – Awaba Colliery	Date Excavated:	7/04/2008
Test Pit No.:	**SCTP9** **Transect T2**	Excavation Method:	Excavator Kobelco SK30SR
Location:	362 652m E 6 344 602m N		

Depth (m)	Test Pit Log	Observations
0.0-0.15	Sandy Gravelly CLAY, medium plasticity, dark grey, fine to medium sand, fine to medium rounded gravel, slightly moist.	Topsoil
0.15-0.35	Sandy Gravelly CLAY, low to medium plasticity, light brown, fine to medium sand, fine to medium rounded/sub-angular gravel, soft, slightly moist.	Colluvium
0.35-0.55	Sandy Gravelly CLAY, high plasticity, red/orange brown, fine to medium sand, fine rounded gravel, stiff, slightly moist.	Residual soil
0.55	End of Test Pit.	

SCTP9 – View of pit profile

SCTP9 – View of spoil material

Project:	**Stoney Creek Alluvial Aquifer Mapping**		
Client:	Centennial Newstan Pty Limited – Awaba Colliery	Date Excavated:	8/04/2008
Test Pit No.:	**SCTP10** **Transect T3**	Excavation Method:	Excavator Kobelco SK30SR
Location:	362 667m E 6 344 408m N		

Depth (m)	Test Pit Log	Observations
0.0-0.1	Sandy Gravelly CLAY, medium plasticity, dark grey, fine to medium sand, fine to medium rounded gravel, slightly moist.	Topsoil
0.1-0.55	Clayey SAND, fine to medium grained, light grey, low plasticity clay, loose, moist.	Alluvium
0.55-0.85	Sandy CLAY, medium to high plasticity, light grey brown with yellow mottling, fine to medium sand, firm to stiff, moist.	Alluvium
0.85	End of Test Pit.	

SCTP10 – View of pit profile

SCTP10 – View of spoil material

Project:	**Stoney Creek Alluvial Aquifer Mapping**		
Client:	Centennial Newstan Pty Limited – Awaba Colliery	Date Excavated:	8/04/2008
Test Pit No.:	**SCTP11** **Transect T3**	Excavation Method:	Excavator Kobelco SK30SR
Location:	362 699m E 6 344 410m N		

Depth (m)	Test Pit Log	Observations
0.0-0.1	Sandy Gravelly CLAY, medium plasticity, dark grey, fine to medium sand, fine to medium rounded gravel, slightly moist.	Topsoil
0.1-0.35	Sandy Gravelly CLAY, low to medium plasticity, light brown, fine to medium sand, fine rounded gravel, soft, slightly moist.	Colluvium
0.35-0.6	Sandy Gravelly CLAY, high plasticity, red/orange brown, fine to medium sand, fine rounded gravel, stiff, slightly moist.	Residual soil
0.6	End of Test Pit	

SCTP11 – View of pit profile

Project:	**Stoney Creek Alluvial Aquifer Mapping**		
Client:	Centennial Newstan Pty Limited – Awaba Colliery	Date Excavated:	8/04/2008
Test Pit No.:	**SCTP12** **Transect T3**	Excavation Method:	Excavator Kobelco SK30SR
Location:	362 629m E 6 344 383m N		

Depth (m)	Test Pit Log	Observations
0.0-0.15	Sandy Gravelly CLAY, medium plasticity, dark grey, fine to medium sand, fine to medium rounded gravel, slightly moist.	Topsoil
0.15-1.5	Sandy CLAY/Clayey SAND, fine to medium grained, light grey, low plasticity clay, loose, moist to wet (at 0.9m – narrow seepage layer).	Alluvium. Groundwater seepage at 0.9m
1.5-1.9	Sandy Gravelly CLAY, low to medium plasticity, grey with some yellow mottling, fine to medium sand, fine rounded gravel, soft to firm (friable), dry to slightly moist.	Alluvium (indurated layer?)
1.9	End of Test Pit.	Hard

SCTP12 – View of pit profile

SCTP12 – View of spoil material

Project:	**Stoney Creek Alluvial Aquifer Mapping**		
Client:	Centennial Newstan Pty Limited – Awaba Colliery	Date Excavated:	8/04/2008
Test Pit No.:	**SCTP13** **Transect T3**	Excavation Method:	Excavator Kobelco SK30SR
Location:	362 613m E 6 344 402m N		

Depth (m)	Test Pit Log	Observations
0.0-0.1	Sandy Gravelly CLAY, medium plasticity, dark grey, fine to medium sand, fine to medium rounded gravel, slightly moist.	Topsoil
0.1-0.25	Sandy Gravelly CLAY, low to medium plasticity, light brown, fine to medium sand, fine to coarse rounded/sub-angular gravel, soft, dry to slightly moist.	Colluvium
0.25-0.6	Sandy Gravelly CLAY, high plasticity, red/yellow brown, fine to medium sand, fine rounded gravel, stiff, slightly moist.	Residual soil
0.6	End of Test Pit.	

SCTP13 – View of pit profile

Project:	**Stoney Creek Alluvial Aquifer Mapping**		
Client:	Centennial Newstan Pty Limited – Awaba Colliery	Date Excavated:	8/04/2008
Test Pit No.:	**SCTP14** **Transect T4**	Excavation Method:	Excavator Kobelco SK30SR
Location:	362 504m E 6 344 144m N		

Depth (m)	Test Pit Log	Observations
0.0-0.15	Sandy Gravelly CLAY, medium plasticity, dark grey, fine to medium sand, fine to medium rounded gravel, slightly moist.	Topsoil
0.15-0.5	Clayey SAND, fine to medium grained, light brown, low plasticity clay, loose to medium dense, moist.	Alluvium
0.5-0.9	Sandy Gravelly CLAY, high plasticity, light grey brown with yellow/orange mottling, fine to medium sand, fine rounded gravel, stiff, moist.	Residual soil
0.9	End of Test Pit.	

SCTP14 – View of pit profile

SCTP14 – View of spoil material

Project:	**Stoney Creek Alluvial Aquifer Mapping**		
Client:	Centennial Newstan Pty Limited – Awaba Colliery	Date Excavated:	8/04/2008
Test Pit No.:	**SCTP15** **Transect T4**	Excavation Method:	Excavator Kobelco SK30SR
Location:	362 494m E 6 344 093m N		

Depth (m)	Test Pit Log	Observations
0.0-0.1	Sandy Gravelly CLAY, medium plasticity, dark grey, fine to medium sand, fine to medium rounded gravel, slightly moist.	Topsoil
0.1-0.5	Clayey SAND, fine to medium grained, light brown, low plasticity clay, loose to medium dense, moist.	Alluvium
0.5-1.25	Sandy Gravelly CLAY, high plasticity, light grey brown with yellow/orange mottling, fine to medium sand, fine rounded gravel, stiff, moist.	Residual soil
1.25	End of Test Pit.	

SCTP15 – View of pit profile

SCTP15 – View of spoil material

Project:	**Stoney Creek Alluvial Aquifer Mapping**		
Client:	Centennial Newstan Pty Limited – Awaba Colliery	Date Excavated:	8/04/2008
Test Pit No.:	**SCTP16** **Transect T4**	Excavation Method:	Excavator Kobelco SK30SR
Location:	362 486m E 6 344 176m N		

Depth (m)	Test Pit Log	Observations
0.0-0.1	Sandy Gravelly CLAY, medium plasticity, dark grey, fine to medium sand, fine to medium rounded gravel, slightly moist.	Topsoil
0.1-0.55	Sandy Gravelly CLAY, low to medium plasticity, light brown, fine to medium grained, soft to firm, slightly moist.	Colluvium
0.55-0.85	Sandy Gravelly CLAY, high plasticity, orange brown, fine to medium sand, fine rounded gravel, stiff, moist.	Residual soil
0.85	End of Test Pit.	

SCTP16 – View of pit profile

SCTP16 – View of spoil material

Project:	**Stoney Creek Alluvial Aquifer Mapping**		
Client:	Centennial Newstan Pty Limited – Awaba Colliery	Date Excavated:	8/04/2008
Test Pit No.:	**SCTP17** **Transect T4**	Excavation Method:	Excavator Kobelco SK30SR
Location:	362 489m E 6 344 149m N		

Depth (m)	Test Pit Log	Observations
0.0-0.2	Sandy Gravelly CLAY, medium plasticity, dark grey, fine to medium sand, fine to medium rounded gravel, slightly moist.	Topsoil
0.2-0.5	Sandy CLAY/Clayey SAND, fine to medium grained, grey, medium plasticity clay, loose, slightly moist to moist.	Alluvium
0.5-1.4	Sandy Gravelly CLAY, high plasticity, grey with yellow mottling, fine to medium sand, fine rounded gravel, stiff, moist.	Alluvium?
1.4-1.85	Sandy Gravelly CLAY, high plasticity, grey with occasional yellow mottling, fine to medium sand, fine rounded gravel, firm to stiff, moist.	Alluvium?
1.85	End of Test Pit.	

SCTP17 – View of pit profile

SCTP17 – View of spoil material

Project:	**Stoney Creek Alluvial Aquifer Mapping**		
Client:	Centennial Newstan Pty Limited – Awaba Colliery	Date Excavated:	9/04/2008
Test Pit No.:	**SCTP18** **Transect T5**	Excavation Method:	Excavator Kobelco SK30SR
Location:	362 330m E 6 343 956m N		

Depth (m)	Test Pit Log	Observations
0.0-0.15	Sandy Gravelly CLAY, medium plasticity, dark grey, fine to medium sand, fine to medium rounded gravel, slightly moist.	Topsoil
0.15-0.5	Sandy CLAY/Clayey SAND, fine to medium grained, light grey to grey, low to medium plasticity clay, loose to medium dense, slightly moist.	Colluvium
0.5-0.85	Sandy Gravelly CLAY, high plasticity, light grey brown with yellow and orange mottling, fine to medium sand, fine rounded gravel, stiff, moist.	Residual soil
0.85	End of Test Pit.	

SCTP18 – View of pit profile

SCTP18 – View of spoil material

Project:	**Stoney Creek Alluvial Aquifer Mapping**		
Client:	Centennial Newstan Pty Limited – Awaba Colliery	Date Excavated:	9/04/2008
Test Pit No.:	**SCTP19** **Transect T5**	Excavation Method:	Excavator Kobelco SK30SR
Location:	362 294m E 6 344 055m N		

Depth (m)	Test Pit Log	Observations
0.0-0.55	Sandy CLAY, medium plasticity, dark grey, fine to medium sand, firm, slightly moist.	Alluvium
0.55-1.15	Sandy CLAY/Clayey SAND, fine to medium grained, light grey to grey, low to medium plasticity clay, loose to medium dense, wet (minor seepage).	Alluvium. Minor groundwater inflow
1.15-1.75	Sandy CLAY, high plasticity, grey with yellow and orange mottling, fine to medium sand, firm to stiff (friable), slightly moist.	Alluvium (indurated layer?)
1.75	End of Test Pit.	

SCTP19 – View of pit profile

SCTP19 – View of spoil material

Project:	**Stoney Creek Alluvial Aquifer Mapping**		
Client:	Centennial Newstan Pty Limited – Awaba Colliery	Date Excavated:	9/04/2008
Test Pit No.:	**SCTP20** **Transect T5**	Excavation Method:	Excavator Kobelco SK30SR
Location:	362 295m E 6 344 054m N		

Depth (m)	Test Pit Log	Observations
0.0-0.1	Sandy Gravelly CLAY, medium plasticity, dark grey, fine to medium sand, fine to medium rounded gravel, slightly moist.	Topsoil
0.1-0.5	Sandy CLAY, medium plasticity, light grey, fine to medium sand, firm, slightly moist.	Colluvium
0.5-0.75	Sandy CLAY, high plasticity, grey with yellow and orange mottling, fine to medium sand, stiff, slightly moist to moist.	Residual soil
0.75	End of Test Pit.	

SCTP20 – View of pit profile

SCTP20 – View of spoil material

Project:	**Stoney Creek Alluvial Aquifer Mapping**		
Client:	Centennial Newstan Pty Limited – Awaba Colliery	Date Excavated:	9/04/2008
Test Pit No.:	**SCTP21** **Transect T5**	Excavation Method:	Excavator Kobelco SK30SR
Location:	362 337m E 6 344 027m N		

Depth (m)	Test Pit Log	Observations
0.0-0.1	Sandy Gravelly CLAY, medium plasticity, dark grey, fine to medium sand, fine to medium rounded gravel, slightly moist.	Topsoil
0.1-0.4	Sandy Gravelly CLAY, low to medium plasticity, light brown, fine to medium sand, fine to medium rounded/sub-angular gravel, soft to firm, slightly moist.	Colluvium
0.4-0.55	Sandy CLAY, high plasticity, red brown, fine to medium sand, stiff, slightly moist to moist.	Residual soil
0.55	End of Test Pit.	

SCTP21 – View of pit profile

Project:	**Stoney Creek Alluvial Aquifer Mapping**		
Client:	Centennial Newstan Pty Limited – Awaba Colliery	Date Excavated:	9/04/2008
Test Pit No.:	**SCTP22** **Transect T5**	Excavation Method:	Excavator Kobelco SK30SR
Location:	362 338m E 6 344 035m N		

Depth (m)	Test Pit Log	Observations
0.0-0.1	Sandy Gravelly CLAY, medium plasticity, dark grey, fine to medium sand, fine to medium rounded gravel, slightly moist.	Topsoil
0.1-0.55	Sandy Gravelly CLAY, low to medium plasticity, light brown, fine to medium sand, fine to medium rounded/sub-angular gravel, soft to firm, slightly moist.	Colluvium
0.55-0.75	Sandy CLAY, high plasticity, red brown, fine to medium sand, stiff, slightly moist to moist.	Residual soil
0.75	End of Test Pit.	

SCTP22 – View of pit profile

Project:	**Stoney Creek Alluvial Aquifer Mapping**		
Client:	Centennial Newstan Pty Limited – Awaba Colliery	Date Excavated:	9/04/2008
Test Pit No.:	**SCTP23** **Transect T6**	Excavation Method:	Excavator Kobelco SK30SR
Location:	362 433m E 6 344 566m N		

Depth (m)	Test Pit Log	Observations
0.0-0.1	Sandy Gravelly CLAY, medium plasticity, dark grey, fine to medium sand, fine to medium rounded gravel, slightly moist.	Topsoil
0.1-0.7	Sandy Gravelly CLAY, low to medium plasticity, light brown, fine to medium sand, fine to medium rounded/sub-angular gravel, soft to firm, slightly moist.	Colluvium
0.7-1.05	Sandy CLAY, high plasticity, light brown with yellow and orange mottling, fine to medium sand, stiff, slightly moist.	Residual soil
1.05	End of Test Pit.	

SCTP23 – View of pit profile

SCTP23 – View of spoil material

Project:	**Stoney Creek Alluvial Aquifer Mapping**		
Client:	Centennial Newstan Pty Limited – Awaba Colliery	Date Excavated:	9/04/2008
Test Pit No.:	**SCTP24** **Transect T6**	Excavation Method:	Excavator Kobelco SK30SR
Location:	362 422m E 6 344 569m N		

Depth (m)	Test Pit Log	Observations
0.0-0.2	Sandy Gravelly CLAY/Clayey Gravelly SAND, fine to medium grained, dark grey, medium plasticity clay, fine to medium rounded gravel, moist.	Alluvium
0.2-0.45	Sandy CLAY, low to medium plasticity, dark grey, fine to medium sand, firm, moist.	Alluvium
0.45-0.65	Sandy Gravelly CLAY, medium plasticity, grey, fine to medium sand, fine to medium rounded gravel, firm, moist.	Alluvium
0.65-1.25?	Sandy Clayey GRAVEL, fine to medium rounded gravel, grey, fine to medium sand, low plasticity clay, medium dense, wet.	Alluvium. Groundwater inflow at 0.65m
1.25?	End of Test Pit.	

SCTP24 – View of pit profile

SCTP24 – View of spoil material

Project:	**Stoney Creek Alluvial Aquifer Mapping**		
Client:	Centennial Newstan Pty Limited – Awaba Colliery	Date Excavated:	9/04/2008
Test Pit No.:	**SCTP25** **Transect T6**	Excavation Method:	Excavator Kobelco SK30SR
Location:	362 413m E 6 344 575m N		

Depth (m)	Test Pit Log	Observations
0.0-0.1	Sandy Gravelly CLAY, medium plasticity, dark grey, fine to medium sand, fine to medium rounded gravel, slightly moist.	Topsoil
0.1-0.45	Sandy Gravelly CLAY, low to medium plasticity, light brown, fine to medium grained, fine to medium rounded/sub-angular gravel, soft to firm, slightly moist.	Colluvium
0.45-0.95	Sandy CLAY, high plasticity, light brown with yellow and orange mottling, fine to medium sand, stiff, slightly moist.	Residual soil
0.95	End of Test Pit.	

SCTP25 – View of pit profile

SCTP25 – View of spoil material

Project:	**Stoney Creek Alluvial Aquifer Mapping**		
Client:	Centennial Newstan Pty Limited – Awaba Colliery	Date Excavated:	9/04/2008
Test Pit No.:	**SCTP26** **Transect T2**	Excavation Method:	Excavator Kobelco SK30SR
Location:	362 591m E 6 344 608m N		

Depth (m)	Test Pit Log	Observations
0.0-0.1	Sandy CLAY, low to medium plasticity, dark grey, fine to medium grained, moist.	Topsoil
0.1-0.5	Sandy CLAY, medium plasticity, dark grey, fine to medium sand, firm, moist.	Alluvium
0.5-0.7	Sandy Clayey GRAVEL, fine rounded gravel, grey, fine to medium sand, low plasticity clay, medium dense, wet.	Alluvium. Groundwater seepage
0.7-1.5	Sandy CLAY, medium to high plasticity, dark grey with yellow mottling, fine to medium sand, firm, moist.	Alluvium
1.5-1.7?	Gravelly Clayey SAND, medium to coarse grained, yellow brown, fine to medium rounded gravel, low plasticity clay, loose, wet.	Alluvium. Groundwater inflow at 1.5m
1.7?	End of Test Pit.	

SCTP26 – View of pit profile

Project:	**Stoney Creek Alluvial Aquifer Mapping**		
Client:	Centennial Newstan Pty Limited – Awaba Colliery	Date Excavated:	9/04/2008
Test Pit No.:	**SCTP27** **Transect T1**	Excavation Method:	Excavator Kobelco SK30SR
Location:	362 653m E 6 344 838m N		

Depth (m)	Test Pit Log	Observations
0.0-1.0	Sandy CLAY, low to medium plasticity, dark grey, fine to medium sand, firm, dry to slightly moist.	Alluvium
1.0-1.9	Sandy Gravelly CLAY, medium to high plasticity, grey to dark grey with yellow mottling, fine to medium sand, fine to medium rounded/sub-angular gravel, firm to stiff, moist.	Alluvium.
1.9-2.4	Gravelly Clayey SAND, medium to coarse grained, grey, fine to medium rounded gravel, low plasticity clay, loose, wet.	Alluvium. Minor Groundwater inflow
2.4-2.5	CONGLOMERATE, highly weathered, light grey/green with yellow /orange mottling, very hard, slightly moist.	Bedrock
2.5	End of Test Pit.	Refusal

SCTP27 – View of pit profile

SCTP27 – View of spoil material

ATTACHMENT 4 AWABA COLLIERY MINING PROJECT PRESENTATION 17 DECEMBER 2010

Centennial Coal

The Awaba Colliery Mining Project

17 December 2010

FUTURE POWER | Centennial Coal

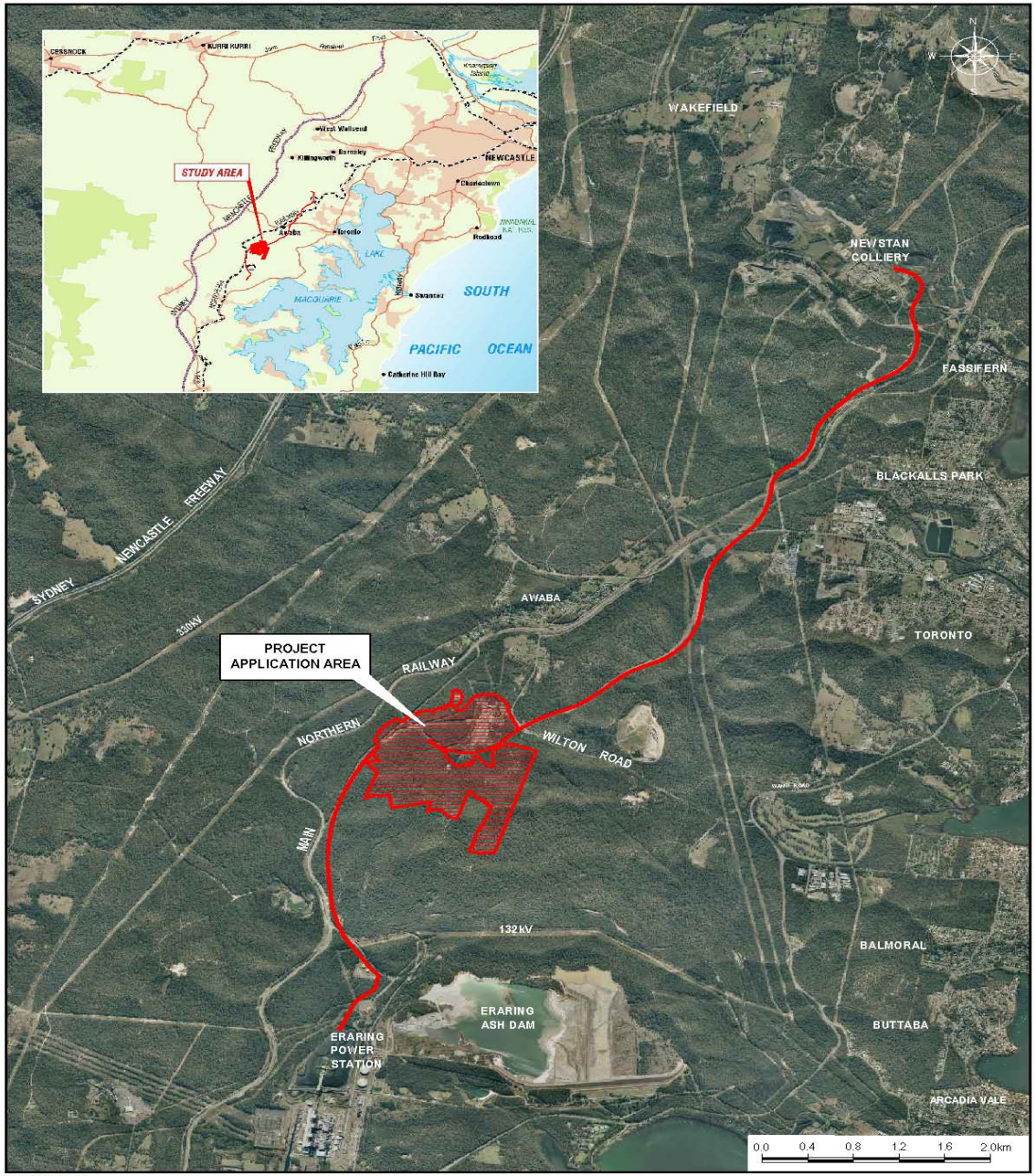
Background

- Awaba Colliery is operated by Centennial Newstan Pty Ltd, a wholly owned subsidiary of Centennial Coal Company Pty Ltd.
- Operating since 1947, Awaba has 100 employees and has historically produced up to 850,000 tonnes of coal annually.
- An application for a Part 3A Project Approval was lodged in March 2010 with the Department of Planning, to allow ongoing and extended underground mining and associated surface operations.
- The Project will extend the mine life of the Awaba Colliery by up to five years (until 2015) and will recover approximately 2.0 million tonnes of coal.

Project Description

- Awaba Colliery is seeking an approval from the Minister for Planning under the provisions of Part 3A of the EP&A Act to:

  - Continue bord and pillar development and pillar extraction by continuous miners within the “Main South Area”;
  - Extend bord and pillar development and pillar extraction by continuous miners into the “East B” Area;
  - Produce, handle and distribute up to 880,000 tonnes of Run of Mine coal per annum (financial year) using existing surface facilities;
  - Continue the use of existing surface facilities;
  - Expand the existing Pollution Control Dam;
  - Continue the delivery of coal to the Newstan Colliery and/or the Eraring Power Station using the existing private haul road/transport facilities.



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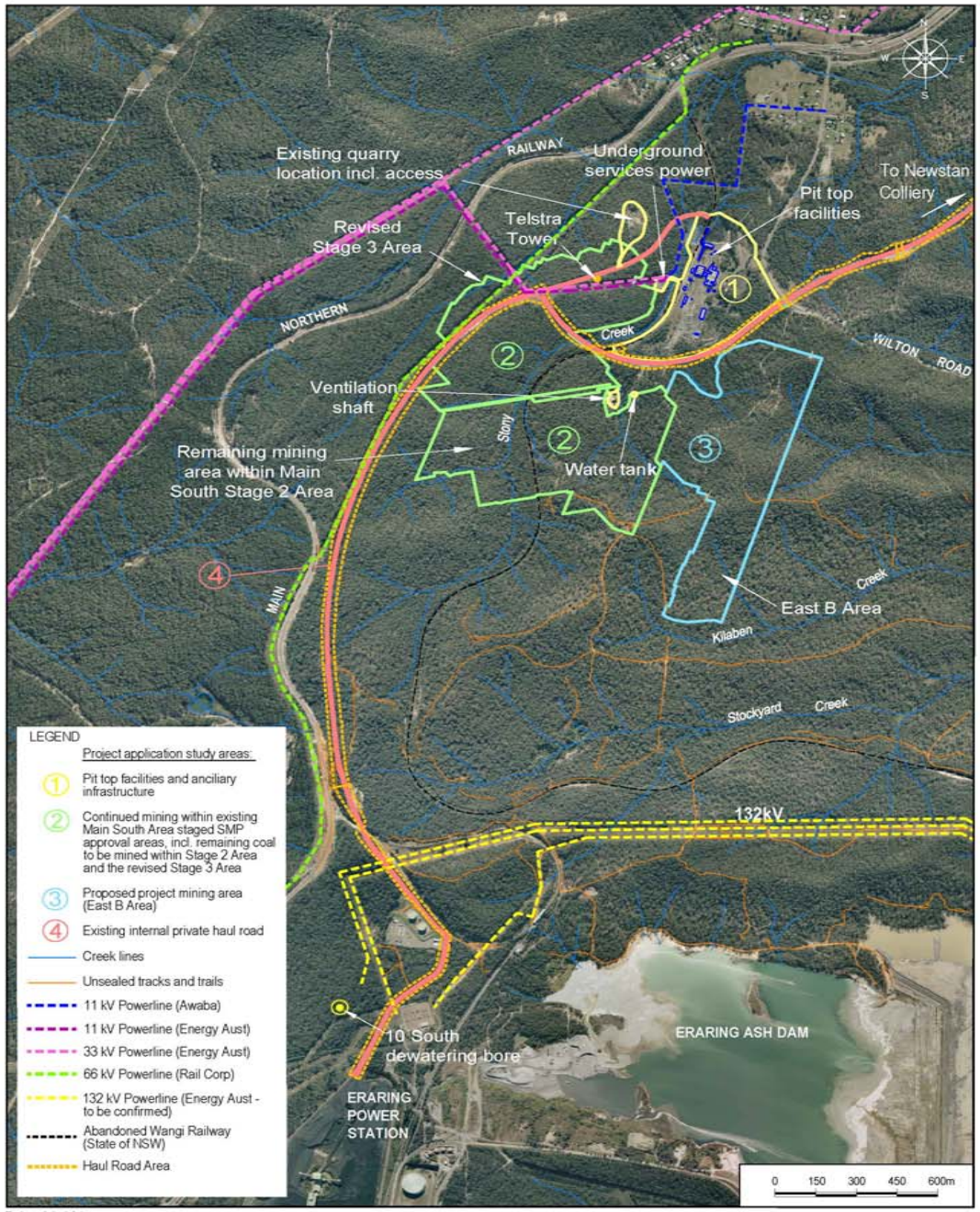
Location Plan
Figure 1.1

Project Application Study Areas

Four study areas were assessed as part of the EA.

- Study Area 1 – includes surface facilities and ancillary infrastructure.
- Study Area 2 – continued mining within the existing main south area (SMP approved areas).
- Study Area 3 – proposed project mining areas (East B area).
- Study Area 4 – existing internal private haul road.



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Project Application Study Areas Detailed

Figure 2.1b

Mine Subsidence – Geotechnical Conditions

- Roof Characteristics
  - The stratigraphic unit above the Great Northern Seam (GNS) is the Teralba Conglomerate.
  - The ability of the Teralba Conglomerate (TC) to maintain unsupported roof spans, following mining, has been a key design factor for the current mining method. TC has the ability to span voids above extraction panels up to 150 metres wide, at depths of cover in excess of 30 metres.
  - Awaba's extraction panel widths are less than 100 metres with a depth of cover in excess of 25 metres.

- Floor Characteristics
  - Immediately underlying the GNS at Awaba Colliery is the Awaba Tuff, which is composed of low strength tuffaceous siltstone and sandstone beds.
  - Floor materials with less than 0.5 megapascal strengths have probably been associated with pillar collapse at Awaba Colliery (Seedsman, 2010).
  - Accordingly secondary extraction does not commence until floor coring and geotechnical review is undertaken to meet design criteria.

Previous Subsidence & History of Mine Planning & Design at Awaba

- Prior to development of the current mining method, historical subsidence events had occurred caused by mining in areas of very low depth of cover (<20m) and or multiple pillar collapse or creeps. The latter events occurred in areas with high factor of safety pillars and it was concluded that a failure in the Awaba Tuff floor was more likely than a coal pillar failure (Seedsman, 2010).
- As a result of these subsidence events, a new mine design was formulated to minimise the potential for significant subsidence events to occur.
- This current mining method was developed in consultation with I&I and has successfully been used at Awaba Colliery without incident since mid 2007 (Seedsman, 2010).
- The current mine design utilises the spanning capabilities of the strong Teralba Conglomerate roof, and is referred to as the “bridging layout”.
- A key aspect of the layout is that floor failure does not result in rapid and uncontrolled collapse of the strata above the extraction panels. Potential for floor failure due to very low strength material is managed by testing the floor prior to extraction.

Current Mine Planning & Design

- The development of the current mine design allows the Awaba Colliery to exclude secondary extraction from potentially sensitive areas. These secondary extraction exclusion areas include:
  - Areas where depth of cover to the GNS is less than 25 metres;
  - Protection barriers for second and third order watercourses;
  - Protection barriers for surface infrastructure including the Newstan – Eraring private haul road, Telstra tower and power poles;
  - The main northern railway protection zone.

- Australasian Groundwater & Environmental Consultants conducted a survey of the Stony Creek Alluvium (AGEC, 2008) and a further baseline ecological assessment of riparian vegetation along Stony Creek in the Main South Area was undertaken by Hunter Wetlands Research Pty Ltd (HWR) in May 2008.

- These investigations provided the scientific basis for establishing appropriate offset/buffer zones for alluvial areas of Stony Creek. This process has been successfully demonstrated during existing mining in the Main South Area to date without detrimental impact to the alluvium and associated vegetation.

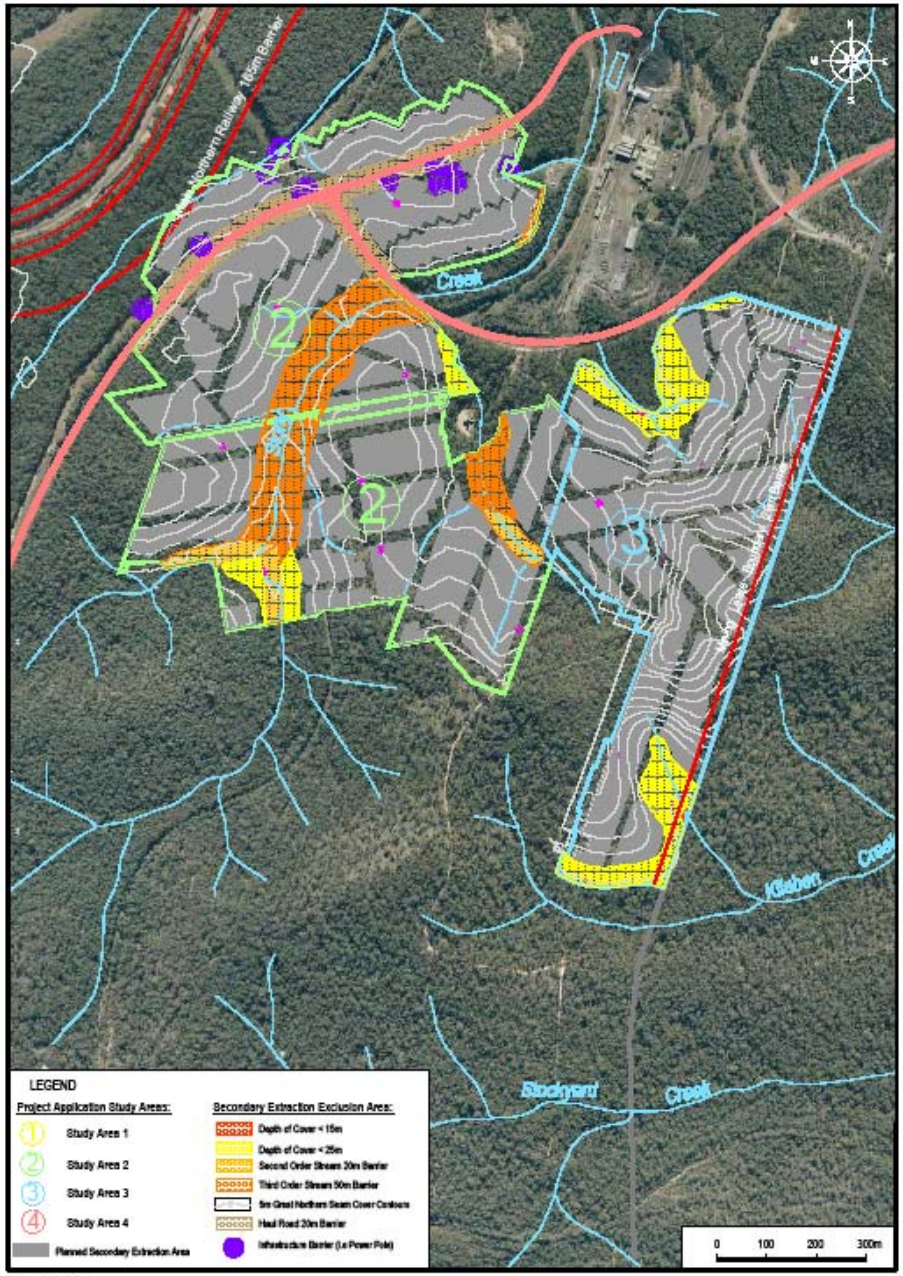
- In general, the amount of subsidence is a function of the sag of the conglomerate and the compression of the pillar system. Experience from adjacent panels has recorded subsidence in the order of 10 to 100 millimetres (sag of the conglomerate) and 50 -100 millimetres (compression of the pillar system) (Seedsman, 2010).

Current Mine Planning & Design

- The maximum vertical subsidence associated with this current mining method measured to date has been around 125 millimetres (Seedsman, 2010). This has been well within conservative subsidence predictions.
- The *maximum* predicted subsidence for the Project mining areas is 200mm (Seedsman, 2010).
- Whilst *not* provided as a prediction (Seedsman, 2010), as a risk-based measure a conservative 'worst case' scenario was also prudently considered.
- The worst case scenario is if the entire thickness of Teralba Conglomerate roof within a panel failed, referred to as a 'plug failure'. It is noted that this has never occurred using the current mining method at Awaba. The failure of the entire roof of a panel would result in approximately 2m vertical subsidence.
- Risk ***elimination and substitution*** are primary controls specifically employed in mine planning and design to **avoid risk** or minimise potential risks, as outlined in the following table.

Hierarchy of Subsidence Management Control Measures

Management Control		Study Area	
		2	3
Elimination – pillar extraction has been eliminated from the following areas	Within a nominal 125 metre from the Rail boundary	✓	n/a
	Under the haul roads and other infrastructure or the identified water courses	✓	n/a
	At depths of cover less than 25 metres	✓	✓
Substitution	The layout adopted has significantly lower subsidence than the alternatives. The proposed mining method is a continuation of the existing mining that has been implemented successfully since 2007 after being developed in consultation with I&I.	✓	✓
Engineering Controls	Factor of safety for pillar failure	1.4-1.7	>1.6
	Factor of safety for compressive failure of the spanning Teralba Conglomerate	Not specified	2.0
Administrative Controls – The following will be undertaken to monitor and ensure mine design prevents subsidence levels above those predicted.	Progressive coring or other testing of the floor in extraction areas and adjacent to rail prior to second workings	✓	✓
	Regular inspections of any water courses especially after heavy rainfall.	✓	✓
	Subsidence cross line(s) to confirm pillar compression and sag predictions.	✓	✓



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Awaba Colliery Mine Design
Secondary Extraction Exclusion Areas

Figure 7.2

Groundwater Systems

- Groundwater systems in the area were described in a groundwater study commissioned by Awaba Colliery to determine the extent of the Stony Creek Alluvium (by investigations involving test pitting along traverses and lithological logging of the strata) which was undertaken by Australasian Groundwater and Environmental Consultants (AGEC), in 2008.

- This study determined that there were three main hydrogeological units (aquifers) in the Stony Creek / Awaba Colliery area: the Alluvial Aquifers, Shallow Weathered Zone Aquifers, and the Triassic & Permian Strata Aquifers. There is no regional aquifer located above the Great Northern Seam. These aquifers were assessed in the Water Management Assessment included in Appendix 6 of the Environmental Assessment.

- As there is no regional aquifer located above the Great Northern Seam, and mine design has incorporated barriers around 2nd and 3rd order streams (and their potential alluvial aquifers), there were no potential impacts upon the aquifers identified for the Project.

Surface and Ground Waters

- Groundwater expert Dr Stuart Gray of GHD has provided further clarification as follows regarding DECCW and NOW queries on information regarding shallow alluvial or perched aquifers and their connectivity to watercourses in the area.
  - Given the competent nature of the Teralba Conglomerate it is unlikely that vertical cracking will occur to the extent where localised groundwater aquifers would be impacted should they be present (e.g. perched local water table located in depressions of the conglomerate)
  - The likelihood of development of fractures above the conglomerate and into the alluvium occurring causing a reduction in alluvial groundwater levels is very low (GHD, 2010).
  - The majority of the alluvium in the vicinity of the proposed mining area is along a thin channel adjacent to Stony Creek, generally extending no more than 50-100 m from the creek. GHD have undertaken alluvial mapping of the area as part of another project.
  - Awaba Colliery has committed to developing a groundwater monitoring program for the Stony Creek alluvial aquifers for inclusion in the Water Management Plan in consultation with DECCW and NOW.

Endangered Ecological Community (EEC).

• One listed Endangered Ecological Community (EEC) was recorded. The EEC, Swamp Sclerophyll Forest on Coastal Floodplains was also classed as a groundwater dependent ecosystem (GDE) as detailed by Hunter Eco in Appendix 11 of the EA – Ecology Impact Assessment.

• Hunter Eco have concluded that "the overall slopes on the subject site are such that subsidence of the range predicted would not result in any diversion of water from the existing drainage lines meaning that there would be no impact on downstream GDE's."

•Although it is unlikely (and not predicted) an assessment of the worst case 'plug failure' scenario, found that the void which would have the greatest impact on flow in Stony Creek would result in the loss of 4% of flow into the downstream EEC and there would be no impact on the smaller upstream patch of EEC.

• A failure would need to be remediated (primarily for safety reasons) and therefore would not result in a sustained impact.

Stony Creek Riparian Vegetation Monitoring

• A baseline ecological assessment of riparian vegetation along Stony Creek (and establishment of 5 monitoring transects) in the Main South Area was undertaken by Hunter Wetlands Research Pty Ltd (HWR) in accordance with Condition 12 (and in consultation with I&I and NOW) of the Awaba Main South Area approval in May 2008.

• A follow-up survey of riparian vegetation along Stony Creek completed by HWR in December 2009 identified no evident changes in vegetation that may be attributed to extraction operations and subsidence.

• As a result, Awaba Colliery has proposed to continue this successful and conservative approach in mine planning for the current EA as mining continues within the Main South Area and the Stony Creek catchment.

• A Watercourse Management Plan has also been developed in accordance with a condition of SMP approval for the Main South Stage 2 Area which details these monitoring, inspection and reporting programs for Stony Creek.

Water Licencing & Water Management Plan

- Awaba Colliery does not currently hold any (Part 5) water licences for the dewatering of its underground workings.
- As included in the Statement of Commitments any additional groundwater licences required for the project will be sought within three months of Project Approval, including 10 South Bore.
- Barnes Dam (LDP005) at Awaba Colliery is currently not in use, however may be required for de-watering of underground workings in future.
- A water balance (including a comparison of predicted and actual take of water) will be included in the Annual Environmental Management Report (AEMR).
- Awaba will include an updated geomorphic description for Stony Creek in the site Water Management Plan in consultation with DECCW and NOW.

Questions