Independent Review of the Environmental Impact Statement for the Watermark Coal Project

prepared for

Caroona Coal Action Group

by

EARTH SYSTEMS

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EXECUTIVE SUMMARY

Earth Systems was commissioned by the Caroona Coal Action Group (CCAG) with the support of the Namoi Valley Environmental Protection Fund, Australian Community Foundation, Namoi Water, Sunrise Project, Cotton Australia, the Upper Namoi Cotton Growers Association, the Namoi Community Network and 322 local landholders, to conduct an independent review of the Environmental Impact Statement (EIS) for the proposed Watermark Coal Project (hereafter referred to as the 'Project') in New South Wales. The EIS was prepared by Hansen Bailey on behalf of Shenhua Watermark Coal Pty Ltd (Shenhua Watermark). This independent review of the EIS has been prepared as a public submission on behalf of the CCAG.

The Project would comprise three open cut Mining Areas, namely Eastern Mining Area (3.5 x 4 km), the Southern Mining Area (2 x 3 km), and the Western Mining Area (2.5 x 3 km) from which approximately 268 Mt of ROM coal would be mined to produce approximately 159 Mt of product coal over 30 years. Up to 1,629 Million bank cubic metres (Mbcm) of overburden material would be moved and approximately 108 Mt of coal reject and tailings would be produced during processing of ROM coal during the life of the Project. The Project would require 4,084 ha of land disturbance and involve:

- Blasting and utilising a standard mining equipment fleet of excavators and shovels, supported by haul trucks, dozers, graders, drill rigs and water carts.
- Progressive backfilling of the pits and establishment of Overburden Emplacement Areas (OEAs) that would extend beyond the pit boundaries. Tailings and coarse rejects would be co-disposed with overburden and interburden in the OEAs.
- Construction and operation of a Coal Handling and Preparation Plant (CHPP), administration, workshop and related facilities, communications and electricity reticulation infrastructure, mine access road, rail spur, rail loop, Kamilaroi Highway rail overpass, associated train load out facility and connection to the Werris Creek to Moree Railway Line.
- Construction and operation of ground and surface water management and reticulation infrastructure including pipelines, pumping stations and associated infrastructure for access to water from groundwater aquifers, the Mooki River and private dams to the north-east of the Project Boundary.
- A workforce of up to approximately 600 full-time equivalent employees during construction and up to 600 full-time equivalent employees during the operation of the Project.

The purpose of this report is to provide an independent and objective review of the EIS and to identify whether the relevant environmental, mining and planning issues have been appropriately investigated and assessed. Specific objectives were to:

- Conduct a 'high level' review of the EIS structure and content, to determine whether it provides a comprehensive and technically robust assessment of potential impacts of the project.
- Review detailed specialist EIS studies to identify whether these studies cover the key issues associated with the Project's development and whether the findings and uncertainties associated with these studies are carried forward to the impact assessment.
- Identify any important aspects or potential issues that have not been fully or adequately assessed, with consideration of The Director-General's Environmental Assessment Requirements, relevant legislation, policies and plans, Australian and International standards and leading practice guidelines for EIS and environmental management in the mining sector.

The key findings of the review are summarised below.

General comments

Many aspects of the EIS have been conducted well and numerous detailed technical studies have been undertaken to support the EIS. Despite this, a number of significant gaps and deficiencies in the EIS were identified during the review. Further work is considered necessary to address these issues and provide an adequate assessment of impacts. Several of the Director General and SEWPaC requirements have not been adequately addressed in the EIS. Specific examples are detailed below and numerous others are documented throughout this report:

- There is a general lack of fundamental information in the Project description (mine model, mine schedule, definition of disturbance areas, extent of blast exclusion zone, details on water supply and treatment infrastructure, workforce accommodation, etc). It is not possible to assess environmental impacts in the absence of such data.
- The Project design with final void remaining in Western Mining Area requires is a concern given the potential long term impacts on receiving water quality and groundwater flows. It should not be presumed that approvals will be granted for future Project expansion, particularly given the conditions of EL 7223 which prohibit longwall mining.
- EL 7223 also prohibits open cut mining anywhere on the floodplain. The Project appears to breach this EL condition, as the flood impact assessment (Section 7) indicates that part of the Eastern Mining Area will experience flood levels up to 1.7 metres in a 100 year event.
- Recent changes to the regulatory framework do not appear to have been considered in the EIS despite their likely significance to the Watermark Project. These include the EPBC Act Environmental Offsets Policy (October 2012), the Murray Darling Basin Plan (November 2012), and the Mining Regulation 2010.
- There are major gaps in the baseline data, particularly in relation to water quality and geochemistry. Other gaps exist in the meteorological, ecological and archaeological / cultural heritage baseline. It is not possible to fully assess environmental impacts in the absence of such data, nor will it be possible to distinguish Project-related impacts from external influences if the Project was to proceed.
- The risk assessment conducted for the Project is condensed into a single page of the EIS and is not considered to be sufficiently detailed or comprehensive given the magnitude of the proposed Project, the significant number of risks involved, and the sensitivity of the receiving environment and community. The assessment of residual risks appears to be largely based on management recommendations from the technical studies, many of which have not been incorporated into Section 7 (Impacts, Management and Mitigation) or Section 8 (Management and Monitoring Summary). Hence, the risk assessment appears to understate the likely impacts and risks associated with the development of the Project.
- For most aspects of the EIS, the potential impacts of the project (without management measures) have not been distinguished from residual impacts (with management measures).
- The potential impacts of the project during construction, operations and post-closure have not been clearly distinguished throughout the EIS.
- In general, very limited detail is provided on many of the proposed management measures proposed in Section 7 of the EIS, and there appears to be only limited commitment to best practice (such as those outlined in the Federal Government leading practice handbook series for sustainable development in the mining sector) with the exception of air quality and noise

management. Several management measures have been documented or recommended by specialists in the technical appendices but have been omitted from the EIS.

- A key requirement of SEWPaC is to include an Environmental Management Plan (EMP) as part of the EIS. This has not been provided.
- A summary of management commitments has been prepared in Section 8 of the EIS. Many of these are simply "commitments" to develop management plans. In the absence of these management plans (and EMP) it is not possible to assess the effectiveness of mitigation measures and hence the likely impacts of the Project. Furthermore, it is not possible to cost the mitigation measures.
- Despite the above, the economic impact assessment has attempted to develop some preliminary cost estimates for environmental impact management, largely associated with greenhouse gas emissions, surface and groundwater (obtaining licences) and road closures. Costs of foregone agricultural production, noise management, blasting, air quality, surface and groundwater, ecology / offsets, road transport, heritage and visual impacts are dismissed as either "minimal" or "included in opportunity cost of land and development costs".
- An environmental monitoring program for the operations phase has not provided. At the very least, this should include a comprehensive water quality monitoring plan "including management triggers to detect potential issues in a timely manner and to avoid, minimise or ameliorate adverse impacts" (SEWPaC requirement).

Water

Key water quality impacts during operations and post-closure have not been adequately assessed, nor have adequately management measures been developed to address these impacts. Some examples are provided below:

- Project water supply sources and specific water supply requirements from each source, including the Mooki River, have not been quantified. It is therefore not possible to fully assess impacts on surface and groundwater resources.
- There is a lack of consistency throughout the EIS regarding the need for off site discharge[1]. In addition, the likely quality of water to be discharged off site has not been assessed. It is therefore not possible to assess impacts on downstream water quality, water resource use and aquatic ecosystems.
- A number of assumptions used to develop the operational water balance are unclear. Uncertainties in the water balance calculations are not explained in the EIS, but may have significant implications for site water demand and discharge requirements. In terms of the post-closure water balance, the void water rebound rate has been estimated at between 100 years (WRM) and 2000 years (AGE). Further work is required to resolve this discrepancy.
- The site salinity balance is completely inadequate and cannot be used as a basis for assessing Project-related impacts on downstream water quality, nor developing an appropriate site water and salinity management strategy.
- The potential for AMD, neutral metalliferous and/or saline drainage from mine waste materials and unsaturated pit wallrock has not been adequately assessed. Saline drainage associated

[1] Furthermore, local stakeholders are concerned at the lack of clear communication by the Proponent regarding this issue. As recently as April 2013 the Proponent advised the Breeza Progress Association Inc. that the site will be a "nil discharge mine", contradicting information presented in the EIS (pers. comm., A. Pursehouse, 2013).

with sulfide oxidation in waste materials and wallrock is likely to be a major contributor to the site salinity load, with potential for impacts to extend for years or possibly decades after mine closure.

- The uncertainties associated with modelled predictions of groundwater drawdown adjacent to the Project area are not clearly explained in the EIS. Furthermore, it has not been possible to confirm the vertical extent of the Gunnedah Formation and any high permeability pathways that may connect the Project area and Gunnedah Formation.
- The measures proposed to mitigate groundwater impacts are limited to acquiring licences to offset the groundwater lost as a result of mine dewatering. Other management options were briefly identified by AGE but not considered in the EIS.
- The final void water quality is predicted to progressively deteriorate after closure, with salinity levels of 30,000 mg/L (and increasing) which is 10 times that of typical background water quality for the Western Mining Area (reported as 3,000 mg/L). The final void water level (around 302.8 m AHD) would be elevated above the Gunnedah Formation (base 230 m AHD). However, impacts on receiving groundwater have not been assessed, nor have management measures been considered.

Agriculture

- The plan to reinstate 1,000 ha of agricultural land within the Project area will be largely dependent on the success of mine rehabilitation and closure. Concerns regarding mine rehabilitation and closure, as identified in this review, therefore apply to the agricultural impact assessment.
- Agricultural impacts beyond the Project area will be dependent on surface and groundwater impacts, as well as potential air quality impacts (see below). Concerns regarding the water and air quality assessments, as identified in this review, therefore apply to the agricultural impact assessment.

Air Quality and Greenhouse Gas Emissions

- On face value the Director General air quality assessment requirements have been met. However, it appears that there is a significant flaw in the quantitative assessment that has been undertaken. Only wind data from November 2010 to October 2011 was used for the modelling which is not representative of long term variation in the region. It is clear that the air modelling should be conducted over a greater spread of wind conditions reflecting the variable nature of wind patterns in the area. Due to the importance of this issue and the potential for impact on community and assets, it is recommended that wind data over a longer time period is used in the modelling of air quality for the Watermark Project and the impact assessment revised.
- The assessment of greenhouse gas (GHG) impacts is significantly underestimated as it excludes the substantial contribution from Scope 2 and 3 emissions sources. Impacts of the Project on anthropogenic global warming should be assessed using a Global Carbon Budget approach as defined in the scientific literature.
- The assessment of greenhouse gas emissions intensity of the Project (0.05 t CO_2e/t saleable coal) excludes Scope 2 and 3 emissions sources. Furthermore, insufficient data is provided to enable direct comparison to the greenhouse gas emissions intensity (all scope emissions) of other coal mines. This should be a key consideration in determining whether the Project is justified, particularly given the IEA in the World Energy Outlook report (2012) which indicated

that "*no more than one-third or proven reserves of fossil fuels can be consumed prior to 2050 if the world is to achieve the 2°C goal*".

- Considering the substantial estimated release of fugitive CH_4 during operations it is unclear why coal seam gas harvesting potential has not been assessed.
- Greenhouse gas emission mitigation strategies are very brief and are not considered sufficient to address the terms listed in the Director General's Environmental Requirements and EPBC Act requirements.

Ecology / Biodiversity

- Assessment of potential impacts on highly mobile fauna, as well as potential indirect and cumulative impacts on fauna, has not been conducted adequately. Further baseline surveying and assessment of potential impacts on highly mobile fauna, as well as potential indirect and cumulative impacts on fauna, should be undertaken within a continuous zone around the Project Boundary as required by *OEH's Survey and assessment guidelines (2009)* guidelines.
- Given the significant risks and uncertainties associated with translocation of koalas, revise the Koala Plan of Management to include:
  - Details of how the Key Performance Indicators for the plan will be measured (including time-bound thresholds for achievement of the Plan Objectives),
  - Contingency measures for the potential scenario where Plan Objectives are not met within a reasonable timeframe,
  - Detailed criteria for assessing the success of establishing corridors/linkages between existing vegetated areas such as Breeza State Forest and other suitable koala habitat, and
  - Detailed information regarding criteria to evaluate at what point animals to be translocated are euthanized (e.g. end point) to protect Koala welfare.
- Offsets required for potential impacts on EPBC Act species and communities should be recalculated based on the new Environmental Offsets Policy released in October 2012, and update the proposed Biodiversity Offset Strategy accordingly (or provide evidence of approval from SEWPaC that assessment under the previous policy is acceptable).

Rehabilitation and Mine Closure

- The potential impacts of expected long term seepage of saline water (283 ha) the Overburden Emplacement Areas (OEAs) on Onsite Offset sites (eg. impacts on revegetation success) and other areas (eg. downstream) have not been assessed.
- The rehabilitation and closure strategy is primarily focussed on revegetation, with no serious consideration given to the significant long term risk associated with geochemical instability of waste materials (and wallrock) and associated water quality issues. The current rehabilitation and closure strategy will result in final groundwater levels above current levels and elevated above surrounding aquifers. Connectivity between aquifers will be enhanced, resulting in significant potential for cross-contamination of aquifers.
- Subsidence of backfilled material in pits is inevitable, however the potential extent of subsidence and irregularity of the final landform (and implications for local final land use) have not been considered.

- A rehabilitation and closure strategy cannot be developed in the absence of a mine model and scheduling information (need to develop a backfill schedule in order to manage long term pore water and seepage issues).
- There remain significant uncertainties regarding availability of sufficient and suitable quality soil for revegetation works.

Socio-Economic and Health

- The EIS captures a number of potential social, economic and health impacts associated with the Project. The major issue associated with the EIS assessment of these aspects is the uncertainty associated with the assessment of the physical impacts. For example, there appear to be gaps in key areas of understanding such as impact to surface and groundwater, and impact to air quality. A full and proper understanding of these key areas is required for a social, economic and health assessment to be considered comprehensive.

Archaeology and Cultural Heritage

- Further Aboriginal archaeological surveys are required within the disturbance footprint to address concerns of the Registered Aboriginal Parties (RAPs) regarding survey coverage and limitations due to poor ground surface visibility.
- The Proponent should commit to establishing procedures for chance finds of unrecorded Aboriginal archaeological evidence (such as human skeletal remains and totemic animal remains) in consultation with OEH, NSW Police, NSW Heritage Branch and RAPs to minimise potential impacts these resources.

Other Comments

- The potential impact of flyrock associated with blasting activities has not been assessed. It has been stated that a 500 m buffer zone will be enforced during blasting. This has not been mapped but is likely to extend beyond the Project Boundary, with potential to impact on people, livestock or property.
- The assessment of noise impacts appears to be compromised by the lack of high quality wind data for the Project area (as is the case for the air quality impact assessment).
- A brief study on regional subsidence was conducted as an appendix to the Groundwater Impact Assessment, however subsidence have not been adequately assessed in the EIS. In addition, the potential for local subsidence of backfilled waste and pit wallrock has not been assessed.
- The potential for environmental emergencies has not been considered, nor have any contingency plans been developed (Director General requirement) to manage such impacts.

In conclusion, it is recommended that these gaps and uncertainties are addressed by the Proponent so that a rigorous assessment of impacts from the Project can be conducted. This will provide the community and other stakeholders with confidence that if the Project is developed, it is developed in a manner that does not compromise other assets and values within the region.

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APPENDICES

APPENDIX A **Environmental Planning and Assessment Regulation 2000 – Schedule 2, Clause 6 and 7**

APPENDIX B **Director General and SEWPaC Requirements**

1.0 Introduction

1.1 Background

Earth Systems was commissioned by the Caroona Coal Action Group (CCAG) with the support of the Namoi Valley Environmental Protection Fund, Australian Community Foundation, Namoi Water, Sunrise Project, Cotton Australia, the Upper Namoi Cotton Growers Association, the Namoi Community Network and 322 local landholders, to conduct an independent review of the Environmental Impact Statement (EIS) for the proposed Watermark Coal Project (hereafter referred to as the 'Project') in New South Wales. The EIS was prepared by Hansen Bailey on behalf of Shenhua Watermark Coal Pty Ltd (Shenhua Watermark). This independent review of the EIS has been prepared as a public submission on behalf of the CCAG.

In October 2008, Shenhua Watermark, a subsidiary of the Shenhua Group, was granted Exploration Licence 7223 by the New South Wales Minister for Mineral Resources. In accordance with Clause 3 of Schedule 2 of the *Environmental Planning and Assessment Regulation 2000*, Shenhua Watermark made a request for Director-General's Requirements (DGRs) on 14th October 2011. The development was declared a '*controlled action'* on 22nd December 2011 and therefore requires an EIS under the *Environment Protection and Biodiversity Conservation Act 1999*. The Director-General of the Department of Planning and Infrastructure issued DGRs for the Project on 19th April 2012 that outlined the key areas that must be addressed in the EIS. The DGRs were prepared in consultation with relevant government agencies, with input from the Watermark Community Consultative Committee and NSW Farmers Association. The EIS was lodged on 29th October 2012 and is on public display from 28th February to 26th April 2013.

Shenhua Watermark completed a comprehensive exploration program focused on defining the potential open-cut coal resource. This led to the development of a detailed mine plan for the Project that would facilitate the extraction of up to 10 Million tonnes per annum (Mtpa) Run of Mine (ROM) coal via open cut mining methods over a 30 year period. The Watermark Project would involve constructing significant infrastructure including a coal handling and processing plant, rail lines and water supply. The Project would subsequently involve transporting the coal from the mine by rail to the Port of Newcastle. Progressive rehabilitation of the site would also be undertaken.

1.2 Objectives

The purpose of this report is to provide an independent and objective review of the EIS and to identify whether the relevant environmental, mining and planning issues have been appropriately investigated and assessed.

Specific objectives of the review are outlined below:

- Conduct a 'high level' review of the EIS structure and content, to determine whether it provides a comprehensive and technically robust assessment of potential impacts of the project.
- Conduct a technical review of specialist EIS studies that feed into the impact assessment with a focus on priority issues such as:
  - Water
    i. Groundwater Impact Assessment (EIS Main Report Section 7.1; Appendix T).
    ii. Surface Water Impact Assessment (EIS Main Report Section 7.3 and 7.4; Appendix S).
    iii. Geophysics survey (EIS Main Report Section 7.2; Appendix V).

iv. Geochemical Assessment (EIS Main Report Section 7.18; Appendix W).

v. Geomorphological Impact Assessment (EIS Main Report Section 7.5; Appendix X).

- Agriculture

i. Agricultural Impact Statement (EIS Main Report Section 7.20; Appendix Z).

ii. Soil Survey and Land Capability Assessment (EIS Main Report Section 7.19; Appendix Y).

iii. Preliminary Contamination Assessment (EIS Main Report Section 7.24; Appendix AD).

iv. Blasting Impacts on Landforms and Slopes (EIS Main Report Section 7.9; Appendix I).

- Air Quality and Greenhouse Gas Emissions

i. Air Quality and Greenhouse Gas Impact Assessment (EIS Main Report Section 7.6 and 7.7; Appendix G).

- Ecology

i. Ecological Impact Assessment (EIS Main Report Section 7.10 and 7.11; Appendix K).

ii. Report on Matters of National Significance (EIS Main Report Section 7.10; Appendix M).

iii. Koala Management Plan (EIS Main Report Section 7.10; Appendix L).

iv. Stygofauna (EIS Main Report Section 7.12; Appendix U).

- Social-Economics and Health

i. Social Impact Assessment (EIS Main Report Section 7.26; Appendix AE).

ii. Economic Impact Assessment (EIS Main Report Section 7.27; Appendix AF).

iii. Visual Impact Assessment (EIS Main Report Section 7.17; Appendix J).

iv. Traffic and Transport Impact Assessment (EIS Main Report Section 7.16; Appendix AB).

- Archaeology and Cultural Heritage

i. Aboriginal Archaeology and Cultural Heritage Impact Assessments (EIS Main Report Section 7.13 and 7.14; Appendix N, O, P and Q).

ii. Historic Heritage Impact Assessment (EIS Main Report Section 7.15; Appendix R).

- Rehabilitation and Mine Closure Strategy (EIS Main Report Section 7.21; Appendix AA).

- Other studies

i. Acoustics Impact Assessment (EIS Main Report Section 7.8; Appendix H).

ii. Blasting Impact Assessment (EIS Main Report Section 7.9).

iii. Preliminary Hazards Analysis (EIS Main Report Section 7.23; Appendix AC).

iv. Bushfire (EIS Main Report Section 7.22).

v. Waste (EIS Main Report Section 7.25).

- Identify any important aspects or potential issues that have not been fully or adequately assessed, with consideration of:

- The Director-General's Environmental Assessment Requirements.
- Other relevant legislation, policies and plans.
- Australian and International standards and leading practice guidelines for EIS and environmental management in the mining sector.

- Identify areas of uncertainty and/or requiring further investigation to meet the requirements of a thorough environmental impact assessment suitable for Project determination.

1.3 Project Overview

1.3.1 Location

The Watermark Project area is located approximately 25 km south-southeast of the township of Gunnedah in New South Wales (Figure 1.1), within the Gunnedah Local Government Area and west of the town of Breeza. The Project area is approximately 282 km by rail from the proposed export Port of Newcastle.

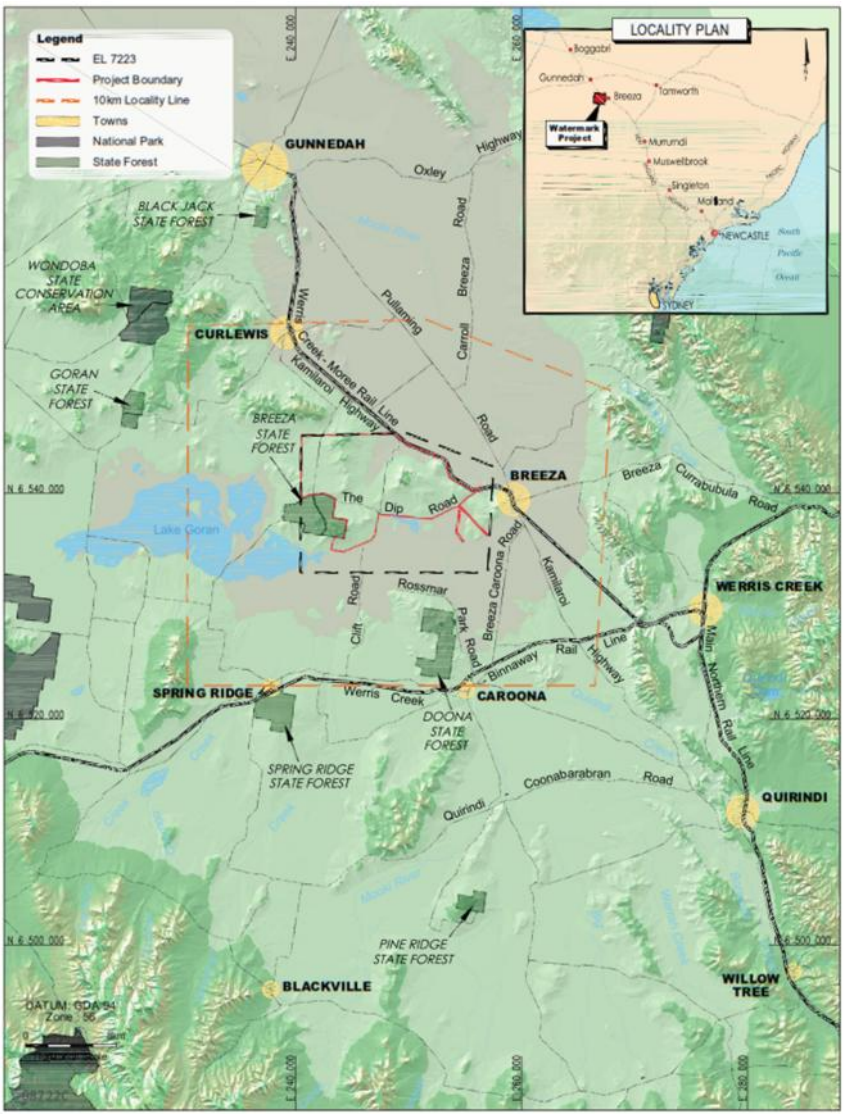

Figure 1.1: General location map showing the Project boundary (black dotted line), 10 km Locality line (orange dotted line), local townships, rail lines, local parks and state forest.

1.3.2 Project Description

The Watermark Project would involve:

- Development of three open cut mining operations – the Eastern, Southern and Western Mining Areas – over a period of 30 years (Figure 1.2).
- Blasting and utilising a standard mining equipment fleet of excavators and shovels, supported by haul trucks, dozers, graders, drill rigs and water carts.
- Progressive rehabilitation of all disturbed areas.
- The construction and operation of a Mine Access Road.
- The construction and operation of administration, workshop and related facilities.
- The co-disposal of tailings and coarse rejects within the Overburden Emplacement Areas (OEAs) (Figure 1.2 and 1.3).
- The construction and operation of a Coal Handling and Preparation Plant (CHPP).
- The construction and operation of a rail spur, rail loop, Kamilaroi Highway rail overpass, associated train load out facility and connection to the Werris Creek to Moree Railway Line.
- The construction and operation of ground and surface water management and reticulation infrastructure including pipelines, pumping stations and associated infrastructure for access to water from groundwater aquifers, the Mooki River and private dams to the north-east of the Project Boundary.
- The installation of communications and electricity reticulation infrastructure.
- A workforce of up to approximately 600 full-time equivalent employees during construction and up to 600 full-time equivalent employees during the operation of the Project.

The Project would require 4,084 ha of land disturbance which would generally be undertaken within the 'Disturbance Boundary' (Figure 1.2). Some of the infrastructure such as water, power and communications infrastructure would extend beyond the Disturbance Boundary and possibly the Project Boundary. Minor additional disturbance associated with ancillary works including fencing, firebreaks, water diversion structures, pipelines, a borefield, minor contour banks, access tracks, explosives storage facilities, power lines, sediment and erosion control structures would also be required.

Figure 1.2: Map of proposed project layout showing the three proposed pits, the disturbance boundary, project boundary and Overburden Emplacement Areas (OEAs).

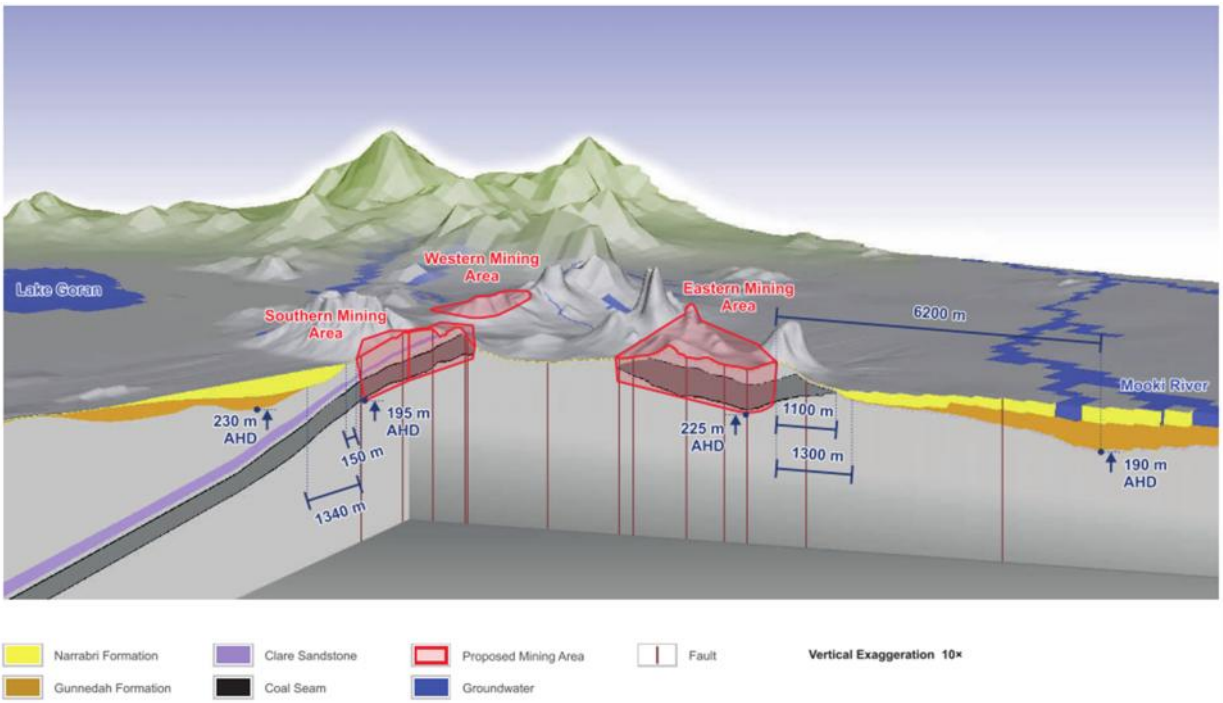

Figure 1.3: Three dimensional cutaway block model of the Project showing the location of the 3 proposed pits and aquifers (AHD - Australian Height Datum) (AGE, 2013).

1.3.3 Mine Plan

The Project would involve mining of approximately 268 Mt of ROM coal within the 30 year mine life to produce approximately 159 Mt of product coal. The EIS states that up to 1,629 Million bank cubic metres (Mbcm) of overburden material would be moved and approximately 108 Mt of coal reject and tailings would be produced during processing of ROM coal during the life of the Project.

The Project would comprise three open cut Mining Areas, namely Eastern Mining Area (3.5 x 4 km), the Southern Mining Area (2 x 3 km), and the Western Mining Area (2.5 x 3 km) as shown in Figure 1.3. As a requirement of EL7223, "*all plans for mining within the licence area must include a horizontal barrier of natural material with a minimum width of 150 metres, between proposed mining excavations and the Gunnedah Formation*". Figure 1.4 presents the locations and progression rates of each open cut Mining Area. Topsoil and subsoil will be stripped and stockpiled ahead of mining for use in progressive rehabilitation of the Mining Areas as the pits are backfilled with waste materials.

Mining operations would commence with an initial box cut in the north-west of the Eastern Mining Area. Overburden from the Eastern Mining Area would be initially placed to the south-west and immediate north and east and rehabilitated so as to visually shield the mining operation from the Kamilaroi Highway. Mining would continue down-dip of the coal seams towards the eastern extent of the Project Boundary until Year 12. The active mining area would then shift to the southern side of the Eastern Mining Area and commence in a reverse direction, up-dip back towards the initial box cut (Figure 1.4). Overburden would then be progressively placed and rehabilitated behind the active mining area, up to RL 380 m. For reference, the existing topography generally varies between RL 280 m and RL 340 m, with the exception of topographic highs such as Mt watermark (RL 512 m). By Year 17, active mining would be completed in the Eastern Mining Area.

In Year 17, mining operations would commence in the northern end of the Southern Mining Area, progressing to the south-west. Overburden from the Southern Mining Area would initially be utilised to backfill the Eastern Mining Area void. By approximately Year 21, the Eastern Mining Area would be completely backfilled and rehabilitated up to RL 380 m. Overburden from the Southern Mining Area would then be placed behind active mining so as to develop a second OEA. By Year 24, active mining would be completed in the Southern Mining Area.

By approximately Year 24, mining operations would commence in the eastern edge of the Western Mining Area. All overburden from this area would initially be utilised to backfill the Southern Mining Area void. By Year 26, the Southern Mining Area is expected to be completely backfilled and rehabilitated up to RL 330 m. Overburden from the Western Mining Area would then be placed behind active mining so as to develop a third OEA. By Year 30, active mining in this area is completed leaving a final void in the Western Mining Area at mine closure, covering an area of around 100 ha in the western extents of the mining area (Figure 1.4). It would have a maximum depth of around 80 m below the natural surface. Groundwater inflows and surface runoff would slowly fill the void to form a permanent water body.

The rationale for backfilling was summarised by AGE (2013) as follows: "*Prior to development of the model, it was recognised that leaving open voids in the open cut mining areas after mining was completed would have the potential to result in a long term flow of groundwater into the voids. There was also concern of a continuing leakage from adjacent Gunnedah Formation aquifers into the voids post mining. These were considered adverse environmental outcomes and the mine was planned to ensure the mining voids were backfilled to ground level and above, ensuring no long term drainage of groundwater into the mining area voids. The final landform will consist of a void in the western section of the Western Mining Area only*."

The mine plan was specifically designed so that the final void will be located in the north-west of the Project Boundary remote from the blacksoil plains. There are deeper coal resources present beyond the 30 year mining limit, for which Shenhua Watermark may seek further relevant approvals for mining in future. The Western Mining Area final void would enable underground access to this coal resource.

The conceptual rehabilitation schedule is summarised in Table 1.1.

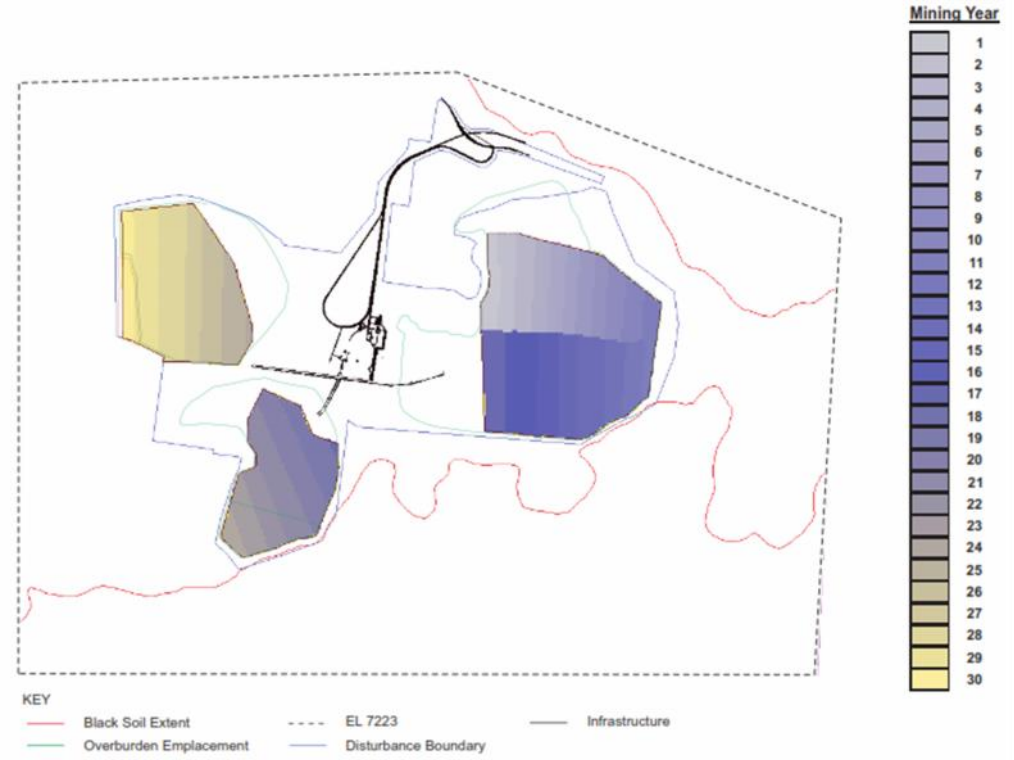

Figure 1.4: The locations and progression rates of the Project open cut Mining Areas (AGE, 2013).

Table 1.1: Conceptual rehabilitation schedule (GSS Environmental, 2013)*.

Project Year	Total Overburden (Mbcm)	ROM Coal (Mtpa)	Rehabilitation (Ha)
Year 1	9.70	0.1	0
Year 2	27.34	2.7	10
Year 5	43.36	10.0	159
Year 10	68.24	10.0	167
Year 15	67.98	9.8	202
Year 21	68.21	9.9	670
Year 25	63.52	10.0	1,136
Year 30	6.90	1.9	815
Total	**1,629**	**268.3**	**3,348**

* As previously noted, the EIS does not clarify whether the overburden volume refers to in situ or mined material. If the estimated 1,629 Mm^3 represents in situ overburden, the disturbed overburden volume could be substantially greater than reported here.

2.0 Review Method

2.1 Overview

This report has been prepared to systematically review and evaluate the potential mining, environmental and planning issues related to the Watermark Coal Project. To ensure a comprehensive review of the EIS, Earth Systems undertook the following steps:

1. Review of the EIS Main Report, EIS Technical Appendices and other relevant literature.
2. Review of the EIS against each of the DGR and *Department of Sustainability, Environment, Water, Population and Communities* (*SEWPaC*) requirements with consideration of relevant Australian and international standards and guidelines.

The review is primarily desktop-based, although Earth Systems personnel are familiar with the Breeza/Caroona region from previous site visits.

2.2 Literature Review

The following key documents were reviewed as a basis for preparation of this report.

- EIS Main Report and Technical Appendices.
- Director General's Environmental Assessment Requirements.
- Relevant Federal and State legislation, policies and plans.
- Relevant Federal and State environmental, sustainability and EIS standards and guidelines.
- Relevant international environmental, sustainability and EIS standards and guidelines.

2.3 Statutory Compliance

An important objective of this review is to assess whether the EIS clearly demonstrates, as a minimum requirement, compliance with relevant Federal and State legislation with respect to mining, planning and environmental impact assessment. Specifically, this review assesses whether the EIS adequately addresses the Director General's and SEWPaC environmental assessment requirements, and whether any environmental assessment requirements have been overlooked or only partly addressed.

Further to this minimum expectation of compliance with the Director General's and SEWPaC requirements, consideration has also been given to relevant Australian and International standards and guidelines as outlined in Sections 2.4 and 2.5, respectively.

2.4 Australian Standards and Guidelines

The review assesses the adequacy of the EIS with consideration of Australian environmental, sustainability and EIS standards and best practice guidelines. The review considers the advice, methodologies, procedures and specific requirements outlined in the *Coal Mines and Associated Infrastructure: EIS Guidelines* by NSW Department of Urban Affairs and Planning (DUAP, 2000). The purpose of the DUAP (2000) guideline document is to present clear and comprehensive information about the matters that may need to be included in an EIS to fulfil the information requirements for the assessment. The DUAP (2000) guidelines represent current best practice guidelines for the preparation of EIS documentation for coal mines in NSW.

The review of the EIS also considers the principles set out in: *Enduring Value - the Australian Minerals Industry Framework for Sustainable Development* by the Mineral Council of Australia (2005). The framework aligns with global industry initiatives, and in particular provides critical guidance on the International Council on Mining and Metals (ICMM) *Sustainable Development Framework Principles* and their progressive application and implementation at the operational level. It also builds on the Australian *Minerals Industry Code for Environmental Management* - the platform for industry's continual improvement in managing environmental issues since its introduction in 1996. The purpose of the framework is to assist the mining companies to operate in a manner which is attuned to the expectations of the community, and which seeks to maximise the long-term benefits to society that can be achieved through the effective management of Australia's natural resources.

A series of Federal Government handbooks on *Leading Practice Sustainable Development in the Mining Industry* (DRET / DITR) were also considered during the review:

- *Airborne Contaminant, Noise and Vibration.*
- *Evaluating Performance: Monitoring and Auditing.*
- *Hazardous Materials Management.*
- *Managing Acid and Metalliferous Drainage.*
- *Biodiversity Management.*
- *Community Engagement and Development.*
- *Cyanide Management.*
- *Working with Indigenous Communities.*
- *Mine Closure and Completion.*
- *Mine Rehabilitation.*
- *Risk Assessment and Management.*
- *Stewardship.*
- *Tailings Management.*
- *Water Management.*

2.5 International Standards and Guidelines

International environmental, sustainability and EIS standards and best practice guidelines were also considered during the review. In particular the review process of the EIS uses the principles, findings and recommendations outlined in:

- *Principles of Environmental Impact Assessment Best Practice* - International Association for Impact Assessment (IAIA, 1999).
- *Environmental Impact Assessment Regulations and Strategic Environmental Assessment Requirements: Practices and Lessons Learned in East and Southeast Asia* (World Bank, 2006).
- *Sustainable Development Framework Principles* (ICMM, 2003).

3.0 General Review of EIS

3.1 Environmental Planning and Assessment Regulation

This section addresses the following Director General Environmental Assessment Requirement:

The Environmental Impact Statement (EIS) for the development must meet the form and content requirements in Clauses 6 and 7 of Schedule 2 of the Environmental Planning and Assessment Regulation 2000.

Both Clause 6 and 7 of Schedule 2 of the *Environmental Planning and Assessment Regulation* 2000 are provided in Appendix A.

Key findings of the review, with respect to the above requirement, are summarised below:

- The form and content requirements of the EIS are in general met with respect to Clause 6, with the requirements of each sub-clause being specifically referred to in the EIS Main Report.
- The four principles of ecologically sustainable development have been addressed in Sections 9.7.1 to 9.7.4 of the EIS Main Report (Clause 7, Sub-Clause 4).
- Clause 6, Sub-Clause 1 requires a full description of the "*likely impact on the environment*" and the "*measures proposed to mitigate any adverse effects of the development*". For some aspects of the EIS this sub-clause has been met, however the level of detail and extent to which impacts are assessed and mitigation measures are developed in the EIS is not considered sufficient in many instances. Specific examples of these deficiencies are detailed in this report.

3.2 Project description

This section addresses the following Director General Environmental Assessment Requirement:

The EIS must include a detailed description of the development including:

- *Need for the proposed development.*
- *Justification of the proposed mine plan, including efficiency of coal resource recovery, mine safety, and environmental protection.*
- *Likely staging of development, including construction, operational and rehabilitation stages.*
- *Likely interactions between the development and existing, approved and proposed mining operations in the vicinity of the site.*
- *Plans of any proposed building works.*

Key findings of the review, with respect to the above requirement, are summarised below:

- A description of the Project is provided in the EIS Main Report (Section 3).
- However, key design criteria for the Project are not specified in the Project description, such as pit and overburden dump dimensions, design specifications and drawings, final void dimensions, tonnages and densities (in situ and post-mining) of ore and waste materials, relative proportions of ore and waste materials located above and below the water table (in situ

and post-mining), topsoil and subsoil stockpile locations, areas and volumes, extent of blasting exclusion zones, etc. The lack of key Project design criteria makes it difficult to fully assess the potential impacts of the Project.

- There are major discrepancies in estimates of disturbance and rehabilitation areas throughout the EIS. For example, the Rehabilitation and Mine Closure Strategy refers to a rehabilitation area of 3,384 ha, whereas the Project description states that the disturbance footprint will be 4,084 ha and the Soil Survey and Land Capability assessment reports a disturbance area of 5,630 ha. These discrepancies make it difficult to assess the potential impacts of the Project and difficult to verify the availability of sufficient soil resources for site rehabilitation.
- Water supply requirements (quantities and sources) and pit dewatering rates are not specified in the Project description. It appears that process water and potable water sources have not been confirmed. Water pipeline options from Mooki River are shown in the Project layout but not discussed. It is not clear whether the pipeline options related to water supply only, or water supply and off site discharge. Without this information, it is not possible to fully assess all potential impacts on surface water and groundwater.
- It has been stated that a sewage water treatment plant will be installed, and that "*the proposed site water management strategy and infrastructure will ensure that the Project has a negligible impact on the quality of surface runoff and receiving waters*". However, the site water management strategy and infrastructure is focussed on potential sediment-related impacts only. Details of water treatment infrastructure for sewage and other potential water quality issues are not provided.
- There will be a significant construction and operations workforce and a 24 hour operation, but the Project description does not confirm where the workforce will be accommodated. Without this information, it is not possible to fully assess all potential social impacts of the Project (which has been a key concern expressed by the community).
- The need for the proposed development is described in the EIS Main Report (Sections 3 and 9.2).
- Justification of the proposed mine plan is provided in the EIS Main Report (Section 9) and Appendix C. A number of Project alternatives were considered, however it is unclear whether consideration has been given to options such as (i) mining the Melville coal seam only (avoiding the deeper Hoskissons seam); and (ii) incorporating coal seam gas harvesting in the mine plan. Direct and indirect greenhouse gas emissions associated with the Project, relative to the Global Carbon Budget, have not been considered in the Project justification (see Section 6). Further justification for maintaining a final void in the Western Mining Area is also warranted given the predicted ongoing concentration of salinity in the final void and potential for long term contamination of receiving groundwater and surface water.
- The 21-month construction schedule and an indicative production schedule is provided in the EIS Main Report (Section 3; Tables 6 and 8). The mining schedule is also illustrated in the Groundwater Impact Assessment (Figure 10.1). Rehabilitation stages are described in Section 7.21, including clear illustration of the progressive approach to rehabilitation (plan views and cross-sections).
- A summary table of other coal mining and coal seam gas projects, including approved and currently proposed projects, is provided in the EIS Main Report (Section 2.2; Table 1). The Caroona Coal Project proposed by BHP Billiton is nearest the Watermark Project area (approximately 3 km south). The Werris Creek Mine (approved) is located approximately 20 km

south-east of the Watermark Project area and within the Gunnedah Basin. A large CSG field (Bando area of interest) exists to the immediate west of the Watermark Project area (AGE, 2013) but is not included in Table 1.

- Potential cumulative impacts are considered in Section 7 and primarily relate to groundwater, air quality, noise, ecology, traffic / transportation and social aspects. Regarding the cumulative impact assessment work undertaken, it should be noted that:
  - There may be significant uncertainties in predicted cumulative impacts on groundwater resources associated with the Watermark and Caroona Projects. These uncertainties have not been quantified.
  - Cumulative impacts on Mooki River were not considered in the Surface Water Impact Assessment. These impacts could be significant given the existing Werris Creek Mine in the Mooki catchment upstream of the Watermark Project area.
- Plans of proposed building works are provided in the EIS Main Report (Section 3) and Appendix B. However, no detailed design drawings have been provided for major Project infrastructure such as pits and overburden emplacement areas, nor water supply infrastructure, treatment systems, etc. Without this information, it is it difficult to fully assess the potential impacts of the Project.

3.3 Environmental planning instruments

This section addresses the following Director General Environmental Assessment Requirement:

The EIS must include consideration of all relevant environmental planning instruments, including identification and justification of any inconsistencies with these instruments.

Environmental planning instruments include State Environmental Planning Policies (SEPPs) and Local Environmental Plans (LEPs) that regulate land use and development. For the purposes of this review, higher level federal and state regulatory requirements have also been considered.

Key findings of the review, with respect to the above requirement, are summarised below:

- In general, this aspect appears to be addressed reasonably well in the EIS Main Report, Section 4.
- The following federal and state legislation relevant to the assessment and approval of mining projects have been referenced in the EIS:
  - Federal legislation
    - *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act, administered by the Commonwealth Department of Sustainability, Environment, Water, Population and Communities)
    - *Native Title Act 1993* (administered through the Commonwealth Native Title Act 1993).
  - NSW State legislation
    - *Environmental Planning and Assessment Act 1979* (administered by the NSW Department of Planning & Infrastructure) – The EP&A Act is the principal piece of legislation regulating the assessment, approval and operation of mining projects. If

approval is granted by the Minister, it is the primary approval instrument with which most other approvals must be consistent.

- *Environmental Planning and Assessment Amendment Act 2008 No 36*.
- *Mining Act 1992* (administered by the Department of Trade & Investment) – Mining leases are granted by DTIRIS under the Mining Act.
- *Protection of the Environment Operations Act 1997* (administered by the NSW Office of Environment & Heritage) – The main objectives of the POEO Act are to protect, restore and enhance the quality of the environment in NSW through pollution prevention and cleaner production, the reduction of harmful discharges and wastes, the reduction in the use of materials and improved re-use, recovery and recycling of materials.
- *Threatened Species Conservation Act 1995* (Administered by the NSW Office of Environment & Heritage).
- *National Parks and Wildlife Act 1974* (Administered by the NSW Office of Environment & Heritage).
- *Heritage Act 1977* (Administered by the NSW Department of Planning & Infrastructure).
- *Water Management Act 2000 and Water Act 1912* (Administered by the NSW Office of Water).
- *Dams Safety Act 1978* (Administered by the Dams Safety Committee).
- *Coal Mine Health and Safety Act 2002* (Administered by the Department of Trade & Investment).
- *Pipelines Act 1967* (Administered by the Department of Trade & Investment).
- *Native Vegetation Act 2003* (Administered by the NSW Office of Environment & Heritage).

- NSW State Environmental Planning Policies (SEPPs)
  - *State Environmental Planning Policy No 33—Hazardous and Offensive Development* (1992-129).
  - *State Environmental Planning Policy No 44—Koala Habitat Protection* (1995-5).
  - *State Environmental Planning Policy No 55—Remediation of Land* (1998-520).
  - *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007* (2007-65).
  - *State Environmental Planning Policy (State and Regional Development) 2011* (2011-511).
- Local Environmental Plans (LEPs)
  - *Gunnedah Local Environmental Plan 2012* (2012-304).
  - *Orana Regional Environmental Plan No 1—Siding Spring* (1990-583).
- Other Relevant Policies

- Of particular relevance, and also covered in the EIS, are the draft Strategic Regional Land Use Policies (SRLUP) and Aquifer Interference Policy (2012). On 7 March 2012, the NSW Government released two Draft SRLUPs concerning the use of agricultural land for mining and coal seam gas projects. The two policies are:
  - *Draft Strategic Regional Land Use Plan for the Upper Hunter*.
  - *Draft Strategic Regional Land Use Plan for New England North West*.
- The Draft Aquifer Interference Policy (2012) – Stage 1 has also been released. This policy sets out the proposed regulation of aquifer interference activities, including those associated with coal and CSG mining and exploration.

The NSW DPI has also proposed that the *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries)* 2007, which regulates mining and CSG projects, be amended to implement the key matters proposed in the Draft SRLUPs and the Draft Aquifer Interference Policy.

- While the main state and federal legislation involved in the regulation of mining project assessments is referred to in the EIS (as listed above) the following key documents were not cited or considered in the EIS:
  - *EPBC Act* 1999 - *Environmental Offsets Policy*
    - On 3rd October 2012 the Government released the national EPBC Act *Environmental Offsets Policy*, and this applies to any new referrals and variations to approval conditions from 2nd October 2012. It also applies to any projects currently under assessment for which a proposed decision has not yet been made.
    - This is an important consideration for the Watermark Project, given the substantial offset areas expected to be required and significant changes introduced in the new policy (see Section 7).
  - *Mining Regulation* 2010 (under the *Mining Act* 1992)
    - The amendments to the *Mining Act* 1992 and new *Mining Regulation* 2010 improve environmental regulation of the mining industry by:
      - Expanding the Government's powers to regulate mining activities, to ensure sound environmental and rehabilitation outcomes.
      - Introducing audit powers to promote compliance.
      - Requiring a rehabilitation cost estimate and disclosure of an applicant's environmental performance record in certain applications for authorisations.
      - Enabling consistency of approach with other environmental regulators.
  - *Nature Conservation Trust Act* 2001
    - *Nature Conservation Trust Amendment Act* 2010.
  - *Protection of the Environment Operations Act* 1997
    - *Protection of the Environment Operations Amendment (Environmental Monitoring) Act* 2010 No 85.
    - *Protection of the Environment Operations (General) Amendment (Pollution Incident Response Management Plans) Regulation* 2012.

- A number of key regulatory requirements under the Exploration License EL 7223 were documented in Section 2.5.1 (Exploration) but omitted from Section 4 (Regulatory Framework). This includes a number of special conditions that were added to EL 7223 in January 2012. Of particular note is the requirement in EL 7223 that "*any development approval sought by the licence holder within the initial term of the licence or during any extensions or renewals of the licence shall not include any of the following activities in the area covered by the licence: … open cut mining anywhere on the floodplain*". The current Project design would involve open cut mining (Eastern Mining Area) on the Mooki River floodplain, as reported in the Surface Water Impact Assessment. Hence, this key requirement of EL 7223 has not been met.

3.4 Risk assessment

This section addresses the following Director General Environmental Assessment Requirement:

The EIS must include a risk assessment of the potential environmental impacts of the development, identifying the key issues for further assessment.

Key findings of the review, with respect to the above requirement, are summarised below:

- A risk assessment was provided in Appendix F and appears to be broadly consistent with Australian and International standards and guidelines on risk assessment and management, although several deficiencies in the risk assessment process have been identified.
- There was insufficient explanation of the method used to conduct the assessment, including the criteria used and assumptions made to assess each risk. This is a particular concern given the qualitative nature of the assessment.
- The risk assessment report has been condensed into a single page and is therefore inadequately covered (over-simplified) in the EIS Main Report, Section 6. For example, the risk summary tables in the EIS Main Report (Section 6) represent broad 'issues' but do not correlate with individual 'impacts' as assessed in Appendix F.
- The Preliminary Risk Assessment identified only one "high" risk issue (*Ecology*) and five "significant" risk issues (*Aboriginal Archaeology and Cultural Heritage*, *Air Quality and Greenhouse Gas*, *Surface Water*, *Flooding and Groundwater*). All other preliminary risk issues were classified as "medium" or "low" risk. The "low" preliminary risk classification assigned to the *Geochemical* and *Rehabilitation and Final Landform* issues is misleading given the large tonnages of mine materials to be disturbed,dewatered, oxidised and leached (see Sections 4 and 8 for specific concerns relating to geochemistry / water quality and site rehabilitation).
- Following stakeholder engagement, a revision of the Preliminary Risk Assessment was undertaken to '*incorporate additional requirements'* (Chapter 6 – Risk Assessment) resulting in a Revised Risk Assessment. It is assumed from Table 1 in Appendix F that the Revised Risk Assessment also incorporates '*proposed management measures*'. Despite the consideration of proposed management measures, the preliminary "low" risk classifications assigned to *Geochemical* and *Rehabilitation and Final Landform* risk issues were upgraded to "medium".
- The list of "impacts" identified in Table 1 in Appendix F does not appear to be comprehensive. For example, one of the key risks will be associated with saline water seepage from OEAs (during operations and post-closure) however this was not identified in the risk assessment.

Furthermore, there is no mention of potential impacts on surface water hydrology, geomorphology, land subsidence, spontaneous combustion, etc.

- Very limited detail is provided on the '*proposed management measures*' in Table 1 in Appendix F. In most cases the measures refer generally to recommendations made in the technical appendices (many of which were not committed to in the EIS Main Report) and/or to management plans that are yet to be developed.
- Very little consideration has been given to distinguishing issues and impacts according to key Project stages - construction, operations and post-closure. Each stage of the project has different impacts and this should be clearly outlined in an EIS.
- A pertinent risk assessment guide overlooked in the EIS is the *Leading Practice Sustainable Development Program for the Mining Industry – 'Risk Assessment and Management'*. This handbook outlines risk assessment and management methods (including semi-quantitative risk assessment methods) specific to the mining industry, that could have been applied to produce a more transparent and robust risk assessment process in the EIS.
- A Hazards Analysis has been conducted as Appendix AC of the EIS. It is unclear how and why this differs from the Risk Assessment. This is discussed further in Section 11.

3.5 Detailed assessment of the key issues

This section addresses the following Director General Environmental Assessment Requirement:

The EIS must include detailed assessment of the key issues (Agricultural and Other Land Resources; Water Resources; Biodiversity; Heritage; Air Quality; Greenhouse Gases; Noise, Vibration and Blasting; Traffic and Transport; Visual; Waste; Hazards; Social and Economic; Rehabilitation), and any other significant issues identified in the risk assessment, which includes:

- *A description of the existing environment, using sufficient baseline data.*
- *An assessment of the potential impacts of all stages of the development, including any cumulative impacts, taking into consideration relevant guidelines, policies, plans and statuses.*
- *A description of the measures that would be implemented to avoid, minimise and if necessary, offset the potential impacts of the development, including proposal for adaptive management and/or contingency plans to manage any significant risks to the environment.*
- *Consolidated summary of all the proposed environmental management and monitoring measures, highlighting commitments included in the EIS.*

Key findings of the review, with respect to the above requirement, are summarised below:

- A description of the existing environment and some baseline data are provided in the EIS Main report (Section 2). Additional baseline data specific to each of the key issues is presented throughout Section 7, although it would have been clearer to keep all information on the existing environment and baseline data in Section 2.
- There are significant gaps in the baseline data, particularly relating to water quality (Section 4) and ecology (Section 7). As a result, it may not be possible to distinguish Project-related impacts on the environment from external influences.

- Furthermore, some of the key baseline information and figures from the technical appendices has been omitted from the EIS Main Report (eg. hydrology, groundwater levels, surface and groundwater quality).
- An assessment of the potential impacts of the Project, including cumulative impacts, is provided in the EIS Main report (Section 7). However:
  - In general, there is no clear distinction of impacts associated with the construction, operations and post-closure phases of the Project.
  - There is no clear distinction of potential impacts (without management) vs residual impacts (with consideration of proposed management measures). In general, it is assumed that the assessment is based on residual impacts only, although this is not always clear.
  - The relative importance of issues is not clearly reflected in the structure of Section 7, nor summarised or consolidated at the end of the section.
  - Several key issues were not adequately covered in the technical appendices nor the EIS Main Report, as detailed later in this report.
  - Furthermore, the attention given to each issue was not always commensurate with the significance of that issue (eg. 16 pages on visual impacts vs 2 pages on environmental geochemistry).
  - The logic of the structure of Section 7 is also unclear and reflects a lack of appreciation of interrelated issues. For example, the geophysics survey has been assessed as a potential impact rather than a component of the groundwater baseline study and impact assessment. Geochemistry has been assessed as a potential impact rather than a component of the surface water and groundwater quality impact assessments. Flooding and geomorphology have been assessed as distinct from “surface water impacts”.
  - The above issues are particularly significant given the lack of an EIS Table of Contents.
- A description of the measures that would be implemented to avoid, minimise and if necessary, offset the potential impacts of the development, is provided in the EIS Main report (Section 7). In addition, proposed baseline and rehabilitation/closure environmental monitoring programs are provided in Sections 2.6 and 7.21. However:
  - In general, very limited detail is provided on the proposed management measures.
  - There appears to be very limited commitment to leading practice environmental and social management practices in the mining industry. The only exceptions include air quality (Section 7.6) and noise (Section 7.8).
  - Several management measures have been documented or recommended by specialists in the technical appendices but not carried through to the EIS Main Report.
  - Management measures have not been detailed in an Environmental Management Plan. This should be a key component of the EIS documentation and is a Federal Government (SEWPaC) requirement.
  - An operational monitoring plan for the 30 year mine life has not yet been developed.
- A consolidated summary of environmental management and monitoring commitments is provided in the EIS Main Report (Section 8). In addition, social management commitments are documented in Section 7 (Table 96). However:

- Many of the environmental management commitments are not well defined, but instead are commitments to develop management plans at a later stage.
- As noted above, several management measures have been documented or recommended by specialists in the technical appendices but not included in the management commitments.
- No consideration has been given to the need for an Environmental Emergency Response Plan.

Additional comments specific to each of the key issues provided in Sections 4-11 of this report.

3.6 Commonwealth Government requirements

This section addresses the following Director General Environmental Assessment Requirement:

The EIS must address the requirements of the Commonwealth Department of Sustainability, Environment, Water, Populations and Communities (SEWPaC).

For reference, SEWPaC requirements are provided in Appendix B of this document.

Key findings of the review, with respect to the above requirement, are summarised below:

- SEWPaC requirements are itemised in Table 17 (Section 5) of the EIS with clear references to the most relevant EIS sections addressing each item. In many cases, however, the item is not adequately covered in the referenced section, and in some cases the item does not appear to have been considered at all. Specific examples are provided throughout this review.
- General information (SEWPaC Requirement 1):
  - This aspect appears to be adequately addressed in Section 1 of the EIS Main Report.
- Description of the controlled action (SEWPaC Requirement 2):
  - This aspect has been addressed in the EIS Main Report Section 3, although a number of deficiencies in the Project description have been identified, as discussed in Section 3.2 of this report, which make it difficult to fully assess the environmental impacts of the Project.
- Description of the existing environment (SEWPaC Requirement 3):
  - Some aspects of the ecological survey methods were consistent with this SEWPaC requirement, however the study area was not clearly defined and areas adjacent to the Project boundary have not been surveyed. These and other concerns relating to SEWPaC Requirement 3 are discussed in Section 7.4.1 of this report.
- Description of the relevant impacts of the controlled action (SEWPaC Requirements 4-6):
  - The relevant impacts are discussed briefly in the EIS (and in more detail in Appendices K, L and M) however a number of concerns relating to the impact assessment have been identified as discussed in Section 7.4.2 of this report.
- Information relating to water (SEWPaC Requirements 7-19):
  - The EIS does not clearly demonstrate how the Proponent will comply with all relevant environmental laws and policies pertaining to water quality management. No clear water quality triggers were identified in the EIS Main Report, and in the absence of a comprehensive water quality baseline (see below) it is difficult to establish suitable triggers.

Furthermore, a number of key deficiencies were identified with regards to proposed water quality management measures during operations and post-closure (refer to Section 4). As a result, the requirements of SEWPaC Item 7 are not adequately addressed.

- SEWPaC Requirements 8-13 appear to be adequately addressed.
- SEWPaC Requirement 14 is not fully addressed due to major gaps in the surface water quality and groundwater quality baseline data sets, as described in Section 4. As a result, it may not be possible to distinguish Project-related impacts on receiving surface water and groundwater from external influences.
- SEWPaC Requirement 15 requires "data and information on proposed discharge water quality, including timing of discharges, concentrations and loads of toxicants and stressors". There is conflicting information throughout the EIS regarding discharge requirements. Furthermore, the potential for uncontrolled off-site discharge from sediment dams is mentioned, but details on discharge quality and management measures are very limited. This is discussed further in Section 4.3.3.
- Water quality management requirements associated with sewage treatment and waterway crossings are briefly covered in Sections 7.25.2 and 7.5.4, respectively, however associated monitoring requirements are not documented. SEWPaC Requirement 16 is therefore not fully addressed.
- Cumulative impacts on groundwater levels have been independently assessed, with the results discussed in the Groundwater Impact Assessment (Appendix T). However, cumulative impacts on surface water hydrology have not been considered. SEWPaC Requirement 17 is therefore not fully addressed.
- A comprehensive water quality risk management and monitoring plan (SEWPaC Requirement 18) has not been developed. This is discussed further in Section 4.4.7.
- Not all of the key water quality issues have been considered (eg. nutrients, dissolved metals, hydrocarbons) as required under SEWPaC Item 19.

- Proposed safeguards and mitigation measures (SEWPaC Requirement 20):
  - A description of mitigation measures is provided in the EIS Main Report (Section 7) although a number of issues have been identified (see Section 3.5).
  - Of particular relevance to SEWPaC Requirement 20 is that:
    - Mitigation measures are not always "based on best available practices". Reference is made to best practice mitigation in the sections on air quality, noise and rehabilitation (only).
    - The "predicted effectiveness of the mitigation measures" has not been assessed. As previously noted, it appears that the impact assessment has been conducted under the assumption that mitigation measures will have been implemented, and therefore applies to "residual impacts" only.
    - An EMP has not been developed as required by SEWPaC. Table 13 in Section 4.8 of the EIS Main Report states that "environmental management plans" will be prepared following the granting of Development Consent". The lack of an EMP is a key deficiency of the current EIS documentation.

        - The cost of the key mitigation measures is provided in the EIS Main Report (Section 3; Table 10). This includes $150 m for haul road dust suppression, $30 m for noise management and $5 m for infrastructure modifications. Other environmental costs are estimated in the Economic Assessment (greenhouse gas impacts $88 m; surface water $2 m; groundwater $2 m; road transport impacts $0.3 m). All other costs are assumed to be "minimal" in comparison, or have been incorporated into "development and operating costs". These cost assumptions are difficult to verify in the absence of an EMP and are therefore likely to have been underestimated.
    - Based on the above concerns, SEWPaC Requirement 20 is not fully addressed.
- Offsets (SEWPaC Requirement 21):
    - Offset requirements have been assessed in the EIS however the assessment has not been undertaken in accordance with SEWPaC's new Environmental Offsets Policy (2012). This and other concerns relating to SEWPaC Requirement 3 are discussed in Section 7.4.3 of this report.
- Other approvals and conditions (SEWPaC Requirement 22):
    - This aspect appears to be adequately addressed in Table 13 in Section 4.8 of the EIS Main Report.
- Economic and social matters (SEWPaC Requirement 23):
    - These aspects have been addressed in the EIS Main Report Sections 7.26 and 7.27, and supporting documents (Appendices AE and AF). A review of these aspects is provided in Section 9 of this report.
- Environmental record of person proposing to take the action (SEWPaC Requirements 24-25):
    - In Section 1.2 of the EIS Main Report, it is stated that "Shenhua Watermark has not been the subject of any proceedings under Commonwealth, State or Territory law for the protection of the environment or the conservation and sustainable use of natural resources".
    - Whilst not explicitly required by SEWPaC, a description of the environmental record of the Proponent in relation to their existing international mining operations would be more relevant for the purposes of this assessment.
- Information sources (SEWPaC Requirement 26):
    - Information sources generally appear to be adequately addressed throughout the EIS. However, there is very limited discussion of "uncertainties" in the environmental information provided throughout the EIS Main Report.
- Consultation (SEWPaC Requirements 27-28):
    - This aspect has been addressed in the EIS Main Report Section 5. A review of this aspect is provided in Section 3.7 of this report.

3.7 Stakeholder Consultation

This section addresses the following Director General Environmental Assessment Requirement:

The EIS must:

- *Describe the consultation process used and demonstrate that effective consultation has occurred.*
- *Describe the issues raised by public authorities, service providers, community groups and landowners.*
- *Identify where the design of the development has been amended in response to issues raised.*
- *Otherwise demonstrate that issues have been appropriately addressed in the assessment.*

Key findings of the review, with respect to the above requirement, are summarised below:

- Chapter 5 of the EIS Main Report, and Appendix E, details the stakeholder consultation process that was undertaken for the Project.
- During preparation of the EIS, consultation was conducted with the stakeholders identified in the Director General Requirements, as well as other stakeholders such as service providers, local community groups and the Aboriginal community (detailed in Section 5.3 of the EIS).
- The EIS Main Report (Section 5.4.5) also summarises the key concerns raised during community consultation. These include potential air quality, noise and blasting impacts, visual amenity issues, cumulative impacts, employment and economic issues, water management, rail and road traffic impacts, and community contributions.
- A detailed overview of the general issues raised by each stakeholder and how these are addressed in the EIS is provided in Section 5.4. The extent to which these requirements have been addressed by the EIS are covered throughout this review, with a focus on the requirements of the primary stakeholders (Director General and SEWPaC).
- There are limited details in the EIS regarding plans for ongoing stakeholder engagement.

3.8 Plans and Documents

This section addresses the following Director General Environmental Assessment Requirement:

The EIS must include all relevant plans, architectural drawings, diagrams and relevant documentation required under Schedule 1 of the Environmental Planning and Assessment Regulation 2000. These documents should be included as part of the EIS rather than as separate documents.

Key findings of the review, with respect to the above requirement, are summarised below:

- Detailed engineering design drawings of project infrastructure / buildings are provided in Appendix B, however the EIS is lacking design drawings / cross-sections of pits, waste dumps and the final void (general conceptual layouts were provided only).
- The Project layout excludes key facilities and disturbance areas such as topsoil and subsoil stockpile locations and the extent of blasting exclusion zones. It is not clear whether these would extend beyond the Project Boundary and/or Disturbance Boundary shown, nor whether they have been considered in disturbance area estimates.

- In addition, the Project description refers to infrastructure such as water, power and communications that will be located outside the Disturbance Boundary (and quite possibly the Project Boundary) among other facilities. No plans have been provided for such infrastructure.
- Furthermore, it is unclear whether the Disturbance Boundary is consistent with the area reported in the Project description (4,084 ha) or alternative estimates reported in the Rehabilitation and Mine Closure Strategy (3,384 ha) and the Soil Survey and Land Capability Assessment (5,630 ha).
- A number of key Project design, baseline and impact assessment figures have been produced for the technical appendices but omitted from the EIS Main Report. For example, the Groundwater Impact Assessment includes figures illustrating the progression of mining, hydrogeological cross-sections, baseline hydrogeological data, adjacent mining and coal seam gas projects (proposed and approved) and maps of predicted seepage zones from the OEAs.

3.9 Potential Impacts Beyond Director General Requirements

The following potential impacts, beyond the Director General requirements, were identified but not considered or fully addressed in the EIS:

- Local subsidence and/or instability of pit wallrock and backfilled waste material in mine pits.
- Regional land subsidence surrounding the Project area associated with pit dewatering.
- Environmental emergencies (eg. uncontrolled discharge during high rainfall events; water storage dam wall failure).
- Neutral Metalliferous Drainage and/or Saline Drainage associated with sulfide oxidation.
- Community health and safety.
- Potential impacts on local meteorological conditions (eg. rainfall and wind patterns) and implications for local agriculture associated with modified landforms.

These issues are discussed in more detail in appropriate sections throughout this report.

4.0 Water Impacts

4.1 Overview and Assessment

Whilst some very thorough assessment work has been undertaken there remain some significant uncertainties in the predicted Project-related impacts on surface water and groundwater, and details of the management measures proposed to address these potential impacts and uncertainties.

To fully understand the water impacts associated with this development, and ensure that adequate management measures are in place, the following actions are considered necessary:

- Develop a comprehensive surface water quality and groundwater quality baseline, in order to ensure that any Project-related impacts on receiving surface water and groundwater can be distinguished from external influences.
- Review the site operational water balance and develop a post-closure water balance, to ensure that Project water supply requirements and off-site discharge volumes are clearly defined, including uncertainties in these estimates.
- Clarify water sources and water supply requirements from each source, including Mooki River (and review hydrological impacts accordingly) during operations and post-closure.
- Conduct further drilling and/or geophysics to verify the extent of the Gunnedah Formation and any high permeability pathways that may connect the Project area and Gunnedah Formation, to reduce the uncertainty associated with modelled impacts on groundwater levels.
- Conduct additional geochemical testwork and block modelling to assess and quantify the potential for AMD, NMD and salinity generation and fluxes from pit wallrock and waste materials (currently no data are available for pit wallrock material, and the potential for long term NMD and saline drainage associated with sulfide oxidation has not been assessed).
- Utilise water balance data, baseline water quality (including dust suppression water chemistry) and geochemical testwork results to develop an internally consistent site salinity balance and management strategy for operations and post-closure, to address the potential for significant accumulation of salt on site and the expected short-term salinity flushing episodes and long term seepage of saline water from the Overburden Emplacement Areas (OEAs).
- Develop a Groundwater Management Plan that addresses the potential for drawdown impacts on regional groundwater systems that may exceed modelled predictions.

The comments made above are based on a review of work undertaken in relation to water impacts (Section 4.2), key findings of this work as identified in the EIS (Section 4.3), and the issues, uncertainties and gaps in the EIS identified in Section 4.4.

4.2 Work Undertaken

Key studies undertaken that are relevant to water impact assessment for the Watermark Project are:

- Groundwater impact assessment (EIS Main Report, Section 7.1; Appendix T).
  - Numerous hydrogeological studies were undertaken by GHD from 2009 to 2012. Subsequently AGE was commissioned by the Proponent to complete the Groundwater Impact Assessment. The impact assessment was based on a field program encompassing routine monitoring of groundwater levels at 103 sites, some (limited) groundwater quality monitoring, field and laboratory measurement of hydraulic conductivity in key hydrogeological units, a census of private farm bores, follow-up installation of bores in the weathered Permian aquifer, radiocarbon and tritium age dating of groundwater, and a site survey of groundwater fed springs and soaks. In addition, AGE commissioned Groundwater Imaging (2011) to conduct a geophysical survey to assess the extent of the Upper Namoi alluvium and any other potential conduits or barriers to groundwater flow into the mining areas (described below). AGE then developed a three-dimensional groundwater model to assess the potential impacts of the Project on local and regional groundwater, and receiving surface water (Mooki River) during operations and post-closure. Additional studies on groundwater quality (Terrenus, 2012) and subsidence (SRK, 2012) are also appended to the AGE report.
- Geophysical survey (EIS Main Report, Section 7.2; Appendix V).
  - A Time Domain Electromagnetic geophysics survey was completed by Groundwater Imaging (2011) over selected areas of Exploration Licence 7223 during September 2011 in order to define the extent of unconsolidated alluvial material and any other potential conduits or barriers for groundwater flow into the proposed open cut mining areas. The survey was also intended to address the relevant Director-General's Environmental Assessment Requirement to provide "*A definition of the limit of the Upper Namoi Alluvium, and justification for the nominated limit*." Some of the proposed survey areas could not be accessed due to agricultural use at the time of the survey.
- Surface water impact assessment (EIS Main Report, Section 7.3 and 7.4; Appendix S).
  - Baseline meteorological, hydrology and surface water quality data have been provided for the Mooki River catchment including tributaries within the Project area. Long term flow data were reviewed and used to develop flow duration curves for the Mooki River at Breeza (1957-2011) and Caroona (1965-2011). Baseline surface water quality data were collected for 12 sites from October 2009 to December 2010 (5 sites in Mooki River, 2 sites in Native Dog Gully, 1 site in Quirindi Creek, Currabubula Creek and Watermark Gully). Parameters included pH, EC, DO, TSS, TDS, sulfate, TKN, TP, turbidity, alkalinity and a selection of total metals. The proposed site water management strategy (for operations) was described. Potential impacts on surface water that were assessed included surface water quality (sediment-laden runoff and salinity), surface water hydrology (changes in catchment areas), water demand and licensing requirements and implications for local catchment and Mooki River flooding. A hydrology (rainfall runoff) model was then developed for the Mooki River catchment, including Lake Goran. WRM developed a mine water balance for the operations phase, and a post-closure final void water balance. A surface runoff "salt balance" and final void water quality (salinity) model was also developed. Detailed flood modelling and impact assessment was conducted for Watermark Gully and Mooki River. Appendix S provides management measures for

surface water runoff, erosion and sediment control, and a surface water monitoring program, including preliminary trigger values for surface water quality.

- Geomorphological impact assessment (EIS Main Report, Section 7.5; Appendix X).
  - This study was prepared in consideration of the DGRs input from the NSW Office of Water (NOW). Specifically, NOW requested the EIS include: "*A geomorphic assessment of Native Dog Gully (Dog Trap) and Watermark Gully and associated tributaries within the mining area, including details of stream order (using the Strahler system), river style and energy regimes both in channel and on any adjacent floodplains*". The study involved a desktop assessment, site investigation and interpretation of outputs from hydrologic and hydraulic studies undertaken by WRM (2013; Appendix S).
- Geochemical assessment (EIS Main Report, Section 7.18; Appendix W).
  - The geochemical assessment aimed to assess the potential water quality impacts associated with sulfide oxidation (which can generate acid, metalliferous and/or saline drainage). 104 overburden/interburden samples, 91 potential coal reject samples, and 18 coarse reject/tailings samples were obtained from 14 drill holes and subjected to static geochemical testwork. In addition, 12 composite samples underwent kinetic geochemical test work over 12 weeks. Additional testwork was conducted on selected samples to assess the potential for spontaneous combustion and potential structural stability issues related to dispersion or erosion. Results from the geochemical assessment were then used as a basis for a Seepage Water Quality Assessment (Terrenus, 2012). This study assessed the likely water quality (salinity) characteristics of run-off and seepage from the waste materials and discussed the potential impacts to surface water and groundwater.

Water-related agricultural and ecological impacts are discussed in Sections 5 and 6, respectively.

4.3 Key Findings and Issues Reported in EIS

4.3.1 Groundwater Impact Assessment

Key findings of the Groundwater Impact Assessment are summarised below:

- Baseline data
  - The regional groundwater flow direction typically follows topography, from the highlands of the Liverpool Ranges in the south of the catchment down into the Upper Namoi alluvial floodplain and along the alignment of the Quirindi Creek and Mooki River.
  - Barrett (2010) examined the hydrographs for monitoring bores across all 12 zones in the Upper Namoi and concluded, "*since 2000 the overall water level trend in the Upper Namoi alluvium has been declining, however the drawdowns in the last two years have not been as significant compared to previous years. This is due to a decline in usage resulting from reduced access to entitlement and the wetter conditions since 2008*".
  - Permian Formation groundwater aquifers have salinity concentrations of <3,000 mg/L TDS around ridgelines within the Project area, increasing to 5,000-10,000 mgl/L TDS downgradient of the ridgelines, and 10,000-20,000 mg/L TDS toward the alluvial plains. In the Upper Namoi alluvium (adjacent to the Project area) the Narrabri Formation also contains brackish to saline groundwater (>10,000 mg/L TDS) however the underlying Gunnedah Formation aquifer salinity is much lower (1,200-3,000 mg/L TDS).

- Groundwater seepage into pits
  - Groundwater seepage rates into the pits have been estimated to peak at <0.5 ML/day or 183 ML/year (Eastern Mining Area), 2.1 ML/day or 756 ML/year (Southern Mining Area) and 1.2 ML/day or 430 ML/year (Western Mining Area). The overall peak seepage rate is estimated at 756 ML/year, corresponding to the peak seepage rate into the Southern Mining Area. The cumulative volume of groundwater seepage rates into the pits over 30 year mine life is approximately 5,500 ML (5.5 GL), which represents <0.1% of the relevant extraction limits.
- Impacts on groundwater levels and flow rates associated with dewatering
  - In the Permian units, groundwater drawdown was predicted to be most significant from the Southern Mining Area operations, with a drawdown zone extending up to 3.2 km from the mining area. Drawdown depths in the Permian were estimated at up to 25 metres beneath the Narrabri Formation (aquitard) and up to 2 metres beneath the Gunnedah Formation (aquifer).
  - The geophysical survey indicates that there may be some contrast in hydraulic properties of the alluvium in the embayment zones and the dividing bedrock spurs, however, the survey did not suggest the presence of any large-scale bedrock structures that could connect the proposed mining areas with the Gunnedah Formation. Therefore, for the purposes of groundwater modelling, it was assumed that the proposed mining will not be in direct hydraulic connection with the unconsolidated alluvial aquifer. Further information on the geophysical survey is provided in Section 4.2.2.
  - While the mining areas were not assumed to directly intersect the Narrabri and Gunnedah Formations, it was acknowledged that depressurisation of the underlying Permian units will result in downward vertical flow from the alluvial aquifers into the Permian units, and hence lowering of groundwater levels in the unconsolidated alluvial aquifer.
  - In the Gunnedah Formation (as with the Permian units), drawdown was predicted to be most significant from the Southern Mining Area operations, with a drawdown zone extending up to 3.9 km from the mining area. Drawdown depths were estimated at 1-2 metres, which is comparable to seasonal variations (± 1-2 metres). This was considered acceptable with regards to the Aquifer Interference Policy (AIP) requirement that the Project should not induce a decline of >2 metres at any water supply bore.
  - In contrast, a drawdown of up to 3.5 m in the Gunnedah Formation was reported in the impact assessment section on Stygofauna (EIS Main Report, Section 7.12) significantly higher than the value reported in the Groundwater Impact Assessment.
  - The decrease in groundwater flow rates from the Permian units to the overlying unconsolidated alluvium was estimated to peak at around 0.3 ML/day or 101.8 ML/year in Groundwater Management Zone 7 (and substantially lower in Zones 3 and 8). This was not considered to be a significant impact given that the average pumping rate from a single licensed agricultural bore in the Upper Namoi alluvium (within 10 km of the Project boundary) is 142 ML/year.
  - The majority (90%) of this 0.3 ML/day reduction in groundwater flow was predicted to affect the Narrabri Formation (where yields and water quality are poorer) with the remaining 0.03 ML/day lost from the Gunnedah Formation.

  - The impacts described above were generally predicted to peak during the later stages of mining and progressively decrease in magnitude thereafter as groundwater rebounds. Post-closure, it was predicted that groundwater will recover to above pre-mining levels in the Eastern and Southern Mining Areas.

- Impacts on surface water flows
  - The groundwater model found that water loss from the Mooki River to the underlying aquifer would increase by up to 0.13 ML/day during mining operations. This was considered to be insignificant as it represents only 0.4% of baseline estimates of total river leakage along the Mooki River. It was predicted that surface flows will have recovered within 30 years post-closure.
  - The cumulative surface water loss was estimated at 323 ML over the mine life, increasing to 489 ML over 30 years post-closure. This too was considered insignificant, representing only 0.02% of the average river flow at Breeza.
  - Following groundwater rebound, it was estimated that:
    - Flows to the Mooki River will have increased slightly (by 0.02 ML/day), representing an increase of only 0.07%, relative to baseline levels (27.3 ML/day).
    - In addition, permanent zones of seepage were predicted to occur at 'spill points' along the base of the Eastern and Southern Mining Areas. Seepage rates were estimated at up to 90 kL/day from the Eastern Mining Area and up to 60 kL/day from the Southern Mining Area.
    - There will be a permanent surface water body in the final void of the Western Mining Area. The water body was predicted to take between 100 and 2000 years to reach equilibrium (depending on model assumptions) but was not expected to overflow. The final water level was predicted to be 20-30 metres below ground.
- Impacts on groundwater and surface water quality
  - The geochemical assessment (see below) reported that leachate from mine waste materials is conservatively estimated to have an initial salt concentration of up to 5,000 mg/L, and that the concentration of seepage/leachate/run-off will decrease over time. Terrenus (2012) applied the upper limit salinity estimates based on column leach testwork (5,000 mg/L) to the predicted long-term seepage rates to estimate salt loads from from the Eastern (average 2-8 kg salt / ha / day) and Southern Mining Areas (average 5.6-23 kg salt / ha / day). These salt loads were regarded as low impacts.
  - The potential impacts on groundwater salinity during operations were assumed to be insignificant as baseline data indicates the groundwater (at least in the Narrabri Formation) is already brackish to saline and of limited agricultural use, and the water quality released from the Southern and Eastern Mining Areas will likely be of a better quality than typically encountered in the Narrabri Formation. Post-closure, it was assumed that the expected increase in groundwater levels to above pre-mining levels will lead to a progressive decrease in groundwater salinity around the mines.
  - The potential impacts on surface water (Mooki River) salinity during operations were assumed to be insignificant as there will be a hydraulic gradient from the river towards the base of the mining areas. Post-closure, it was assumed that groundwater salinity will not be impacted (as noted above) hence there would be no potential for increased salinity in receiving surface waters.

- It was recognised that other proposed mining and gas projects within the Liverpool Plains area may also result in depressurisation of the Permian. Potential cumulative impacts on groundwater levels have been assessed in a separate study by Schlumberger (2012). The extent of the 1 metre drawdown contour was predicted to increase to 5 km from the Southern Mining Area. This increase was attributed to the proposed Caroona Coal Project. Drawdown in the Gunnedah Formation aquifer was predicted to be less than 1.5 metres and generally of a similar magnitude in Zone 7 to that predicted by the AGE model.
- A peer review of the AGE report was undertaken by Heritage Computing who concluded that the model was developed competently and is regarded as "fit for purpose" for addressing the potential environmental impacts and estimating indicative dewatering rates.
- The key focus of the groundwater management plan, as documented in the Main Report, is to obtain relevant water licenses to account for water taken as a result of the Project. Of most significance, the predicted peak annual water take (during mining) is up to 101.8 ML/year (Namoi Groundwater Zone 7), 756 ML/year (Porous Rock – Gunnedah Oxley Basin, Other), 33 ML/year (Porous Rock – Gunnedah Oxley Basin, Spring Ridge), 47.5 ML/year (Mooki River)[2]. An additional 600 ML/year is expected to be required for Project water supply, and will require licenses for Mooki River and/or Namoi Groundwater Zones 3, 7 and/or 8. In addition, several potential management options were identified in the Groundwater Impact Assessment.

4.3.2 Transient Electromagnetic Geophysical Survey

Key findings from the geophysical survey are summarised below:

- The alluvium of the Liverpool Plains (Narrabri and Gunnedah Formations) was revealed as an extremely high conductivity layer. Within this alluvium, variations probably represent a contrast between heavy clays and lighter and coarser sediment.
- Very high conductivity unconsolidated alluvium of the Liverpool Plains appears to be limited to the low flat land, extending to only a few tens of metres deep, and most conductive near the alluvium boundary.
- Drilling and seismic profiling clearly indicated that the TEM has identified a diffuse base to the alluvium / weathered bedrock. In other words, the top of the pre Quaternary sediment beneath the alluvium is weathered so as to give similar geophysical responses, in many places, to the Quaternary plains sediment. Hence, the TEM survey cannot, in isolation, distinguish between weathered Permian bedrock and less saline / clayey sediment (Gunnedah Formation).
- In the ridge country surrounding the plains, some high conductivity features were interpreted as either weathered Permian bedrock or palaeochannels.
- Some steeply dipping high conductivity features were interpreted as faults hosting saline groundwater.

[2] This is estimated at 153 ML/year in Appendix S.

4.3.3 Surface Water Impact Assessment

Key findings from the Surface Water Impact Assessment are summarised below:

- The Mooki River is generally characterised by near-neutral to slightly alkaline pH (but with a maximum reported pH of 12.2) and salinity ranging from 89 to 2,200 µS/cm (fresh to brackish). Near-neutral to slightly alkaline pH's were reported in Watermark Gully and Native Dog Gully, although salinity values differed notably (14-266 µS/cm and 3-48,200 µS/cm, respectively).
- Phosphorus and total metal concentrations (Cr, Cu, Fe, ± Pb, ± Zn) are reportedly elevated in all three streams. Sulfate was also elevated in Native Dog Gully. The relative proportion of metal concentrations in dissolved vs suspended forms is unknown.
- Median flows in the Mooki River at Breeza and Caroona are in the order of 10 ML/day. The flow-duration relationship for Mooki River at the Breeza and Caroona gauges indicates that flow is non-zero about 85% of the time (ie. there is no flow 15% of the time). The volumetric runoff coefficient is typical of natural Australian catchments, averaging around 4%. Very little runoff is generated by the catchment when annual rainfall is less than about 500 mm. Once annual rainfall exceeds this value, the volume of surface runoff increases substantially.
- The following potential impacts of the Project on surface water resources were identified:
  - Impacts on regional water availability due to the potential need to obtain water from external sources to meet operational water requirements of mining operations;
  - Adverse impacts on the quality of surface runoff draining from the disturbance area to the various receiving waters surrounding the Project;
  - Adverse impacts on downstream water quality in Watermark Gully associated with possible overflows from the Mine Water Management System;
  - Loss of catchment area draining to Watermark Gully, Native Dog Gully and Lake Goran due to capture of runoff within onsite storages and the open cut mining; and
  - Interference with flood flows along Watermark Gully and Native Dog Gully.
- The water requirements of the Project were investigated using a detailed site water balance model. The model results may be summarised as follows:
  - On average, different stages of mining will operate with a net water deficit of the order of 20 to 160 ML/year (in reality, the site water balance will vary significantly from year to year, depending upon climatic conditions).
  - On average, water collected on site, such as groundwater inflow and surface runoff to mining pits and storages should meet all mine water demands about 90% of the time.
  - There is a 10% chance that the volume of external water supply required in any year from Year 4 to Year 19 will be of the order of 300 to 600 ML/year.
  - Under extreme drought conditions (1% chance), the annual volume of external water supply could potentially be 900 ML/year.
- During operations, catchment areas were predicted to reduce by <1% (Mooki River), 17% (Watermark Gully), 29% (Native Dog Gully) and <0.4% (Lake Goran). Post-closure, the most significant change will be an increase of around 13% in the Watermark Gully catchment area.
- The expected impact of the Project on stream flows was estimated for Watermark Gully, during operations and post-closure, by estimating changes to the flow duration curve. Impacts of the

Project on Mooki River flows were not assessed in the Surface Water Impact Assessment, but were covered in the Groundwater Impact Assessment.

- Water balance calculations for the operations phase indicate gross water inputs of 1,185 ML/year (Year 2) to 2,037 ML/year (Year 25) and comparable gross water outputs (1,203 ML/year in Year 2; 2,069 ML/year in Year 25). The average water deficit was predicted to be highest in Year 5, at up to 162 ML/year. To account for 90th percentile (dry) rainfall, the peak annual Project water demand was estimated at 600 ML.
- Water balance calculations for the operations phase indicate that average off-site discharge volumes of up to 307 ML/year (Year 21) can be expected.
- Post-closure water balance simulation of the final void shows that the water level is expected to reach an equilibrium water level approximately 20 to 30 metres below the overflow level. The lake will take approximately 100 years to reach the equilibrium level. This estimate is substantially lower than that provided in the Groundwater Impact Assessment (2000 years).
- The key water quality expected during operations is related to sediment-laden runoff from disturbed areas. The extent of this potential impact has not been quantified. The salinity of surface runoff (in Native Dog Gully, Watermark Gully and Lake Goran) was also predicted to increase during operations. A maximum total average salt load of 65.7 t/day was estimated; this represents only 0.8% of the pre-mine salt load from these three sources. No other potential surface water quality impacts during operations were considered in the EIS.
- The key water quality expected post-closure reported by WRM is related to increasing salinity concentrations in the final void (Western Mining Area). The salinity was predicted to increase from around 3,000 mg/L to nearly 30,000 mg/L over a 450 year period post-closure, and it appears a similar rate of increase can be expected thereafter. Seepage from the Eastern and Southern Mining Areas (post-closure) was discussed in the Groundwater Impact Assessment. These seepages could affect water quality in the Native Dog Gully and Mooki River, although not mentioned in the Surface Water Impact Assessment. No other potential surface water quality impacts post-closure were considered in the EIS.
- A detailed flood modelling study of Mooki River indicates that, under a 100 year ARI design flood event, a small part of the Eastern Mining area will be inundated to 1.7 metres. A shaped levee embankment may be required to prevent flooding of the mining areas. The levee would have the potential to increase flood levels by up to 5 mm. Based on this information, it was concluded that the Project will not impact flood behaviour on the Mooki River floodplain.
- A detailed flood modelling study of Watermark Gully indicates that, under a 100 year ARI design flood event, floodwaters may encroach on a small part of the Western Mining Area. The upper reaches of Watermark Gully will be partially filled in for development of the OEA for the Western Mining Area. As a result, the main channel of Watermark Gully will be relocated to the east.
- Proposed management measures for surface water during operations include:
  - Obtaining water from external sources under appropriate Water Access Licences to ensure no adverse impacts on water availability for other licensed water users.
  - Implementing a site water management strategy to minimise the impacts of the Project on downstream water quality during operations. The strategy is focussed on sediment-related water quality impacts.
  - Excess water will only be released from site if water quality is acceptable, or during a rainfall event that exceeds the design capacity of the sediment control system.

4.3.4 Geomorphological Impact Assessment

Key findings from the Geomorphological Impact Assessment are summarised below:

- A total of four different stream types were identified within the study area: Undefined Drainage Lines; Low Sinuosity, Fine Grained systems; Channelised Fill Systems; and Valley Fill Systems.
- These stream types are low to moderate energy systems, reflecting their relatively gentle gradients and intermittent flow regimes. As a result, the streams transport sediment in suspended load only and are generally stable.
- Due to the relatively disturbed nature of the Study Area as a result of past agricultural practices, most of the streamlines assessed are in moderate to poor geomorphic condition.
- The potential impacts on the geomorphology of waterways in the Study Area as a result of the Project include (GHD, 2012):
  - Changes to catchment areas resulting in altered hydrologic regimes and potential impacts on sediment transport and scour processes.
  - Encroachment of the Western Mining Area into a section of Watermark Gully resulting in flow concentration, flow impedance and the potential for stream scour.
  - Construction of the proposed pump station on the Mooki River resulting in localised changes to flow behaviour with the potential for bank erosion.
  - Construction and/or upgrade of temporary and/or permanent waterway vehicular crossings.
- The assessment determined that the significance of these potential impacts will be negligible to low with implementation of the following recommendations:
  - At the proposed pump station location on the Mooki River, appropriate bank protection measures should be implemented to address the existing erosion and to protect the pump station into the future.
  - An appropriately designed channel diversion should be provided for the section of Watermark Gully subject to encroachment by the Western Mining Area.
  - The potential for initiating bed and bank instabilities at waterway crossings can be minimised through adoption of the recommended management measures.

4.3.5 Geochemical Assessment

Key findings from the Geochemical Assessment of overburden/interburden and coal reject materials are summarised below:

- The majority of overburden/interburden and coal reject materials were reported to have low sulfur content, excess Acid Neutralising Capacity, and Non Acid Forming (NAF) classification.
- A very small proportion of Potential Acid Forming (PAF) overburden/interburden and coal reject materials are likely to be produced. The PAF overburden/interburden appears to be restricted to isolated parts of the fresh Permian interburden located near the Lower Hoskissons coal seam. The PAF coal rejects appear to be limited to roof and floor strata associated with the Lower Hoskissons seam. Key results are summarised below:
  - Overburden/interburden samples have NAPP values of -298 to +60.7 kg H_2SO_4 / tonne (with Total Sulfur contents up to 2.6 wt%). The majority of samples tested have negative

NAPP values (95%), resulting in >95% of samples being classified as NAF-Barren or NAF. However it should be noted that samples classified as NAF (~12.5% of samples) may have the potential to generate neutral metalliferous drainage (NMD) or saline drainage (SD).

- Coal reject samples have NAPP values of -218 to +75.7 kg H_2SO_4 / tonne (with Total Sulfur contents up to 5.4 wt%). The majority of these samples (91%) also have negative NAPP values, resulting in around 89% of samples being classified as NAF-Barren or NAF. Nevertheless, around 16.5% of samples (those classified as NAF) may have the potential to generate NMD/SD.
- Coarse reject and tailings samples were predominantly classified as NAF-Barren or NAF. Again, those samples classified as NAF (approximately half) may have NMD/SD potential.

- From the kinetic geochemical testwork results, it was concluded that:
  - Most overburden/interburden and coal reject materials reporting to overburden emplacement areas was predicted to generate pH neutral to slightly alkaline run-off/seepage with low to moderate salinity values, respectively, following surface exposure. The salinity of run-off/seepage from these materials was predicted to decrease with time.
  - The concentration of trace metals in run-off and seepage from most overburden/interburden and coal reject material was predicted to be low with some possible minor exceptions (selenium and molybdenum).
  - Overall, the risk of potentially significant water quality impacts from overburden/interburden and coal reject materials was considered low.
- Some overburden/interburden and most coal reject materials may be sodic and have structural stability problems related to potential dispersion and erosion.
- The concentration of total metals in overburden/interburden and coal reject materials is below the applied guideline criteria for soils and was considered unlikely to present any environmental issues associated with revegetation and rehabilitation.
- The report noted the potential for spontaneous combustion, primarily related to pyrite oxidising in the presence of combustible material (coal and/or other highly carbonaceous material). From preliminary tests on three samples, it was concluded that there is a low probability of spontaneous combustion for coal, overburden and coal reject materials.

4.4 Issues, Uncertainties or Gaps Identified in EIS Review

4.4.1 Quality and Quantity of Surface and Groundwater Resources

This section addresses the following Director General Environmental Assessment Requirement[3]:

Detailed assessment of potential impacts on the quality and quantity of existing surface and groundwater resources, including:

- *Detailed modelling of potential groundwater impacts.*
- *Impacts on affected licensed water users and basic landholder rights.*
- *Impacts on riparian, ecological, geomorphological and hydrological values of water courses, including environmental flows.*
- *Consideration of the proposal against the Draft Aquifer Interference Policy.*

Key findings of the review, with respect to the above requirement, are summarised below:

- Detailed modelling of potential groundwater impacts has been conducted and documented in a very detailed and comprehensive report by AGE (Appendix T). This work has also undergone a rigorous peer review by Heritage Computing. The modelling work is primarily focussed on hydrogeological impacts (groundwater flows and levels).
- In addition, some modelling of potential groundwater quality (salinity) impacts has been conducted by Terrenus (2012) and WRM (Appendix S), utilising groundwater modelling results (Appendix T) and geochemical test results (Appendix W).
- Baseline groundwater level data and trends are not well described in the EIS. The AGE (2013) report states that "*from approximately 1990 onwards, groundwater levels tend to decline…*" and "*from the start of the Water Sharing Plan (Upper and Lower Namoi Groundwater Sources 2003) in 2006/2007, the extraction of groundwater has been decreasing, but groundwater levels have still continued to decline*". The latter statement is not consistent with hydrographs presented in Figures 7.16 to 7.21 (AGE, 2013) nor any of the hydrographs for Namoi Groundwater Zones 3, 7 and 8 presented in the *Upper Namoi Groundwater Source – Status Report 2011* (DPI, 2012).
- Impacts on affected licensed water users and basic landholder rights were assessed in detail in the AGE Report (Appendix T). This includes predictions of groundwater level reductions in individual bores (up to 1.4 metres) and groundwater flow reductions from the Permian units to the overlying alluvium (maximum flow reduction of 0.3 ML/day, representing less than 0.5% of flow from registered bores within 10 km of the Project area).
- Potential impacts on groundwater dependent ecosystems (vegetation and stygofauna) were considered in the groundwater impact assessment (EIS Main Report, Section 7.1) and were not reported to be significant. However, impacts on aquatic ecology of water courses downstream of the Project were not assessed, despite the potential for increased salinity loads and modified flow conditions in the Mooki River (refer to Section 7 of this report).
- Impacts on geomorphological values of water courses are identified in the EIS Main Report (Section 7.5) and the Geomorphological Impact Assessment (Appendix X). One of the key impacts will be the potential for significantly increased rates of erosion and sediment transport

[3] The discussion below is also relevant to SEWPaC Requirement 17 (refer to Appendix B).

associated with disturbed land areas (total of more than 4,000 ha), particularly during the construction phase of the Project. This was not documented in the EIS or Appendix X.

- Impacts on hydrological values of water courses are identified in the EIS Main Report (Section 7.3) and the Surface Water Impact Assessment (Appendix S). The assessment is largely based on expected loss of catchment areas during operations, and increase in catchment area (particularly of Watermark Gully) post-closure. A flow duration curve is used to illustrate the expected impact on flows in Watermark Gully (in Appendix S). Impacts of the Project on Mooki River flows have not been assessed in the Surface Water Impact Assessment, but are covered in the Groundwater Impact Assessment (surface water losses from Mooki River to the groundwater system were estimated to increase by 0.13 ML/day as a result of mine dewatering, equivalent to around 1.5 L/s or a total of 323 ML over the mine life, increasing to 489 ML post-closure). However, the implications for low flow and no-flow events in Mooki River have not been defined relative to baseline river flows[4]. Furthermore, there has been no consideration of environmental flows. The assessment of flood risk is considered below (Section 4.3.8).
- Furthermore, the potential requirement to pump water from the Mooki River (one of 3 water sources being considered for supplying 600 ML/year to the Project, or up to 900 ML in a dry year) has not been considered in the above calculation. This is considered significant as the Project water demand will be greatest during the dry season (and dry years) when the river flows are lowest. Given the pipeline is a key part of the Project design, this warrants further assessment.
- The EIS provides a comparison of the Project against the Draft Aquifer Interference Policy in the Main Report (Section 7.1). Furthermore, the EIS states that the Project complies with the AIP as the predicted impacts of the project are all less than the Level 1 requirements. However, some limitations have been identified regarding the assumptions and data used to assess Project impacts against these requirements (particularly related to water quality impacts). These are discussed further below.
- The uncertainty in modelled drawdown levels is not clearly defined in the Main Report. In particular, there is significant uncertainty in the hydraulic conductivity of the Permian units (5 orders of magnitude; Appendix T, Table 7.6), and the connection between the Project area which could affect peak drawdown levels. Sensitivity testing allows only ± 1 order of magnitude change in each parameter at most. Consideration of a wider range of input parameters may have been warranted in the sensitivity analysis (and variation of multiple parameters at once to assess a worst-case scenario).
- Furthermore, sensitivity testing associated with uncertainties in the geophysics (connectivity between project area and alluvial aquifer) does not appear to have been assessed. The model assumes no direct connection between the Permian units and the alluvial aquifer.
- Additional drawdown associated with Project water demand (eg. 600 ML/year) does not appear to have been quantified.
- If modelled drawdown levels are incorrect, the Aquifer Interference Policy (AIP) requirement that drawdown in water supply bores must not exceed 2 m, may not be met.

[4] For example, an additional loss of 0.13 ML/day represents a reduction of around 1% of median flows (in the order of 10 ML/day) and around 10% of 80th percentile low flows (~1 ML/day).

- There is significant discrepancy between WRM and AGE model estimates of final void water rebound rates (100 vs 2000 years). Clearly these estimates are highly sensitive to model assumptions and input parameters.
- Although cumulative impacts on groundwater levels have been independently assessed, with the results discussed in the Groundwater Impact Assessment (Appendix T), cumulative impacts on Mooki River flows associated with upstream mining developments have not been considered. SEWPaC Requirement 17 is therefore not fully addressed.
- The potential impacts of progressively deteriorating pit void water quality (Western Mining Area) on receiving groundwater and surface water appear to have been understated, particularly given that the final void water elevation will be hydraulically upgradient of the Gunnedah Formation aquifer (resulting in long term potential for groundwater contamination via multiple Permian aquifers).
- The progressive accumulation of saline pore water in backfilled wastes in the Eastern and Southern Mining Areas, and potential risks to receiving groundwater and surface water, also appear to have been understated. Pore water levels in these mining areas will also rebound to an elevation hydraulically upgradient of the Gunnedah Formation aquifer (resulting in long term potential for groundwater contamination via multiple Permian aquifers).

4.4.2 Site Water Balance

This section addresses the following Director General Environmental Assessment Requirement:

A detailed site water balance, including a description of site water demands, water disposal methods (inclusive of volume and frequency of any water discharges), water supply infrastructure and water storage structures.

Key findings of the review, with respect to the above requirement, are summarised below:

- A detailed site water balance has been developed by WRM as described in the EIS Main Report (Section 7.3) and the Surface Water Impact Assessment (Appendix S).
- Evapotranspiration and infiltration rates have not been clearly defined but are likely to be major components of the site water balance and can be expected to vary significantly throughout the Project life.
- For example, runoff coefficients for OEAs are expected to be lower (and hence net percolation higher) than pre-mining conditions. This is reflected in the Groundwater Impact Assessment which indicates the "*recharge rate to the aquifers increases from 252 ML/day to 255 ML/day due to the increased recharge through the overburden waste material in the backfilled mining areas*" (although runoff coefficients are not clearly stated) but not in the water balance (runoff coefficient assumed to be 3.6% before and after mining; Appendix S, Table 7.11).
- From the water balance summary table (Table 29) it is unclear how the "water retained on site" has been calculated. In Year 2 for example, Sediment Dams receive 239 ML from rainfall/runoff yield and lose 23 ML by evaporation and 55 ML by off-site discharge, yet only 2 ML is retained on site. Similar discrepancies are observed throughout the table.
- Accumulation of pore water within backfilled waste materials could add significantly to the "water retained on site". Similarly, ponding of water in pits does not appear to be considered in "water retained on site" but could be significant as noted in the Surface Water Impact

Assessment (eg. the active pit is expected to store >500 ML approximately 16% of the time) particularly during the later years of mining.

- The highest groundwater inflows are reported at 371 ML/year in Year 25 (Table 29). However, inflows of up to 2 ML/day were predicted for the Southern Mining Area, peaking at 760 ML/year in Year 23. This underestimation of groundwater inflow rates would reduce the water deficit during the later years of operation, but may also increase the requirement for off-site discharge.
- Uncertainties in the water balance have not been quantified or described, but could be significant given the issues noted above and uncertainties in predicted groundwater inflows to the pits.
- The water balance applies to the operations phase only. However, the post-closure water balance could have significant implications for long term impacts on surface water quality and flows within and downstream of the Project area.
- The current water balance appears to be insufficient to develop an accurate site salinity balance (Section 4.4.4) and fully assess impacts on local surface and groundwater resources.

4.4.3 Site Discharge Quantity and Quality

This section addresses the following Director General Environmental Assessment Requirement[5]:

An assessment of proposed water discharge quantities and qualities against receiving water quality and flow objectives.

Key findings of the review, with respect to the above requirement, are summarised below:

- There is conflicting information throughout the EIS regarding site discharge requirements during mining operations, as exemplified below.
- It is understood from the site water balance (Table 29) that off-site discharge from sediment dams will occur, and it is clearly stated that "*this water will only be released from site if water quality is acceptable, or during a rainfall event that exceeds the design capacity of the sediment control systems*" (Appendix S).
- The same report (Appendix S) and Executive Summary of the EIS, states that "*the results of mine water balance modelling show that under the full range of historical rainfall conditions, the proposed mine water management system will have sufficient capacity to contain all mine water on the site without the need for off-site releases*". This statement is considered misleading.
- Local stakeholders are concerned about the lack of a consistent message regarding site discharge requirements. For example, Breeza Progress Association Inc. members were apparently advised at a stakeholder meeting on 9/4/2013 that the mine will be a "nil discharge mine" (pers. comm., A. Pursehouse, 2013).
- Estimates of site discharge water quantities during operations are summarised in the site water balance (Table 29) and the Surface Water Impact Assessment (Appendix S, Figure 7.1). However, some of this information appears contradictory. For example, the summary table indicates off-site discharges ranging from 55 ML/year (Year 2) to 224 ML/year (Year 30), whereas Figure 7.1 of Appendix S indicates that discharge only occurs from Year 12 onwards.

[5] The discussion below is also relevant to SEWPaC Requirements 14, 15 and 19 (refer to Appendix B).

- In terms of site discharge water quantities post-closure, long term seepage rates of 80 kL/day from the Eastern and Southern Mining Areas were estimated from the groundwater model (AGE, 2013). Higher estimates sourced from the AGE model were reported by Terrenus (2012) – up to 90 kL/day from the Eastern Mining Area (over an area of 230 ha) and up to 60 kL/day from the Southern Mining Area (over an area of 53 ha). These seepage zones can be expected to release saline seepage overland and into Native Dog Creek and further downstream during flush events. Downstream surface water impacts, particularly associated with salinity, during operations and post-closure have not been assessed.
- The Groundwater Impact Assessment indicates that from 15 years post-closure "*the enhanced spoil recharge and mounding causes a net gain of 0.1 ML/day to the alluvial groundwater management areas*". Effectively, this represents an additional 0.1 ML/day of off-site discharge (to receiving groundwater) post-closure. This is in addition to the predicted 0.02 ML increase in groundwater flows to the Mooki River.
- Estimates of site discharge water quality during operations have been developed through "salt balance" calculations as part of the Surface Water Quality Impact Assessment. The impacts are assumed to be minor (increased salt load of 0.8%) but may have been significantly underestimated based on the limitations of the geochemical testwork, as discussed below.
- No other water quality parameters in discharge water (other than salinity) have been considered. Furthermore, impacts on receiving surface waters have not been assessed. This deficiency was also identified in the independent peer review of the Groundwater Impact Assessment (Heritage Computing, 2012).
- Some baseline data on surface water quality has been collected, but this excludes some key parameters such as major ions (Ca, Mg, Na, K, Cl), dissolved metals, nitrogen species (TN, NO_3 and NO_2), organic compounds / hydrocarbons, biological and bacteriological components. The elevated metal concentrations in baseline surface water quality data could be misleading and result in masking of any downstream water quality impacts. Furthermore, no explanation was provided for the maximum pH reported in Mooki River (pH 12.2) which appears to be unnaturally high and likely a data error.
- In terms of site discharge water quality post-closure, long term seepage from the Eastern and Southern Mining Areas were estimated by Terrenus (2012) was estimated to have a salinity of 2-8 kg of salt per ha per day from the Eastern Mining Area (seepage area 230 ha) and 5.6-23 kg from the Southern Mining Area (seepage area 53 ha). This is equivalent to a long term discharge of around 1-3 tonnes of salt per day into Native Dog Gully, potentially extend downstream to Mooki River. A salt load discharge of 1 tonne per day entering Mooki River (via Native Dog Gully) is significant relative to median salt loads which are estimated at 5.5 tonnes per day (based on a median flow of around 10 ML/day and typical baseline TDS concentrations of around 550 mg/L). This increase would be well in excess of the AIP limit of 1%.
- Furthermore, these figures reported above may have been significantly underestimated based on limitations of the geochemical testwork, as discussed further below.
- No other water quality parameters in seepage water (other than salinity) have been considered. Furthermore, impacts on receiving groundwater have not been assessed.
- Given that not all of the key water quality issues have been considered (eg. nutrients, dissolved metals, hydrocarbons) SEWPaC Requirement 19 has not been met.

- A baseline groundwater quality assessment is not provided in the EIS Main Report or the Groundwater Impact Assessment (Appendix T). Summary statistics for groundwater salinity and pH data are provided for each of the key formations in Appendix 1 of the Groundwater Impact Assessment, with only a brief description of other water quality parameters such as inorganic chemicals, including total, pesticides and hydrocarbons is provided in a descriptive manner only (reference is made to GHD reports which do not form part of the EIS documentation). No data appears to have been collected on dissolved metal concentrations.
- Given the lack of a comprehensive surface water and groundwater quality baseline, SEWPaC Requirement 14 has not been met.
- Based on all of the above comments, SEWPaC Requirement 15, which requires "*data and information on proposed discharge water quality, including timing of discharges, concentrations and loads of toxicants and stressors*", has not been met.

4.4.4 Salinity Impacts on Groundwater and Surface Water

This section addresses the following Director General Environmental Assessment Requirement:

Assessment of impacts of salinity from mining operations on groundwater and surface water resources, including disposal and management of coal rejects and modified hydrogeology, a salinity budget and the evaluation of salt migration to the surface, near surface and groundwater sources.

Key findings of the review, with respect to the above requirement, are summarised below:

- Salinity impacts on groundwater and surface water have been considered to some extent in the EIS, as described above.
- The potential for salinity impacts on soils, groundwater and surface water due to saline groundwater for dust suppression has not been considered.
- A "salt load" balance has been prepared for the operations phase. This is effectively a comparison of existing salt loads in Watermark Gully, Native Dog Gully and Lake Goran, as opposed to a site salinity budget. The potential requirement for treatment of saline water on site is therefore unknown.
- The "salt load" balance does not quantify salinity inputs from groundwater dewatering, sulfate salinity in seepage from mine wastes, cone of depression salinity flushing during groundwater rebound, salinity accumulation and flushing from evaporated dust suppression water, seepage from sediment dams into groundwater, long term seepage from final void and backfilled pits into receiving groundwater, salt loads in off site discharge, etc.
- The Surface Water Impact Assessment predicted a 0.8% increase in the total average salt load released off site, from an existing load of 65.2 t/day to a load of 65.7 t/day at Year 30. This is considered misleading as the majority of the existing load (65.2 t/day) appears to be attributed to pre-mining salt loads from the Lake Goran catchment (1,320 km^2) rather than the Project area (which covers less than 100 km^2)[6]. Furthermore, the relative increase in salt load (0.5 t/day increase) attributed to the Project appears to have been significantly underestimated.
- The magnitude and extent of salinity impacts downstream of the Project area has not been assessed.

[6] The Executive Summary also refers to a predicted daily salt load of 65.7 t/day from areas disturbed by the Project. This figure has been taken out of context from the Surface Water Impact Assessment.

- There appear to be some key limitations in the assessment of salinity generation (and other water quality issues relating to pH and dissolved metal concentrations) associated with:
  - Sulfide oxidation within waste materials between the time of mine dewatering and final inundation.
  - Sulfide oxidation within pit wallrock between the time of mine dewatering and final inundation.
  - Long term sulfide oxidation within waste materials that remain above the final groundwater rebound level.

  This may significantly affect the site salinity budget and therefore estimates of salinity loads in site discharge water during operations and post-closure. This is essential to understanding the potential magnitude and extent of salinity (and other water quality) impacts on receiving surface waters and groundwater.
- Key limitations in the assessment of salinity generation (and other water quality issues relating to pH and dissolved metal concentrations) include:
  - Sampling
    - The number of samples collected for static geochemical characterisation is not sufficiently representative of the material to be mined over 30 years (eg. 104 samples for 1629 Mm^3 of overburden/interburden is equivalent to 1 sample per 20,000,000 m^3 of overburden/interburden).
    - Pit wallrock was not sampled, although a substantial volume of this material will become desaturated as a result of the dewatering. Significant salinity and neutral metalliferous drainage inputs can be expected from this source from all pits.
  - Characterisation (static geochemical testwork)
    - Block modelling of AMD risk has not been conducted to confirm the relative abundance of each of the waste types. In the case of overburden/interburden, even if PAF material represents only 2.9% of the total volume (1629 Mm^3) this still has the potential to generate in the order of 2 Mt H_2SO_4 acidity. Even if this material is neutralised in situ, it could still generate a similar tonnage of salinity (ie. ~2 Mt SO_4 salinity). Furthermore, materials classified as "Uncertain" (an additional 1.9% of overburden/interburden samples) should be conservatively regarded as PAF.
    - Some materials classified as "NAF" contain ≥0.1 wt% S and therefore have the potential to generate NMD or saline drainage. This has not been considered or assessed in the study. In the case of overburden/interburden, even if "NAF" material represents only 12.5% of the total volume (1629 Mm^3) this still has the potential to generate an additional 0.5-1 Mt of sulfate salinity.
  - Characterisation (kinetic geochemical testwork)
    - Column leach testwork was conducted on composite samples. All of these composite samples had negative NAPP values (even Column 1 which contained 2 sub-samples of PAF material). Leachate characteristics of PAF material are therefore unknown. It has been acknowledged that testing on PAF materials "should be completed as part of operational planning", but unclear why this work was not conducted.

- Column leach testwork was conducted over a limited time period (12 weeks). Even if PAF material was tested, this duration is considered insufficient to characterise long term leachate quality based on the method used and given that the duration of exposure of mine wastes (and dewatered pit wallrock) to oxidising conditions could be years-decades, well in excess of the test period.
- Oxidation rate calculations are based on sulfate generation rates. However, based on the column leach test method used, this could result in significant underestimation of pyrite oxidation rates (as any sulfate precipitation within the columns will not be accounted for in the leachate).
- The concentration of soluble sulfate in leachate from the column leach tests was used to calculate the residual sulfur content of the sample materials. The results show that typically more than 90% of the total sulfur content remains in the samples after 12 weeks of leaching. This suggests that up to 10% of the total sulfur content has been oxidised over 12 weeks, corresponding to a very rapid pyrite oxidation rate of up to 40% FeS_2 per year.
- It has been assumed that the salinity of run-off/seepage from mine materials will decrease with time. This could be misleading as it is based on the results of only 12 weeks of column leach testwork (which actually provide evidence of ongoing sulfate release) and does not consider the potential for ongoing oxidation and associated sulfate salinity generation. Furthermore, it is more relevant to consider trends in leachate salinity loads (rather than concentrations, which cannot be simply extrapolated to field conditions).
- The column leachate quality is unlikely to be representative of pore water quality in dewatered waste materials and pit wallrock. The mining process will result in substantial volumes of this material being exposed to oxidising conditions for years-decades before being inundated and flushed of accumulated salts. Based on the available data, Terrenus (2012) has assumed a maximum salinity of 5,000 mg/L in runoff/seepage from mine wastes. This could result in significant underestimation of site salinity loads, particularly after mine closure and groundwater rebound.

4.4.5 Licensing Requirements and Approvals

This section addresses the following Director General Environmental Assessment Requirement:

Identification of any licensing requirements or other approvals under the Water Act 1912 and/or Water Management Act 2000.

Key findings of the review, with respect to the above requirement, are summarised below:

- This aspect is addressed in Table 13 (Section 4.8) and Table 26 (Section 7.1) of the EIS Main Report.
- Licensing requirements for the Mooki River associated with groundwater drawdown impacts (but not Project water demand) were estimated at up to 47.5 ML/year in Table 26, but considerably higher in the Surface Water Impact Assessment (153 ML/year).

- Licensing requirements have not been assessed against current Sustainable Diversion Limits (SDL) as outlined in Schedule 4 of the Murray Darling Basin Plan[7].
- It is unclear whether the recent purchase of Boondah by the Proponent, and the associated groundwater licence (for Namoi Groundwater Zone 8) and irrigation dam inherited with this property, have been included in the assessment.

4.4.6 Water Supply for Project Construction and Operation

This section addresses the following Director General Environmental Assessment Requirement:

Demonstration that water for the construction and operation of the development can be obtained from an appropriately authorised and reliable supply in accordance with the operating rules of any relevant Water Sharing Plan (WSP) or water source embargo.

Key findings of the review, with respect to the above requirement, are summarised below:

- This aspect is addressed in Table 13 (Section 4.8) and Table 26 (Section 7.1) of the EIS Main Report.
- Table 26 indicates that up to 600 ML/year will be extracted from Mooki River and/or borefields located in Namoi Groundwater Zones 3, 7 and/or 8. However, specific water supply locations and the quantities to be extracted from each source have not yet been confirmed. The timing of extractions has not been specified either, but is likely to be greatest during the dry season (and dry years). Daily extraction limits for the Mooki River were mentioned in Section 7.3.1 but not quantified. Potential impacts on the hydrology of the Mooki River have not been assessed but could be significant, as previously noted. Hence, the feasibility of the Mooki River as a Project water supply has not been confirmed.
- Furthermore, the feasibility of groundwater extraction from Namoi Groundwater Zones 2, 7 and/or 8 for Project water supply cannot be confirmed until borefield sites have been identified and potential impacts on local groundwater resources assessed.

[7] For example, the long-term average SDL for the Gunnedah-Oxley Basin is 114.5 GL/y. This is less than the 199.9 GL/y Long Term Average Annual Extraction Limit for the Gunnedah-Oxley Basin presented in Table 26 of the EIS (Section 7). Long-term average SDL are to take effect on 1 July 2019, within the life of the proposed Project.

4.4.7 Water Management System

This section addresses the following Director General Environmental Assessment Requirement[8]:

A detailed description of the proposed water management system (including sewage), water monitoring program and other measures to mitigate surface and groundwater impacts.

Key findings of the review, with respect to the above requirement, are summarised below:

- The proposed site water management system is described in detail and clearly illustrated in the Surface Water Impact Assessment. The site water management system is primarily designed to manage potential impacts associated with sediment loads in site runoff. Additional management measures are documented as part of the Geomorphology Impact Assessment.
- The groundwater management strategy described in Section 7.1 is limited to the acquisition of water licenses to meet the Project water demand. One of the key management measures (already part of the current design) is to backfill the pits to address the post-closure risk of long term alluvial aquifer drawdown. This strategy is mentioned in the Groundwater Impact Assessment but not the EIS Main Report.
- Several additional groundwater management options were identified in the Groundwater Impact Assessment. Management options have not been developed in sufficient detail, particularly given the uncertainties in modelled groundwater levels. Furthermore, these were excluded from the EIS Main Report.
- The potential requirement for treatment of saline water on site has not been documented. This could be significant, particularly during mining at the Southern Mining Area, given that groundwater inflows are estimated at up to 2 ML/day with TDS of around 14,000 mg/L (equivalent to nearly 30 tonnes of salt inflow per day).
- Very preliminary AMD management measures have been documented in Section 7.18. This includes selective handling and capping of PAF material. However, a commitment should be made to ensuring that PAF material will remain below the final groundwater table post-closure (and managing AMD during operations). Furthermore, a management strategy for saline drainage or NMD associated with sulfide oxidation in waste materials and pit wallrock should also be developed. Enhanced groundwater rebound may need to be considered. No ANC resources for dealing with PAF material were defined.
- The EIS Main Report (Section 7.25) states that: "*Sewage will be managed via an on-site sewerage treatment facility. The treated effluent will be utilised as irrigation water supply for rehabilitation in accordance with Environmental Guideline for the Use of Effluent by Irrigation (DEC, 2003), reused within the mine water management system or pumped out regularly by a licensed contractor*". No further detail on treatment plant design or specifications (target water quality criteria) is provided.
- No other water quality issues have been considered in the proposed water management system, aside from those mentioned above.
- This is despite acknowledgment in the Surface Water Impact Assessment that the Dirty Water System Maximum Operating Volume (MOV) could be exceeded and "mining could be affected" as a result.

[8] The discussion below is also relevant to SEWPaC Requirements 7, 16 and 18 (refer to Appendix B).

- In addition, there are no plans for emergency response in the event of an uncontrolled discharge of water quality that exceeds triggers values (when confirmed). This is a particular concern of local stakeholders in light of uncontrolled discharges that have been reported from similar mines in the region (eg. Werris Creek and Boggabri Mines) and others in the Hunter Valley and Central Queensland (pers. comm., A. Pursehouse, 2013).
- Surface water quality triggers were proposed in the Surface Water Impact Assessment (Appendix S) although not carried through to the EIS Main Report. Groundwater quality triggers have not yet been developed but it has been suggested triggers are developed for salinity (EC and TDS), sulfate and pH (only). Some key groundwater quality parameters have been excluded and no reference has been made to ANZECC/ARMCANZ (2000). It is difficult to identify suitable triggers in the absence of a comprehensive water quality baseline. Even where triggers are proposed, it is not always clear how these are going to be achieved. A number of key deficiencies have been identified with regards to proposed water quality management measures during operations and post-closure (refer to Section 4). As a result, SEWPaC Requirement 7 has not been adequately addressed.
- As noted in Section 3.6, SEWPaC Requirements 16 and 18 have not been met:
  - Water quality management requirements associated with sewage treatment and waterway crossings are briefly covered in Sections 7.25.2 and 7.5.4, respectively, however associated monitoring requirements are not documented. SEWPaC Requirement 16 is therefore not fully addressed.
  - A comprehensive water quality risk management and monitoring plan (SEWPaC Requirement 18) has not been developed.

4.4.8 Flood Impact Assessment

This section addresses the following Director General Environmental Assessment Requirement:

A detailed flood impact assessment, which identifies impacts on local and regional flood regimes, including:

- *An assessment of the potential for flooding to occur in the open-cut pits.*
- *Any measures proposed to mitigate potential flood impacts.*

Key findings of the review, with respect to the above requirement, are summarised below:

- Detailed flood impact assessments have been prepared for Watermark Gully and Mooki River. These are documented in the Surface Water Impact Assessment and summarised in the EIS Main Report (Section 7.4).
- The potential for flooding to occur in the open-cut pits has been assessed in detail in the Surface Water Impact Assessment. This included modelling of the in-pit storage inventory as part of the site water balance calculations, and modelling the likely extent of flood backwaters from Watermark Gully and Mooki River in response to 100 ARI and PMP events.
- It is likely that a levee embankment will be constructed within the disturbance boundary to prevent floodwaters from potentially overflowing into Eastern Mining Area. It has also been suggested in the Geomorphological Impact Assessment that part of Watermark Gully may also be diverted to avoid the risk of flooding the Western Mining Area. Details regarding these management measures are limited.

- A stand-alone report on the potential for regional land subsidence as a result of mine pit dewatering was prepared by SRK (2012) as an appendix to the Groundwater Impact Assessment. This does not appear to have been considered in the flood assessments.
- Special Condition 48 under EL 7223 requires that development approval may not be sought for open cut mining anywhere on the "floodplain". This does not appear to have been considered in the flood assessments and mine plan. As previously noted, the south-eastern margin may be inundated to a depth of up to 1.7 m during a 100 year ARI event.
- The potential for pit wall instability during such a flood event has not been assessed.

5.0 Agricultural Impacts

5.1 Overview and Assessment

The following key conclusions and actions from the review of the EIS relevant to potential agriculture impacts include:

- A thorough description of the soils, soil physical and chemical properties, and the suitability of soils for rehabilitation has been prepared and presented in the EIS and Appendix Y (Soil Survey and Land Capability Assessment).
- The EIS partially addresses each of the Director General's Environmental Assessment Requirements related to Agriculture and other Land Resources but fails to fully address each of these requirements.
- There are key gaps in the soil balance which must be addressed to adequately assess the capability of the proposed Project to meet post-mining / rehabilitation land capability and land use objectives including:
  - The soil balance is based on a rehabilitation area of 3,384 ha, while the disturbance footprint provided in Section 3 of the EIS is 4,084 ha (or 5,630 ha in Section 7.20 and the AIS Appendix Z). The soil balance should be extended to include the full Project disturbance footprint.
  - It includes soils that were classified in the soil classification as not suitable for use in rehabilitation (soil type 4a between 0.25 and 1.2 m, soil type 6a between 0 and 1.2 m, soil type 6b between 0.35 and 1.2 m, soil type 7 between 0.6 and 1.2 m and soil type 8 between 0.25 and 1.2 m). The soil balance should exclude soils classified as unsuitable for use in rehabilitation in the Soil Survey (Appendix Y).
  - Some of the soils in the soil balance (soil type 3b, soil type 5, soil type 6b and soil type 7) are reported to require blending with either limestone or sandy material in order to be appropriate for use in rehabilitation. The mitigation and management section of Section 7.19 of the EIS and the rehabilitation and mine closure strategy (Section 7.26) should acknowledge that these soils will be blended appropriately if they are to be used in rehabilitation.
  - The potential to meet proposed post-mining / rehabilitation land capability and land use objectives should be reassessed accounting for the results of the above actions.
- 238 ha of seepage zones (230 ha Eastern Overburden Emplacement Area; 53 ha Southern Overburden Emplacement Area) from the overburden emplacement areas have been identified and mapped in the Groundwater Impact Assessment (Appendix T; Appendix 6). There is overlap between these seepage areas and the post-mining rehabilitated agricultural land which may impact the potential to achieve post-mining agricultural land objectives. The Section 7.19-7.20 of the EIS should be updated to account for these areas of seepage and the potential quality of the seepage in its assessment of post-mining land capability.
- Subsidence of backfilled waste material is likely to be significant and could be irregular resulting in ponding across the surface of the backfilled waste. This may affect final land use, particularly for areas designated for agricultural use.
- 1,000 ha of rehabilitated Class III land within the Project disturbance boundary has been

flagged for agricultural use, 100 ha of which will be rehabilitated to meet biophysical strategic agricultural land (Appendix AA). It is uncertain whether the composition of the overburden material / pore water / surface seepage / subsidence will allow for the establishment of Class III agricultural land and biophysical strategic agricultural land (uncertainties with the geochemical and water impact assessment of the overburden material are discussed further in Section 4.4). Further work needs to be undertaken to adequately assess potential impacts related to the geochemistry of the overburden, quality of the dump pore water and surface seepage and potential for subsidence in the overburden emplacement areas.

- The air quality assessment has utilised site data, potentially influenced by local topography, sourced over a period of approximately 1.5 years over available longer term meteorological data in the Project locality (Discussed further in Section 6 of this review). Variability in the dominant wind direction in the Project locality, observed in long term meteorological data, has not been accounted for in the EIS assessment of potential air quality impacts. As a result of this, potential adverse air quality impacts from the proposed Project have not been fully assessed. The air quality impact assessment should be updated to account for variability in the dominant wind direction in the Project locality and the potential Project impacts should be re-assessed.
- All conclusions and actions from Section 4 (Water Impacts) of this review are relevant to the agriculture impacts section of this review.
- All conclusions and actions from Section 8 (Rehabilitation and Mine Closure) of this review are relevant to the agriculture impacts section of this review.

The comments made above are based on a review of work undertaken in relation to agriculture impacts (Section 5.2), key findings of this work as identified in the EIS (Section 5.3), and the issues, uncertainties and gaps in the EIS identified in Section 5.4.

5.2 Work Undertaken

Key studies undertaken that are relevant to agricultural impact assessment for the Watermark Project are:

- Agricultural Impact Statement (Main Text Section 7.20; Appendix Z).
  - An agricultural impact statement has been prepared by Scott Barnett & Associates. The agricultural impact statement includes a description of the local climate, topography, soils, land management units, agricultural history, regulated water sources, agricultural enterprises, supporting infrastructure and services, agricultural resources, agricultural value and employment. The agricultural impacts statement provides an assessment on potential agricultural impacts based on a desktop review of the specialist studies prepared for the EIS, including availability and productivity of agricultural land, groundwater, surface water, movement of water from agriculture, soils, land capability, impact on biophysical strategic agricultural land, air quality, noise, visual amenity, traffic and support infrastructure and services and labour supply. Mitigation and management measure to minimise potential adverse impacts associated with the proposed Project are discussed.
- Preliminary Contamination Assessment (Main Text Section 7.24; Appendix AD).
  - The Preliminary Contamination Assessment was undertaken by Hansen Bailey in accordance with Clause 7 of SEPP 55 and the *Guidelines for Consultants Reporting on Contaminated Sites*

(OEH, 2011). A desktop assessment was undertaken to identify the past and present potential for contamination within the Project Boundary. The assessment involved a review of soil landscape maps, historical aerial photographs, Shenhua Watermark property condition inspection reports, OEH public registers and the Historic Heritage Impact Assessment prepared for the Project (Appendix R).

- Soil Survey and Land Capability Impact Assessment (Main Text Section 7.19; Appendix Y).
  - A soils and land capability impact assessment has been prepared by GSS Environmental. The soils and land capability impact statement includes a detailed characterisation of the soils within the proposed Project disturbance boundary, an assessment of the boundary of the alluvial black soils, an assessment of the pre and post-mining land capability and agricultural suitability, development of a soil balance, soil stripping and management strategy and erosion management strategy.
- Blasting impacts on landforms and slopes (Main Text Section 7.9; Appendix I).
  - A blasting impacts on landforms and slopes assessment has been prepared by SCT Operations. The study includes a desktop assessment of the topography, geology and unconsolidated deposits, an assessment of the potential interactions of the Project with sensitive landforms and slopes and provides mitigation measures for potential adverse impacts associated with the Project.

Other studies of direct relevance to agriculture impacts include the studies on surface water (refer to Section 4 of this review), groundwater (refer to Section 4 of this review), geochemistry (refer to Section 4 of this review), geophysics (refer to Section 4 of this review), air quality (refer to Section 6 of this review) and transport (refer to Section 9 of this review).

5.3 Key Findings and Issues Reported in EIS

5.3.1 Agricultural Impact Statement

Key findings from the agricultural impact statement are summarised below:

Direct Impacts (Project Disturbance Boundary)

- 96.1 ha of biophysical strategic agricultural land has been identified within the proposed Project disturbance boundary.
- A further 696 ha of biophysical strategic agricultural land has been identified within the on-site biodiversity offset areas.
- No significant agricultural resources within the locality of the off-site biodiversity offset areas have been identified.
- The gross value of agricultural production from the combined Shenhua Watermark owned land, residual on-site biodiversity offset areas, off-site biodiversity offset areas and Shenhua Watermark water entitlements is approximately $6.7M, representing 5.3% of the total agricultural production of the Gunnedah Local Government Area (LGA), 2.9% of the combined Gunnedah and Liverpool Plains LGA's, 0.07% of NSW and 0.02% of Australia. When compared to the total agricultural production on a regional, state and national scales, the reduced availability and productivity of this land will have a minimal impact to the agricultural industry.

- In total, foregone gross value and net value of agricultural production from land resources required for the Project is estimated at a present value of $73.4M and 39.3M, respectively (using a 7% discount rate).
- The Project is predicted to result in an annual average relocation of approximately 194 ML/y of water from agricultural purposes to coal mining purposes at a gross value loss of $0.1M per annum and net value lost $0.06M per annum in agricultural production.
- The present value of net production benefits of the Project to Australia are estimated at $1,310M (7% discount rate) in contrast to the present value of future use of agricultural lands and water that will be used by the Project, estimated at $40M (7% discount).

Indirect Impacts

- The Project is not considered to reduce the agricultural productivity of biophysical strategic agricultural land within the Project boundary and surrounds due to impacts to highly productive groundwater.
- Overall the surface water impact assessment has determined that the Project will not impact on receiving waters in the locality and as such will not impact on agricultural resources in the region.
- The potential for significant impact of dust on agricultural resources and enterprises in the Project locality are considered to be minimal and will meet all the relevant air quality criteria.
- The Project's operational noise levels will be audible over areas of land owned by Shenhua Watermark and neighbouring private land owners. Noise and blasting impacts on agricultural resources and enterprises in the locality is anticipated to be minimal.
- Visual impacts associated with the Project will affect viewing locations to the north, south, east and west of the Project boundary varying in significance and in time during the life of the proposed Project. No sensitive receptors will experience visual impacts as a result of the Project. The productivity or the marketability of products from surrounding enterprises will not be affected by the visual impacts as a result of the Project.
- Traffic generated by the construction and operation phase of the Project will be absorbed into the existing traffic stream, accounting for an 1.9% per annum growth in background traffic. An average of 8 train movements, peak of 16 movements, will be required by the Project each day.

5.3.2 Preliminary Contamination Assessment

Baseline sources of contamination found within and adjacent to the Project Boundary include (EIS Section 7.24):

- Deregistered and concentrated chemical use (such as from sheep showers and mixing of chemical including herbicides during agriculture);
- Imported filling and waste materials (such as from rubbish tips, quarries and former coal mines);
- Sewage and sewage treatment and disposal;
- Livestock slaughter operations (such as former piggeries, meat houses, slaughtering sheds and poultry houses);
- Building materials (such as stockpiled construction materials);

- Potential chemical leaks and spill (from workshops, chemical storage sheds, underground and above ground storage tanks).

5.3.3 Soil Survey and Land Capability Impact Assessment

Key findings from the soil survey and land capability impact assessment are summarised below:

- 18 soil types within the Project disturbance boundary were identified and characterised for their physical and chemical properties, stripping requirements and appropriateness for use in rehabilitation.
- The boundary for alluvial black soils was defined and mapped. The proposed Project will maintain a 150 m buffer between the open cut mining areas and the alluvial black soils and, thus no disturbance of this soil type is anticipated.
- The total volume of material (topsoil and subsoil) required for rehabilitation is 24,578,000 m^3. The total volume of suitable material available for reuse in rehabilitation is 28,279,800 m^3, which results in a surplus of 3,701,800 m^3.
- The current land capability classification within the disturbance boundary ranges from Class II to Class VII, with Class VII dominating the existing environment.
- Following the completion of mining, land capability classes within the disturbance boundary are predicted to range from Class II to Class VIII.
- The creation of gentle slopes within the final landform and the availability of excess topsoil and subsoil resources will ensure the recreation of 3,233 ha of Class III land capability, of which 1,000 ha will be dedicated for agricultural purposes.
- The current agricultural suitability classification within the Project disturbance boundary ranges from Class 1 to Class 5, with Class 2 dominating the existing environment.

5.3.4 Blasting Impacts on Landforms and Slopes

Key findings from blasting impacts on landforms and slopes assessment are summarised below:

- Slopes, landforms and Aboriginal grinding groove sites associated with the underlying bedrock have a low sensitivity to vibration as these features are able to naturally fluctuate with ground movements. Impacts generated from blasting on these features is limited to overbreak, which is breakage beyond the excavation limits in the intermediate area surrounding blast holes.
- Enforcement of a 100 m buffer zone around all high risk ranked slopes, landforms and grinding groove areas is deemed as effective until an internal blasting risk management plan has been prepared and adopted.
- The risk of flyrock damage to the grinding grooves will be controlled by covering the grooves with flexible mats, sand or other suitable materials during blast events within 500 m of the grooves.
- Use of pre-split face batter or trim blasting where required to increase slope and highwall stability, particularly in areas of high risk.

5.4 Issues, Uncertainties or Gaps Identified in EIS Review

5.4.1 Agricultural Impact Statement

This section addresses the following Director General Environmental Assessment requirement:

An Agricultural Impact Statement that includes a specific focused assessment of the impacts of the proposal on strategic agricultural land, having regard to the draft gateway criteria in the draft New England North West Strategic Regional Land Use Plan.

Key findings of the review are summarised below with respect to the above requirement and the New South Wales State Government Strategic Regional Land Use Policy, Guideline for Agricultural Impact Statements (October, 2012):

Detailed assessment of the agricultural resources and agricultural production of the project area

- Section 7.20 of the EIS and the AIS (Appendix Z) provide an estimate of the water entitlements currently held by Shenhua Watermark, the available water licence allocations and the potential agricultural production value of the Shenhua Watermark water entitlements. Discussion of baseline surface and groundwater quality within the Project area and surrounding locality is not adequate as a comprehensive surface water and groundwater quality baseline has not been established (limitations associated with the baseline water quality assessment are discussed further in Section 4.4 of this report).
- The location and area of agricultural land to be temporarily displaced by the Project is described in Section 7.20 of EIS and the AIS (Appendix Z). The total area of disturbance for the Project is listed as 5,630 ha in Section 7.20 of the EIS and the AIS, this is higher than the 4,084 ha of land disturbance described in Section 3 of the EIS.
- A description of the land and agricultural capability classification system has not been provided in either Section 7.19 or 7.20 of the main EIS. This is however provided in the Soils and Land Capability Impact Assessment (Appendix Y) and should be brought into the main EIS document.

Identification of the agricultural resources and current agricultural enterprises within the surrounding locality of the project area.

- Section 7.20 and the AIS provide a description of the agricultural resources and current agricultural enterprises within the Project area and the surrounding locality.
- The areas of strategic agricultural land within the Project disturbance boundary (96.1 ha) and biodiversity offset areas (a further 696 ha) have been described in Section 7.20 of the EIS and the AIS (Appendix Z). These documents also acknowledge the presence of additional strategic agricultural land within 2 km of the Project boundary however the additional strategic agricultural land located within 2 km of the Project boundary is not quantified or described.

Identification and assessment of the impacts of the project on agricultural resources or industries.

- Section 7.20 and the AIS acknowledge the proposed Project will impact directly on the 96.1 ha of strategic agricultural land within the disturbance boundary. Section 7.20 and the AIS (Appendix Z) do not discuss in detail potential impacts to agricultural land, resources and strategic agricultural land outside of the proposed disturbance boundary associated with the

potential discharge of water and salinity from the Project during operations and post-closure. These are discussed further in Section 4.4 of this report.

- Potential Project related impacts associated with land value are not addressed in Section 7.20 and the AIS (Appendix Z), as required by the NSW guideline for Agricultural Impact Statements. Land value in relation to housing affordability, particularly in the regional centres, is discussed in Section 7.26 of the EIS. However potential impacts for land values for agricultural land in the locality of a coal mine during operations and post-closure are not discussed.
- Potential agricultural related impacts associated with pests and weeds are not addressed in Section 7.20 of the EIS, although mitigation strategies for weeds and pests are provided in Section 7.20 of the EIS and the AIS (Appendix Z).
- The air quality assessment has utilised site data, potentially influenced by local topography, sourced over a period of approximately 1.5 years over available longer term meteorological data in the Project locality (Discussed further in Section 6 of this review). Variability in the dominant wind direction in the Project locality, observed in long term meteorological data, has not been accounted for in the EIS assessment of potential air quality impacts. As a result of this, potential adverse air quality impacts from the proposed Project have not been fully assessed. This includes potential impacts to local cotton crops from coal dust. Cotton growers are concerned about the potential for coal dust to lead to cotton discolouration and a lower cotton sale price.
- Livestock impacts associated with noise, vibration and blasting are addressed in Section 7.20 and the AIS (Appendix Z) with the statement "*Mining operations within the region and abroad have for many years used company-owned land within close proximity to open cut mining to raise beef cattle and operate dairy farms. This suggests that livestock are not sensitive to environmental noise. As such it is unlikely that livestock on privately owned grazing properties within the locality of the Project will be affected by noise. Similarly, livestock quickly become accustomed to vibration from blast events, which would limit the potential for impacts on livestock health"*. Scientific literature or specific examples have not been cited to support these findings.
- Potential impacts, associated with flyrock, to livestock in active farmland close to active mining areas are not addressed in Section 7.20 and the AIS (Appendix Z).
- Potential impacts of dust on grazing livestock are addressed in Section 7.20 and the AIS (Appendix Z) by a literature review conducted for the Mt Pleasant Coal Project (Kannegieter, 1997). Kannegieter (1997) states that the possible effects of an increase in dust deposition level, whether it be in the range of 0-2 g/m^2/month; 2-4 g/m^2/month; or 4-10 g/m^2/month on grazing stock have not been adequately documented or investigated. However the uncertainly associated with the findings of this review are not acknowledged in Section 7.20 and the AIS (Appendix Z) when stating some of the findings of this literature review. A thorough review of the recent literature should be conducted to account for any potential recent additions to the scientific literature.
- Potential impacts associated with subsidence are not acknowledged in Section 7.20 and the AIS. Potential impacts relating to regional subsidence due to groundwater depressurisation are discussed in a report by SRK consulting which is appended in the Groundwater Impact Assessment (Appendix T). The findings and recommendation of this report have not been addressed in Section 7.20 and the AIS (Appendix Z). Potential subsidence impacts associated

with settling of unconsolidated overburden material in the overburden emplacement areas and instability of highwalls are not addressed in Section 7.20 of the EIS or the AIS.

- Generally, the level of uncertainty associated with predicted indirect impacts (eg. water, dust etc.) are not provided in either Section 7.20 or the AIS (Appendix Z).
- A cumulative assessment of Project impacts is not provided in either Section 7.20 of the EIS or the AIS (Appendix Z).

Account for any physical movement of water away from agriculture.

- The relocation of an average of 194 ML/y of water from agricultural purposes to the proposed Project is accounted for in Section 7.20 and the AIS (Appendix Z). The potential impacts on agricultural productivity are quantified by calculating the agricultural economic productivity of this volume of water. However, the potential agricultural impacts associated with the displacement of larger volumes of water (up to 600-900 ML/y, in addition to pit dewatering) during times of water stress are not addressed.
- The uncertainty associated with the water balance is not acknowledged when discussing the quantities or impacts of water potentially displaced from agriculture by the Project.

Assessment of socio-economic impacts.

- Section 7.20 of the EIS and the AIS (Appendix Z) address the potential impacts associated with traffic and support infrastructure and services, visual amenity, and labour supply. Potential impacts to the other rail network users are acknowledged due to the proposed transport of coal via the rail network. These potential impacts are not discussed relative to peak agricultural transport times (eg. harvests).
- Section 7.20 of the EIS and the AIS (Appendix Z) site a number of network upgrades to increase the capacity and operational flexibility for existing rail users to assist in relieving the impact of the Project and other existing and proposed rail users on the haulage requirements of the agricultural industry. No contingency strategies are provided if the proposed network upgrades are delayed or not completed.

Identification of options for minimising adverse impacts on agricultural resources, including agricultural lands, enterprises and infrastructure at the local and regional level.

- It is not possible to conduct a detailed assessment of the potential Project impacts on agricultural resources and production as the geochemistry of mine waste materials, their management and potential water quality and salinity impacts have not been addressed in adequate detail (These issues are discussed further in Section 4 of this review). However, from the data available at this point in time, the management measures proposed in the EIS, relating to surface water and groundwater resources and indirectly soils, land capability and land use, are inadequate.
- Options for the mitigation of potential adverse impacts on agricultural resources are provided in Section 7.20 and the AIS (Appendix Z). The mitigation measures provided are very general and do not provide detail addressing the content of monitoring programs, trigger points and trigger response plans.

Document consultation with adjoining land-users and Government Departments.

- Section 7.20 of the EIS does not address details of an engagement strategy with adjoining land users and Government departments. This is however addressed in the AIS (Appendix Z). Details of the engagement strategy should be provided in Section 7.20 of the EIS.

5.4.2 Soils and Land Capability

This section addresses the following Director General Environmental Assessment requirement:

The EIS must also include a detailed description and assessment of the potential impacts on:

- *Soils and land capability (including salinization and contamination).*

Key findings of the review, with respect to the above requirement, are summarised below:

Soils

- Section 7.19 of the EIS includes an assessment of the soils and land capability prepared by GSS Environmental (Appendix Y of the EIS). This section provides a detailed characterisation of soils within the Project boundary.
- Figure 59 of the EIS shows the location of the reference soil profiles used to characterise the soils within the Project disturbance boundary. The majority of the soil profiles within the Project disturbance boundary (approximately 74%) are within the Eastern extent of the Project disturbance boundary. The rationale for the location of the soil profiles is not provided and as such it is unclear whether the soils in the Western extent of the Project disturbance boundary haven been adequately characterised.
- Neither Section 7.19 of the EIS or Appendix Y provide a detailed assessment of the potential impacts associated with the disturbance of soils (topsoils and subsoils) within the Project disturbance boundary during construction, operations and/or post-closure.
- Section 7.19 of the EIS and the Appendix Y state there will be no disturbance of the alluvial black soils as a buffer of 150 m will be maintained between the soils and the open cut pits. Potential impacts to alluvial black soils related to the development of other mining related infrastructure or the potential discharge of surface water during operations and post-closure are not addressed.
- A detailed soil balance is provided in Section 7.19 and Appendix Y. The key uncertainties with the soil balance are:
  - The soil balance is based on a rehabilitation area of 3,384 ha, while the disturbance footprint provided in Section 3 of the EIS is 4,084 ha (5,630 ha in Section 7.20 of the EIS). It is unclear whether there is adequate soil available for rehabilitation of the entire Project disturbance boundary.
  - It includes soils that were classified in the soil classification (Appendix Y) as not suitable for use in rehabilitation (soil type 4a between 0.25 and 1.2 m, soil type 6a between 0 and 1.2 m, soil type 6b between 0.35 and 1.2 m, soil type 7 between 0.6 and 1.2 m and soil type 8 between 0.25 and 1.2 m).
  - Some of the soils in the soil balance (soil type 3b, soil type 5, soil type 6b and soil type 7) require blending with either limestone or sandy material in order to be appropriate for use in rehabilitation (Appendix Y). It is not stated in the mitigation and management section of Section 7.19 of the EIS or the rehabilitation and mine closure strategy (Section 7.26) that these soils will be blended appropriately prior to use in rehabilitation.
- The location of soil (ie. topsoil and sub-soil) stockpiles are not provided in Section 7.19 and Appendix Y. Soil stockpile locations may be quite large given the volumes of soil to be stripped

and stored for rehabilitation. Potential impacts associated with the location of soil stockpiles have not been addressed in Section 7.19 of the EIS.

- As discussed in Section 5.4.1 there is no detailed discussion of potential salinity or contamination impacts during operations and post-closure associated with the discharge of water and salinity on soils within and surrounding the proposed Project.
- A desktop assessment was undertaken to identify the past and present potential for contamination within the Project Boundary. The assessment involved a review of soil landscape maps, historical aerial photographs, Shenhua Watermark property condition inspection reports, OEH public registers and the Historic Heritage Impact Assessment prepared for the Project (Appendix R). Section 7.19 of the EIS does not incorporate the findings of the Preliminary Contamination Assessment (Appendix AD) in its assessment of potential impacts or development of mitigation strategies for soil disturbance and management.

Land Capability

- Section 7.19 of the EIS and Appendix Y state that no Class II land will be disturbed as a result of the Project, however Class II land is shown within the indicative Project disturbance boundary. The proponent must clarify whether Class II land will be disturbed as a result of the Project.
- Similarly, Class 1 agricultural land is located within the Project disturbance boundary, but it is stated in Section 7.19 of the EIS and Appendix Y that no Class 1 agricultural land will be disturbed by the Project. The proponent must clarify whether Class 1 agricultural land will be disturbed as a result of the Project.
- 238 ha of seepage zones (230 ha Eastern Overburden Emplacement Area; 53 ha Southern Overburden Emplacement Area) from the overburden emplacement areas have been identified and mapped in the Groundwater Impact Assessment (Appendix T; Appendix 6). There is overlap with these seepage areas and the post-mining rehabilitated agricultural land. The Section 7.19-7.20 of the EIS do not account for these areas of seepage or the potential quality of the seepage in its assessment of post-mining land capability.
- 1,000 ha of rehabilitated Class III land within the Project disturbance boundary has been flagged for agricultural use, 100 ha of which will be rehabilitated to meet biophysical strategic agricultural land (Appendix AA). It is unclear whether the composition of the overburden material / pore water / surface seepage will allow for the establishment of Class III agricultural land and biophysical strategic agricultural land (uncertainties with the geochemical assessment of the overburden material are discussed further in Section 4.4).

5.4.3 Landforms and Topography

This section addresses the following Director General Environmental Assessment requirement:

The EIS must also include a detailed description and assessment of the potential impacts on:

- *Landforms and topography, including cliffs, rock formations, steep slopes, etc.*

Key findings of the review, with respect to the above requirement, are summarised below:

- The preliminary success criteria for the Rehabilitation, Conceptual Final Landform and Mine Closure Section of the EIS, Section 7.21 state that no less than 75 % of the rehabilitated area

will have slopes less than 10° (within the <15° slopes in the Project locality). It remains unclear what range of slopes will occur for the remaining 25 % of rehabilitated landforms.

- Potential impacts and mitigation strategies associated with the subsidence (eg. settling of unconsolidated waste rock material in overburden emplacement areas and/or pit wall instability during operations) and/or swelling (eg. associated with the wetting of unconsolidated waste rock material in overburden emplacement areas) of the overburden emplacement areas have not been discussed. These potential impacts may impact the ability to achieve post-mining land capability and land use objectives.
- Potential impacts relating to regional subsidence due to groundwater depressurisation are discussed in a report by SRK consulting which is appended in the Groundwater Impact Assessment (Appendix T). The findings and recommendation of this report should be addressed in Section 7.20 and the AIS (Appendix Z).
- The Geochemical Over-Interburden Assessment (Appendix AD) notes that a proportion of the overburden/interburden samples collected were sodic or strongly sodic, and that these materials may be prone to dispersion and erosion. Section 7.21 of the EIS does not incorporate the recommendation of the Geochemical Assessment (Appendix AD) for selective disposal of sodic or strongly sodic overburden within the interior of the overburden emplacement area (ie. encapsulation) or establishment of a good topsoil cover to minimise erosion.

5.4.4 Land Use and Pre and Post-mining Agricultural Assessment

This section addresses the following Director General Environmental Assessment requirement:

The EIS must also include a detailed description and assessment of the potential impacts on:

- *Land use, including agricultural, forestry, conservation and recreational use, with particular reference to agricultural land use and Breeza State Forest;*
- *Pre-mining and post-mining agricultural assessment and mapping (including Land Capability and Agricultural Suitability mapping) of soil characteristics across all proposed disturbance areas, and an assessment of their value and rehabilitation limitations.*

Key findings of the review, with respect to the above requirement, are summarised below:

- 238 ha of seepage zones (230 ha Eastern Overburden Emplacement Area; 53 ha Southern Overburden Emplacement Area) from the overburden emplacement areas have been identified and mapped in the Groundwater Impact Assessment (Appendix T; Appendix 6). There is overlap with these seepage areas and the post-mining rehabilitated agricultural land. The rehabilitation and mine closure plan does not account for these areas of seepage or the potential quality of the seepage in its assessment of post-mining land capability.
- 1,000 ha of rehabilitated Class III land within the Project disturbance boundary has been flagged for agricultural use, 100 ha of which will be rehabilitated to meet biophysical strategic agricultural land (Appendix AA). It is unclear whether the composition of the overburden material / pore water / surface seepage / subsidence will allow for the establishment of Class III agricultural land and biophysical strategic agricultural land (uncertainties with the geochemical assessment of the overburden material are discussed further in Section 4.4).

- 2,384 ha of rehabilitated land will be restored with native vegetation (Appendix AA). It is unclear whether the composition of the overburden material / pore water / surface seepage / subsidence will allow for the establishment of the specified native vegetation communities (uncertainties with the geochemical assessment of the overburden material are discussed further in Section 4.4).

5.4.5 Definition of the Upper Namoi Alluvium

This section addresses the following Director General Environmental Assessment requirement:

Agricultural resources and/or enterprises in the local area, with particular reference to highly productive alluvial soils that may be impacted directly or indirectly by the project, and including:

- *Definition of the Upper Namoi Alluvium, and justification for the nominated limit.*

Key findings of the review, with respect to the above requirement, are summarised below:

- It has not been possible to achieve the Director General's Requirement to define the limit of the Upper Namoi Alluvium given that:
  - The data is relatively sparse within the key areas of interest.
  - It can be difficult to pick base of alluvium as weathered Permian bedrock highs can also have a low resistivity response.
- Further drilling and/or geophysical data are required in the key areas of interest in order to verify the extent of the Gunnedah Formation and any high permeability pathways that may connect the Project area and Gunnedah Formation, to reduce the uncertainty associated with modelled impacts on groundwater levels.

5.4.6 Land Use Implications of Biodiversity Offsets

This section addresses the following Director General Environmental Assessment requirement:

Agricultural resources and/or enterprises in the local area, with particular reference to highly productive alluvial soils that may be impacted directly or indirectly by the project, and including:

- *Any change in land-use arising from requirements for biodiversity offsets.*

Key findings of the review, with respect to the above requirement, are summarised below:

- Section 7.19 and 7.20 identify 696 ha of biophysical strategic agricultural land which will be classified as on-site biodiversity offset areas. This would result in the unavailability 696 ha strategic agricultural land for agricultural production. This review acknowledges the requirement of fertile land for successful biodiversity offset areas. However, it is unclear whether other potential biodiversity offset areas were considered in order to retain the availability of the 696 ha of strategic agricultural land for agricultural purposes or minimise the amount of strategic agricultural land locked up in a biodiversity offset area.

5.4.7 Management Measures

This section addresses the following Director General Environmental Assessment requirement:

Agricultural resources and/or enterprises in the local area, with particular reference to highly productive alluvial soils that may be impacted directly or indirectly by the project, and including:

- *A detailed description of the measures that would be implemented to avoid, reduce or mitigate impacts of the development on local agricultural resources and/or enterprises.*

Key findings of the review, with respect to the above requirement, are summarised below:

- It is not possible to conduct a detailed assessment of the potential Project impacts on agricultural resources and production as the geochemistry of mine waste materials, their management and potential water quality and salinity impacts have not been addressed in adequate detail (these issues are discussed further in Section 4 of this review). However, from the data available at this point in time, the management measures proposed in the EIS, relating to surface water and groundwater resources and indirectly soils, land capability and land use, are inadequate.
- Options for the mitigation of potential adverse impacts on agricultural resources are provided in Section 7.20 and the AIS (Appendix Z). The mitigation measures provided are very general and little detail addressing the content of monitoring programs, trigger points and trigger response plans is provided.
- There is no discussion in Section 7.20 of potential compensation strategies for local agricultural enterprises where potential adverse Project impacts to agricultural resources and productivity are not appropriately minimised.
- Section 7.19 and 7.20 identify 696 ha of biophysical strategic agricultural land which will be classified as on-site biodiversity offset areas. This will result in the unavailability of 696 ha of strategic agricultural land. It is unclear whether other potential biodiversity offset areas were considered in order to minimise the amount of biophysical strategic agricultural land impacted by the biodiversity offset areas.

5.4.8 Justification for Long Term Impacts to Agricultural Resources or Soils

This section addresses the following Director General Environmental Assessment requirement:

Agricultural resources and/or enterprises in the local area, with particular reference to highly productive alluvial soils that may be impacted directly or indirectly by the project, and including:

- *Justification for any significant long term changes to agricultural resources, particularly highly productive soils potentially affected by the development.*

Key findings of the review, with respect to the above requirement, are summarised below:

- It is not possible to conduct a detailed assessment of the potential Project impacts on agricultural resources and production as the geochemistry of mine waste materials, their management and potential water quality and salinity impacts have not been addressed in adequate detail (These issues are discussed further in Section 4 of this review). As such potential long term impacts to local agricultural resources (soils, surface water and groundwater) and productivity have not been adequately addressed or justified.

6.0 Air Quality and Greenhouse Gas Impacts

6.1 Overview and Assessment

An air quality and greenhouse gas impact assessment was undertaken by PAE Holmes (Appendix G). This is a detailed and comprehensive study that is reflected in the EIS Main Report.

Air quality impact on the surrounding environment is one of the major environmental impacts from coal mining in NSW. This has been well documented in the *NSW Coal Benchmarking Study: International Best Practice Measures to Prevent and/or Minimise Emissions of Particulate Matter from Coal Mining* (Katestone, 2010) identifying that coal mining produces 34% of the particulate matter less than 10 micron in the greater metropolitan region of NSW.

Detailed modelling of air quality impacts has been undertaken by PAE Holmes.

It appears that one significant flaw of the study is the selection of the wind data that has been used in the modelling. Wind data was used from November 2010 to October 2011 for the modelling. This data shows wind predominantly from the South East. Inspection of data from other years at the nearby Caroona Feedlot, which was discounted in the study, shows that wind is much more variable, including wind direction from the north which would impact many more private receptors.

It is clear that the air modelling should be conducted over a greater spread of wind conditions reflecting the variable nature of wind patterns in the area.

Due to the importance of this issue and the potential for impact on community and assets, it is recommended that wind data over a longer time period is used in the modelling of air quality for the Watermark Project and the impact assessment revised.

Calculations carried out in estimating greenhouse gas emissions are generally well conducted and are in accordance with the *National Greenhouse and Energy Reporting (Measurement) Determination* (DCCEE, 2008) and the *National Greenhouse Accounts Factors July 2012* (DCCEE, 2012) methodology. The calculations have included the majority of emission activities and Scopes (Scope 1: direct emissions, Scope 2: indirect emissions with respect to purchased electricity, and Scope 3: general indirect emissions).

However, the greenhouse gas emission mitigation strategies are very brief and are not considered sufficient to address the terms listed in the Director General's Environmental Requirements and EPBC Act requirements.

In order to fully address these requirements and to achieve emissions reduction during construction and operation, the following actions are considered necessary:

- Assess coal seam gas harvesting potential considering the substantial estimated release of fugitive CH_4 during operations.
- Develop more detailed approaches for implementing the proposed greenhouse gas reduction measures. For example, conduct feasibility assessments of each proposed measure including establishment of best practice, document planning and management of measures to be implemented, list goals to be achieved and develop a monitoring framework, as well as conducting financial assessments).
- Provide a more realistic assessment of greenhouse gas (GHG) impacts by including Scope 2 and 3 emissions sources in the analysis of the GHG impacts; and updating impacts of the

Project on anthropogenic global warming using a Global Carbon Budget approach as defined in the scientific literature.

The comments made above are based on a review of work undertaken in relation to air quality and greenhouse gas emission impacts (Section 6.2), key findings of this work as identified in the EIS (Section 6.3), and the issues, uncertainties and gaps in the EIS identified in Section 6.4.

6.2 Work Undertaken

6.2.1 Air Quality Assessment

Key tasks undertaken for the air quality assessment included (EIS Main Report, Section 7.6):

- An air quality assessment which was completed by developing emissions inventories and allocation of sources of dust for different activities within the Project for Years 1, 2, 5, 10, 15, 21, 25 and 30.
- An assessment of air quality impacts associated with blasting for the Project.
- Diesel fume assessment.
- Cumulative impact assessment taking into account the Project and other non-mining sources.

6.2.2 Greenhouse Gas Assessment

Key tasks undertaken for the greenhouse gas assessment included (EIS Main Report, Section 7.7):

- Quantification of greenhouse gas emissions (Scopes 1, 2, and 3) based on the Project's operation and the assumed end use of the coal including:
  - Fuel consumption (diesel generators and mobile equipment) during construction and operation – Scope 1.
  - Release of fugitive emissions during operation (CH_4 release) – Scope 1.
  - Explosives consumption (ANFO) – Scope 1.
  - Emissions associated with the loss of carbon through vegetation clearing – Scope 1.
  - Electricity consumption – Scope 2.
  - Production and transport of fuels – Scope 3.
  - Transport of the coal (via rail to Newcastle) – Scope 3.
  - The use and combustion of the product coal – Scope 3.
- Preliminary qualitative assessment of the effect of greenhouse gas emissions on global warming (including comparison of the Project's Scope 1 emissions with respect to Australia's first commitment for emissions reduction under the Kyoto Protocol).
- Brief outline of strategies to reduce greenhouse gas emissions.

6.3 Key Findings and Issues Reported in EIS

6.3.1 Air Quality Assessment

Key findings of the Greenhouse Gas Impact Assessment are summarised below:

- The Air Quality specialist assessment and EIS indicates that there are no significant impacts on receptors due to the Project as detailed below:

  "Dispersion modelling results showed that that the predicted impacts for PM_{10}, $PM_{2.5}$, NO_2 and SO_2 at all receptors were significantly below their respective assessment criteria/standard. Further, there were no additional exceedances of the criteria at the residences when the NO_2 impacts from the diesel fumes were included with the predicted impacts from blast fumes and the existing background."

- The modelling predicts some exceedences of criteria for certain receptors on some days. The level of predicted impact is unusually low given the size and nature of the project and the proximity of receptors to the Project.
- A commitment to best practice management and monitoring measures has been made within the EIS.

6.3.2 Greenhouse Gas Assessment

Key findings of the Greenhouse Gas Impact Assessment are summarised below:

- Quantification of greenhouse gas emissions
  - Data provided by the Proponent was used to estimate the emissions for all Scopes 1, 2 and 3.
  - The estimated emissions over the Project lifetime (30 years) are as follows:
    - Scope 1: 7,674,838 tCO_2e
    - Scope 2: 741,576 tCO_2e
    - Scope 3: 403,731,823 tCO_2e
  - The major contributors of Scope 1 emission sources are: fuel consumption (diesel generators and mobile equipment) during construction and operation (52%) and fugitive CH_4 emissions release during operations (39%). The remainder is comprised of emissions due to loss of carbon during vegetation clearing and the consumption of explosives (ANFO) during operations (emissions for vegetation clearing have been derived from Australian Greenhouse Office, 2000).
  - The emissions for the consumption of explosives have been calculated using an emission factor released by the Australian Green Office (AGO) in 2006.
- Impact of greenhouse gas emissions
  - To illustrate the Project's greenhouse gas emissions impact, the specialist study draws comparison between the Project's Scope 1 emissions and estimates for the total global (2005 data) and national anthropogenic total emissions (2009 data). This report states that the Project's Scope 1 emissions would represent 0.04% of Australia's allowance under the first Kyoto Protocol commitment and a very small portion of global and national emissions.

- An attempt to quantify the temperature increase associated with various global warming scenarios has also been carried out for towns/cities closest to the Project. This has been derived from studies conducted by CSIRO (2007) and IPCC (2007a and 2007b). It is noted that the Project's contribution to projected climate change, and the associated impacts, would be in proportion with its contribution to global GHG emissions.
- The estimated GHG emissions intensity of the Project is approximately 0.05 tCO_2e/t saleable coal (based on Scope 1 emissions only).

- Greenhouse gas mitigation strategies
  - The EIS Main Report (Section 7.7.4) and Appendix G provide a brief outline of possible strategies to reduce emissions from the Project's operation.

6.4 Issues, Uncertainties or Gaps Identified in EIS Review

6.4.1 Air Quality Assessment

This section addresses the following Director General Environmental Assessment Requirement:

A quantitative assessment of potential:

- *Construction and operational impacts, with a particular focus on dust emissions (including $PM_{2.5}$ and PM_{10} emissions, and dust generation from coal transport), as well as diesel and blast fume emissions.*
- *Spontaneous combustion properties of overburden or reject material.*
- *Reasonable and feasible mitigation measures to minimise dust, diesel and blast fume emissions, including evidence that there are no such measures available other than those proposed.*
- *Monitoring and management measures, in particular real-time air quality monitoring and predictive meteorological forecasting.*

Key findings of the review, with respect to the above requirement, are summarised below:

- On face value the Director General air quality assessment requirements have been met. However, it appears that there is a significant flaw in the quantitative assessment that has been undertaken. Wind data was used from November 2010 to October 2011 for the modelling. This data shows wind predominantly from the South East. Inspection of data from other years at the nearby Caroona Feedlot, which was discounted in the study, shows that wind is much more variable, including wind direction from the north which would impact many more private receptors.
- It is clear that the air modelling should be conducted over a greater spread of wind conditions reflecting the variable nature of wind patterns in the area.
- Due to the importance of this issue and the potential for impact on community and assets, it is recommended that wind data over a longer time period is used in the modelling of air quality for the Watermark Project and the impact assessment revised.

6.4.2 Greenhouse Gases - Quantitative Impact Assessment

This section addresses the following Director General Environmental Assessment Requirement:

A quantitative assessment of potential Scope 1, 2, and 3 greenhouse gas emissions.

Key findings of the review, with respect to the above requirement, are summarised below:

- Supporting documentation in relation to the calculations of emissions, relevant data, and sampling locations for fugitive CH_4 (coal seam gas) release are not provided. Therefore, it is not possible to determine the accuracy on the estimate of the Scope 1 fugitive CH_4 emissions and whether appropriate sampling and measurement methodology and standards (as stated under the *NGER Measurement Determination July 2012*) have been followed. Note it is unclear if the Proponent applied a higher order method[9] under NGER. Under a default Method 1 of *NGER Measurement Determination*, the emission factor is 0.045 tCO_2e/t ROM coal, which results in estimated fugitive emissions of 12,374,648 tCO_2e over the Project lifetime. Therefore, without additional information it is unclear if the fugitive emissions have been calculated correctly (as per *NGER Measurement Determination*) and it is possible that this source has been underestimated.
- The emissions from the use of explosives (assumed to be ANFO) during operation of the mine site were based on an emission factor released by the Australian Green Office (AGO) in 2006. The method has since been updated and therefore calculation should be re-evaluated as per the method outlined in Supplementary Guideline for Reporting on blended fuels and other fuel mixes (released by the Clean Energy Regulator in August 2012).
- Emissions from the shipping of the product coal have been excluded due to the many uncertainties associated with destinations and emission factors and/or fuel consumption for ocean going vessels. To understand the potential magnitude of such emissions, a conservative scenario should have been assumed and modelled. Emission factors for shipping of bulk commodities are available (eg. from IPCC reports) and could be applied. It is likely that this Scope 3 emission source will be significant and will be in the top three highest emission sources of the Project.
- The reference for the emission factor for coal transportation (Queensland Rail Network, 2002) cannot be found and verified. However, the emission factor stated here does seem reasonable.
- It is not clear whether emissions from activities at auxiliary facilities (eg. sewage treatment plant) within the Project boundary have been included in the Scope 1 emissions calculations.
- There are no detailed calculations provided in the specialist study (Appendix G) for the *indirect emissions associated with the production and transport of fuels – scope 3* (item 6 on Table 37: Total Greenhouse Gas Emission Prediction in the EIS Main Report). It is therefore not possible to determine the accuracy of this estimate.
- The potential for fugitive greenhouse gas emissions due to carbonate dissolution, associated with sulfide oxidation and acid generation and neutralisation reactions, could be substantial (eg. in the order of 1 Mt tCO_2e over the Project lifetime) but has not been assessed.

[9] Under NGER, higher order method implies actual measurement of gas content (i.e. through sampling of gas at bore holes) and determination of emission factor based on the samples taken (i.e. via laboratory analysis). Whereas, Method 1 measurement would require the use of the default emission factor (as set out in NGER Measurement Determination) of 0.045 tCO_2e/t ROM coal for NSW.

6.4.3 Greenhouse Gases - Qualitative Impact Assessment

This section addresses the following Director General Environmental Assessment Requirement:

A qualitative assessment of the potential impacts of these emissions on the environment.

Key findings of the review, with respect to the above requirement, are summarised below:

- The impact assessment is largely based on the Project's Scope 1 direct emissions only (see second paragraph of Section 7.7.3 of the EIS Main Report). When considering the impact in national and global context, all three scopes of emissions should be included to reflect the overall impact (direct and indirect) of the Project's construction, operation, and closure activities. Limited attention has been given to the most significant GHG emission activity – the 'use and combustion of the product coal' – although it is the largest source of total Project emissions by nearly 2 orders of magnitude (representing 98% of total Project emissions).
- In the Executive Summary, under 'Greenhouse Gas', only direct GHG emissions are discussed. Considering that indirect emissions are the largest source by nearly 2 orders of magnitude, the global warming impacts discussion should also these Scope 2 and 3 emissions.
- The methodology presented in Section 7.7.3 in the EIS Main Report and in Section 13.3 'Impact on the Environment' has not considered recent scientific literature regarding greenhouse gas emissions and impacts, as needed to assess the Project's total emissions impact in the national and global context, such as:
  - The Global Carbon Budget of 750 $GtCO_2e$ has not been used as a basis for assessing the Project's total emissions (including Scope 1, 2 and 3) contribution. Note: the 750 $GtCO_2e$ budget is believed to offer a 2/3 chance of maintaining anthropogenic global warming to a 2 degree temperature rise (Schellnhuber et al, 2009). The Project would represent 0.05% of total international greenhouse gas emissions under the Global Carbon Budget approach.
  - No consideration has been given to the implications of recent International Energy Agency (IEA) analysis regarding remaining Global Carbon Budget and what proportion of existing known fossil fuel reserves must not be combusted. The IEA in the World Energy Outlook report (2012) indicated that to "*no more than one-third of proven reserves of fossil fuels can be consumed prior to 2050 if the world is to achieve the 2 °C goal*".
  - There is no mention of the internationally agreed threshold of limiting anthropogenic global warming to 2 degrees above pre-industrial levels, nor there analysis conducted on long term impacts at 2100, which is a standard scientific reporting timeframe. Discussion of global warming impacts at projected temperature increases of 4 to 6 degrees in 2100 would have been more appropriate.
- In Section 13.4 'Greenhouse Gas Emissions Intensity':
  - To enable a transparent impact assessment, the GHG emissions intensity estimates for the Watermark Project and other coal mines should incorporate all scopes emissions (Scope 1, 2 and 3). However, the GHG emissions intensity estimates for the Watermark Project refers to Scope 1 emissions only, and it is unclear whether Scope 2 and 3 emissions have been included in the "greenhouse intensity" data presented for other Projects. It is therefore not possible to compare the Project "greenhouse intensity" with other coal mines.

  - It should be stressed on the last paragraph of Section 13.4 that the largest emissions activity of all scopes is the '*end use and combustion of coal*'.

- It is not stated whether the liquid petroleum fuel (for Scope 1 emission calculations purposes) would be subject to any duty under *Customs Tariff Act 1995* or *Excise Tariff Act 1921*, in which case the emissions from the combustion of the liquid petroleum fuel may not be directly liable under the carbon pricing mechanism (thus, this could alter the amount of carbon tax payable by the Proponent).
- The Project's Scope 1 emissions have been compared with Australia's first commitment under Kyoto Protocol. However, Australia has now signed up to a second commitment period since December 2012 to reduce its emissions by at least 5% below 2000 emissions levels. As this is more stringent than the previous commitment, the relative impact of the Project will be greater than indicated in the EIS.

6.4.4 Assessment of Greenhouse Gas Emissions Reduction Measures

This section addresses the following Director General Environmental Assessment Requirement:

An assessment of reasonable and feasible measures to minimise greenhouse gas emissions and ensure energy efficiency.

Key findings of the review, with respect to the above requirement, are summarised below:

- There is no mention in the assessment about the potential harvesting options of coal seam gas released during operations. This may be a significant factor for consideration due to the substantial amount of coal seam gas (fugitive CH_4) release and the Project's proximity to other coal seam gas exploration areas.
- The EIS Main Report only provides a very brief outline of possible strategies to reduce emissions from the Project's operation (see Section 7.7.4 of the EIS Main Report or in the specialist study in Appendix G). The Proponent does not appear to have considered tangible emission reduction approaches in any detail, despite the requirement under the Director's General Requirements and EPBC Act (*"...a description of the mitigation measures that will be undertaken to prevent or minimise the relevant impacts of the action. These mitigation measures should be substantiated and based on best available practices.*").
- More detailed approaches in implementing the greenhouse gas reduction measures should be developed. This could be achieved by conducting feasibility assessment of GHG reduction measures including establishment of best practices, thorough planning and management of measures to be implemented, goals/KPIs/targets to be achieved, monitoring framework, as well as financial assessment.
- No best practice analysis with regards to the qualitative assessment of the greenhouse gas emissions reduction strategies and emissions intensity has been carried out in the report.
- Carbon capture and storage (CCS) faces regulatory, policy and technical barriers that make its deployment uncertain in an international context. It is unclear how the Project will assist the research and promotion of low emission coal technologies given the lack of development to date, and significant obstacles discussed by international energy agencies (IEA, 2011).
- As part of managing carbon tax liability, it may be worth considering carbon offset mechanisms (eg. actual purchase of carbon credits for offsetting purposes or co-investment in local renewable energy projects). The latter would represent a long term tangible emission reduction

measure, for example through funding a local renewable energy plant to offset a certain percentage of the Project's annual emissions.

- Reporting and monitoring of greenhouse gas emissions is required by law under the *National Greenhouse and Energy Reporting Act 2007* (NGER Act) and the *Clean Energy Act 2011*. As the Project is likely to exceed the threshold for reporting, therefore, an appropriate and accurate greenhouse gas emissions inventory and monitoring framework should be in place for reporting purposes and determining carbon tax liability.

7.0 Ecological / Biodiversity Impacts

7.1 Overview and Assessment

In general, a thorough baseline has been established for the flora, fauna and ecological communities present within the proposed Project footprint. The potential impacts of the Project on these areas have generally been assessed in detail and a variety of mitigation measures have been proposed, including an offset strategy for residual impacts on vegetation. However, there are several significant gaps in the assessment of potential impacts of the Project (particularly regarding impacts on surrounding areas), and uncertainties regarding the mitigation measures outlined, as well as the approach used to assess offsets. Clarification of the issues identified will be required to ensure that the potential impacts on flora and fauna are adequately assessed and an appropriate management and offset strategy are in place to address these impacts. Further survey work will also be required if these issues are unable to be addressed based on existing data.

To adequately comprehend and manage the potential impacts from the Project, the following actions are considered necessary:

- Conduct further baseline surveying and assessment of potential impacts on highly mobile fauna, as well as potential indirect and cumulative impacts on fauna, within a continuous zone around the Project Boundary as required by OEH's Survey and Assessment guidelines (2009). With the exception of some potential offset sites in the surrounding area, detailed flora and fauna surveys have only been conducted within the 'Project Boundary' which is defined as the location of Project activities. As per the guidelines the Project area plus the immediately adjacent areas should have been surveyed so that impacts can be assessed for species in the surrounding region.
- Given the significant risks and uncertainties associated with translocation of koalas, revise the Koala Plan of Management to include:
  - Details of how the Key Performance Indicators for the plan will be measured (including time-bound thresholds for achievement of the Plan Objectives).
  - Contingency measures for the potential scenario where Plan Objectives are not met within a reasonable timeframe.
  - Detailed criteria for assessing the success of establishing corridors/linkages between existing vegetated areas such as Breeza State Forest and other suitable koala habitat.
  - Detailed information regarding criteria to evaluate at what point animals to be translocated are euthanized (e.g. end point) to protect Koala welfare.
- Recalculate the offsets required for potential impacts on EPBC Act species and communities based on the new Environmental Offsets Policy released in October 2012, and update the proposed Biodiversity Offset Strategy accordingly (or provide evidence of approval from SEWPaC that assessment under the previous policy is acceptable). The current EIS does not take the latest policy into account in the determination of offsets required.
- Consider the potential impacts of expected long term seepage of saline water from the Overburden Emplacement Areas (OEAs) on Onsite Offset sites (eg. impacts on revegetation success) and other areas (eg. downstream), and re-evaluate the Biodiversity Offset Strategy based on the findings of this assessment. The current EIS does not consider the potentially

significant ecological impacts of this seepage.

The comments above are based on a review of the work undertaken pertaining to impacts on flora, fauna and vegetation communities (Section 7.2), key findings of this work (Section 7.3) and the issues, uncertainties and gaps identified from relevant ecological sections in the EIS identified in Section 7.4.

7.2 Work Undertaken

Four main studies/reports were used to determine the current ecological environment and assess potential impacts upon flora, fauna and ecological communities. The main specialist study drawn on is the Ecological Impact Assessment. Potential impacts on Stygofauna were assessed in a separate study and are discussed separately in the EIS. The key studies undertaken that are relevant to the ecological/biodiversity impacts are the:

- Ecological Impact Assessment (EIS Main Report, Section 7.10 and 7.11; Appendix K).
  - Several flora and fauna studies were undertaken by GHD in 2009 and Cumberland Ecology between 2010 and 2012. The ecological characteristics within the Project Boundary were assessed by a two-stage process; (1) literature/database review and (2) field surveys. Field surveys were generally restricted to woodland areas (i.e. not pasture). Flora and vegetation were mapped and the presence of vegetation communities was confirmed against set criteria. The fauna field surveys involved observation and capture methods for all vertebrate fauna potentially inhabiting the site. Searches and capture methods targeted threatened species known, or having the potential, to inhabit the site. Aquatic or potentially aquatic environments within the Project Boundary were assessed for vegetation and macroinvertebrate diversity. The work undertaken in this study led to additional studies/reports on Koala (*Phascolarctos cinereus*) management and Matters of National Environmental Significance (see below).
- Koala Plan of Management (EIS Main Report, Section 7.10; Appendix L).
  - Preliminary assessments highlighted that the Koala (listed as Vulnerable at national and state levels) is likely to be significantly impacted by the Project and therefore, a species-specific management plan was drafted to supplement the results of the field surveys provided in Appendix K. The Koala Plan of Management compiled by Cumberland Ecology provides a framework to reduce impacts on the substantial Koala population within the Project Boundary, translocate affected individuals, as well as to improve and revegetate surrounding Koala habitat. The plan details how the approximately 270 Koalas will be encouraged to leave the Project Boundary once clearing begins and the methods of translocation (if necessary). Additionally, the Plan outlines how habitat in the surrounding area will be improved and/or further areas revegetated over the life of the Project (30 years) to provide suitable Koala habitat.
- Report on Matters of National Environmental Significance (EIS Main Report, Section 7.10; Appendix M).
  - This report was compiled by Cumberland Ecology to provide requisite information about the controlled action as identified by the Commonwealth Minister for the Environment. The report provided information and key findings from the Ecological Impact Assessment and discussed potential impacts on water. There was no new field data/information presented within this report.

- Stygofauna Impact Assessment (EIS Main Report, Section 7.12; Appendix U).
  - Eco Logical Australia conducted a study on the impact of the Project on Stygofauna in 2011 and this was briefly summarised in a separate section of the EIS. The assessment involved a literature review and field testing of soil/bore samples. Samples were screened for all stygofauna from varying strata and aquifer types. Hydrogeological modelling results (AGE, 2013) were also used to indicate potential stygofauna habitat.

7.3 Key Findings and Issues Reported in EIS

7.3.1 Ecology

Key findings from the sections outlining baseline ecological setting and potential biodiversity/ecology impacts are summarised below:

- Existing Environment
  - Six vegetation communities with critically endangered status under the EPBC Act (covering a total of 1265 ha) were identified within the Project Boundary. A further five nationally (EPBC Act) and state endangered vegetation communities (122 ha) and several other non-listed vegetation communities were identified. The area within the Project Boundary is dominated by low diversity grassland and planted and exotic pasture (7290 ha).
  - Several threatened flora species were identified as having the potential to inhabit the Project Boundary. Only one nationally vulnerable flora species was recorded during the 2010-2012 field surveys (Lobed Blue-grass *Bothriochloa biloba*). Although only one threatened flora species was found during the field surveys, it is likely that other threatened species are present within the Project Boundary.
  - High quality fauna habitat is located within the Project Boundary, including remnant patches of woodland and grassland that can support a range of common and threatened native vertebrate species. Key habitat characteristics for threatened species occupancy identified included blossom and fruit bearing trees, tree hollows, caves, culverts, leaf litter and fallen logs. These characteristics were found in abundance in the remnant patches of vegetation within the Project Boundary.
  - Eight bird species listed as vulnerable at the state level and one migratory species listed under the EPBC Act were observed within the Project Boundary. The EPBC Act vulnerable Koala was recorded as inhabiting most of the woodland areas (~900 ha). It is estimated from surveys that 262 individuals inhabit the woodland within the Project Boundary. The Yellow-bellied Sheathtail Bat (*Saccolaimus flaviventris*) which is listed as vulnerable at the state level was the only other threatened mammal found inhabiting the site. No threatened reptiles or amphibians were detected during surveys and although it is possible that some threatened reptiles use the site, there is little suitable habitat for amphibians. Several other nationally and state threatened fauna species have the potential to occur but were not observed during the surveys conducted (2010-2012).
  - Aquatic habitat within and alongside the Project Boundary was reported as being highly degraded and considered to be in poor condition. Most aquatic areas identified were artificial dams or ephemeral/intermittent waterways with low water quality and minimal flows. No threatened macroinvertebrates were found during sampling of aquatic areas and most locations had low macroinvertebrate diversity and abundance.

  - It was stated that one potential groundwater dependent ecosystem (terrestrial vegetation) was identified within the Project Boundary. Terrestrial vegetation may be periodically sustained by groundwater.

- Impact Assessment
  - The Project will remove 738 ha of woodland and grassland vegetation communities listed as critically endangered under the EPBC Act. Another 51 ha of nationally and state endangered vegetation communities will also be removed. The removal of such a substantial portion of critically endangered and endangered vegetation communities will impact upon the conservation of these communities. These vegetation communities also provide habitat for threatened flora and fauna.
  - Removal of 789 ha of threatened and 148 ha of non-listed vegetation communities that provide habitat for threatened flora and fauna is likely to severely impact upon the ecological characteristics of the Project Boundary. Impacts include reducing habitat for flora and fauna, increasing habitat fragmentation and edge effects, and increasing erosion and sedimentation.
  - Mobile fauna will retreat to surrounding habitat and increase competition for resources (eg. breeding habitat, food) in these areas.
  - The Project will remove 847 ha of suitable Koala habitat; there is approximately 1 Koala per 3 ha within this habitat. Over the life of the Project, 262 Koalas will need to be translocated by force or coercion.
  - The construction of pipelines, pump stations and a bore field was stated as having no significant impact on native fauna or flora as the areas are degraded.
  - Groundwater dependent ecosystems, such as wetlands, are absent from within the Project Boundary. It has been argued that the terrestrial vegetation present on site is not dependent on groundwater and therefore unlikely to be impacted by changes in groundwater quality or quantity.
  - Since the Project is located within an area that has been and continues to be used for agriculture, forestry and mining, it has been stated that the Project is unlikely to contribute to cumulative impacts.

7.3.2 Biodiversity Offset Strategy

Key findings with regards to the biodiversity offset strategy for the Project are summarised below:

- To compensate for anticipated vegetation loss, three main offset components have been proposed. Onsite, offsite and indirect offsets will be secured, restored or invested.
- Some of the onsite vegetation was assessed for its conservation value following the same methodology as for the vegetation to be removed. This vegetation is within the Project Boundary but will not be removed. This vegetation is similar to affected vegetation and is proposed as a “like for like”. Proposed offsets within the “onsite” area also include rehabilitating pits that will be backfilled upon closure of the mine and therefore their quality is not currently secure. Additionally, the western portion of the onsite offset area has not been secured for protection and its settlement is still being negotiated.
- Offsite vegetation was assessed remotely by GIS and satellite imagery, and some areas by field surveys. These offsite areas offer 575 ha of remnant endangered and critically endangered

communities. The sites also offer suitable habitat for threatened flora and fauna, some being recorded during surveys.

- Indirect offsets will include conservation research and landcare projects.

7.3.3 Stygofauna Impact Assessment

Key findings with regards to the stygofauna impact assessment are summarised below:

- No stygofauna were recorded from bore samples.
- The Gunnedah Formation alluvial aquifer is the most likely aquifer to contain stygofauna.
- Hydrogeological modelling indicated that the level of drawdown expected within the Gunnedah Formation will be unlikely to significantly impact on stygofauna if they occur within the Project Boundary or immediate vicinity.
- No significant changes in groundwater quality are expected which would impact on stygofauna occurring in the Project Boundary or immediate vicinity.

7.4 Issues, Uncertainties or Gaps Identified in EIS Review

7.4.1 Description of the Existing Environment

This section addresses the following SEWPaC Requirements:

A description of the existing environment of the proposal location and the surrounding areas that may be affected by the action, including:

- *Surveys using accepted methodology for targeting listed threatened species, ecological communities and their respective habitat, including but not limited to OEH's Survey and assessment guidelines (2009), available at http://www.environment.nsw.gov.au/threatenedspecies/surveymethodsfauna.htm and the Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) species-specific survey guidelines for nationally threatened species.*

In addition to these requirements, the following must also be included:

- *A description of the distribution and abundance of threatened species and ecological communities, as well as suitable habitat (including breeding, foraging, roosting habitat, habitat critical to the survival of threatened species) within the site and in surrounding areas that may be impacted by the proposal; and*
- *The regional distribution and abundance of suitable and potential habitat surrounding the site.*

Key findings of the review, with respect to the above requirements, are summarised below:

- The ecological characteristics within the Project Boundary were assessed by a two-stage process; literature/database review and field surveys. This follows the generally accepted methodology for the assessment of an area's baseline ecology.
- Surveys were conducted between November 2010 and March 2012 to account for seasonal and temporal variation in flora and fauna. Accounting for temporal and seasonal variation is consistent with the accepted methodology for surveys in an area such as that of the proposed Project that potentially has high biodiversity (i.e. based on the known fauna and flora records in the area).

- Field surveys conducted for threatened species within the proposed Project footprint followed accepted methodology and thoroughly assessed the existing flora, fauna and vegetation within woodland in the Project Boundary. Flora and fauna surveys adhered to, and built upon, standard survey guidelines set by the relevant authorities.
- Flora surveys adhered to the guidelines to determine the quality of the vegetation to be removed and subsequently calculate appropriate vegetative offsets. Additionally, the flora surveys targeted threatened species known to be in the region. Vegetation was mapped and the presence of vegetation communities was confirmed against set criteria.
- In general, the fauna surveys conducted involved considerably more effort (per survey point) and detail than is required by the relevant guidelines. The surveys involved observation and capture methods for all vertebrate fauna potentially inhabiting the site. Although the guidelines do not include this amount of detailed surveying, it was highly appropriate to survey to this standard for a site with such high conservation value vegetation and the high likelihood of many threatened species. Only vertebrate species were surveyed, this is unsurprising since very few invertebrates have been classified as threatened by regulatory authorities and targeted invertebrate surveys can be highly problematic (eg. logistically).
- One of the main criteria outlined by the NSW OEH for a flora and fauna survey (generally and for threatened species) is a clearly defined study area. According to the *OEH's Survey and assessment guidelines (2009)*[10], the study area should (1) be clearly defined and (2) should include the development site as well as adjacent areas. As outlined in the following points, neither of these main criteria has been sufficiently or thoroughly met within the EIS or the relevant appendices:
  - Upon review of the relevant appendices, the Project Boundary appears to be the main study area. The Project Boundary is defined as encompassing all land required for the Project, hence presumably, all of this land will be disturbed during the construction and/or operation. It is unclear whether this included the main roads (or transport corridors) in and out of the Project. It appears that the Disturbance Boundary/Area only included areas of vegetation removal (i.e. disturbance to fauna will include all activity). If all of this area (within the Project Boundary) is to be used during mining construction and operation, a buffer should be placed around this border to account for indirect impacts and highly mobile fauna. The size of this buffer zone is dependent on the type of the disturbance, but a typical buffer zone ranges from 100 to 500 m. There are areas where the Disturbance Boundary/Area and Project Boundary overlap and therefore there is no buffer here for either flora or fauna.
  - The *OEH's Survey and assessment guidelines (2009)* state that a study area should be "larger than the development site as it includes any adjacent areas that will be directly or indirectly affected by the proposal". While some of the surrounding area was surveyed within the potential offset sites, flora and fauna surveys were not conducted within a continuous buffer area around the entire Project/Disturbance Boundary.
- While most habitat types within the Project Boundary were surveyed, there were no general fauna surveys conducted in the pasture areas (Appendix K, Figure 2.2). Although the pasture areas are likely to be low in species diversity and abundance, this cannot be assumed and

[10] The 2009 guidelines were updated in *2012* http://www.environment.nsw.gov.au/threatenedspecies/surveymethodsfauna.htm. There have been no changes to the main guidelines, species-specific guidelines have been added.

should be demonstrated by appropriate surveying effort. The EIS stated that the surveys were conducted in accordance with, for example, the *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities* (OEH 2009)[11]. However, these particular guidelines state (in section 3.1.2) that "although native animal species are more likely to occur in areas of native vegetation, introduced vegetation may provide important habitat and must be considered in any assessment." The fact that pasture areas were not surveyed may have resulted in threatened species present not being detected. Additionally, the movement of threatened species through these cleared areas was not considered.

- In relation to the Requirements for the EIS to include *"A description of the distribution and abundance of threatened species and ecological communities, as well as suitable habitat within the site and in surrounding areas that may be impacted by the proposal*", the main text of the EIS did not adequately describe the distribution and abundance of threatened species and ecological communities. Substantial information relating to this requirement was provided within the Ecological Impact Assessment Appendix K. The main text of the EIS also did not discuss the presence of suitable habitat critical to the survival of a threatened species. The Ecological Impact Assessment Appendix K discussed some aspects of this, however it was unclear whether suitable breeding habitat was present or absent (for all threatened species). Presumably nests and roosting sites were not located. As above, threatened species in surrounding areas were also not adequately surveyed or assessed.
- The main text of the EIS does not discuss the regional distribution and abundance of suitable and potential habitat surrounding the site. In the appendices, this was only discussed for proposed offset sites (beyond the Project Boundary) and in general terms rather than specific details.
- The aquatic fauna baseline within the Mooki River has not been adequately established. Macroinvertebrates within this watercourse were surveyed as an indicator of aquatic ecosystem health, however the aquatic surveys conducted as part of the EIS did not include vertebrate sampling (e.g. fish and amphibians). As per Appendix S (Figure 3.9), the Mooki River has a median flow in the order of 10 ML/day. This Figure also indicates that while it is an ephemeral watercourse it runs approximately 85% of the year. As indicated in the EIS, the aquatic ecological community in the natural drainage system of the lowland catchment of the Darling River (within which the Mooki River occurs) is listed as an Endangered Ecological Community (EEC) under the Fisheries Management (FM) Act. There is therefore the potential for the Mooki River to support threatened fish species. Additional sampling of aquatic vertebrate fauna in this watercourse should be conducted to establish a baseline for fish species utilising the river and the adequacy of the proposed mitigation and management measures for aquatic habitats should be reviewed accordingly.

[11] Documents have been updated and available at:
http://www.environment.nsw.gov.au/resources/nature/TBSAGuidelinesDraft.pdf,
http://www.environment.nsw.gov.au/surveys/GuidelinesForCarryingOutASurvey.htm

7.4.2 Description of the Relevant Impacts of the Controlled Action

This section addresses the following SEWPaC Requirements:

- *An assessment of all relevant impacts with reference to the EPBC Act Policy Statement 1.1 Significant Impact Guidelines Matters of National Environmental Significance (2009) that the controlled action has, will have or is likely to have on relevant threatened species and/or threatened ecological communities, and migratory species.*
- *A description of the relevant impacts on the ecological communities should include an analysis of the vegetation condition on the site, as well as the methods by which this was determined. It should also include direct, indirect, cumulative and facilitative impacts.*
- *If an endangered ecological community, threatened or migratory species listed at Appendix A is not believed to be present on the proposed site, detailed information must be included in the Environmental Assessment Report to provide certainty that this community will not be impacted.*

Key findings of the review, with respect to the above requirements, are summarised below:

- Descriptions of the relevant impacts of the Project are discussed briefly within the main text of the EIS and further detail is provided within three appendices (Appendices K, L and M). Appendix M includes detailed discussion of several of the impacts likely to occur on Matters of National Environmental Significance. Notably these specific impacts were not discussed in detail in the main text of the EIS.
- One of the most significant issues with the assessment of potential impacts of the Controlled Action is that potential impacts on fauna areas surrounding the 'Project Boundary' were not adequately assessed. As discussed in Section 7.4.1, with the exception of some potential offset sites in the surrounding area, detailed flora and fauna surveys have only been conducted within the 'Project Boundary' which is defined as the location of Project activities. Further information regarding the fauna occurring in the surrounding areas should be provided and the EIS should include detailed assessment of potential impacts on highly mobile fauna in surrounding areas, as well as potential indirect and cumulative impacts on fauna.
- Very limited detail was provided in the EIS and relevant appendices regarding potential ecological impacts during the different phases of the mine (i.e. construction, operation, closure). There are expected to be markedly different potential impacts on flora and fauna in these three phases. Potential impacts associated with each phase should be clearly identified.
- It was predicted that all impacts on flora, fauna and ecological communities were likely to be known and reversible (Main Text Section 7.10.4; Appendix K, Section 6.12). However, this conclusion is questionable as ecological systems are inherently complex and potential impacts are often unpredictable. For example, a locally endemic and endangered species may be severely impacted by loss of habitat and the presence of a major disturbance source causing local extinction. Impacts on fauna species are especially unpredictable. For example, species may not reproduce once disturbed despite ample, high quality habitat being provided nearby.
- A comprehensive description of the potential impacts on ecological communities was provided in Appendix K including an analysis of vegetation condition and other biotic and abiotic factors necessary for the community's survival. However, this information was not adequately addressed or summarised within the main text of the EIS.

- Some of the assumptions made in regards to the impact of noise and lighting during both operation and construction appear to be unsubstantiated. Appendix K states "light pollution from the Project is unlikely to have a significant or long-term impact on any fauna species". Previous studies indicate that many threatened species have attained threatened status because they are incapable of habituating to human-created disturbance, even by their presence (eg. Beale & Monaghan 2004). Diurnal species will probably avoid the area, whereas some nocturnal species may be attracted by an increase in insect activity around the lights. These impacts may continue for the life of the Project and possibly beyond, and should be appropriately considered in the EIS.
- Threatened ecological communities, flora and fauna listed in Appendix A of the SEWPaC Requirements were discussed within the appendices, but not all of this information was summarised in the EIS. For example, the EIS does not include the Brush-tailed Rock-Wallaby or the Painted Snipe in Table 50.
- The Koala Plan of Management generally addressed impacts upon, and mitigation measures for, the conservation of this species; however, there are several uncertainties and issues regarding the translocation program. Particularly in regards to animal welfare and contingency measures. For example, animals can die during capture, translocation and post-release (eg. mortality rates of ~35% within 12 months of release (Whisson et al. 2012)). The Koala Plan of Management does not provide detailed protocols to evaluate at what point animals are euthanized or contingency measures should population numbers significantly decrease/increase, or in the event of a natural disaster (eg. end points). The Koala Plan of Management also does not provide details of how the Key Performance Indicators for the plan will be measured (including time-bound thresholds for achievement of the Plan Objectives). This should include detailed criteria for assessing the success of establishing corridors/linkages between existing vegetated areas such as Breeza State Forest and other suitable koala habitat. Additionally, contingency measures for the potential scenario where Plan Objectives are not met within a reasonable timeframe should also be provided.

7.4.3 Offsets

This section addresses the following SEWPaC Requirement:

Should any residual impact exist that cannot be mitigated it may be necessary for offset measures to be considered in order to ensure the protection of matters of national environmental significance in perpetuity. If required, the department may negotiate offsets with you during the assessment phase. Reference should be made to the Department's draft policy statement, including any revisions to this statement.

Key findings of the review, with respect to the above requirement, are summarised below:

- The assessment of the requirements for biodiversity offsets has not been undertaken in accordance with SEWPaC's new Environmental Offsets Policy (2012). As stated in DSEWPC (2012), this policy "applies to any new referrals and variations to approval conditions from 2 October 2012. It also applies to any projects currently under assessment for which a proposed decision has not yet been made", which includes the current Project. Offsets were calculated using the Department's draft policy statement, which has markedly different criteria for calculating offset requirements. For example, offsets are no longer calculated solely based on ratios and take into account many characteristics of the MNES and proposed offsets.

- If assessed against the Department's draft policy statement regarding offsets, the Biodiversity Offset Strategy proposed appears to be comprehensive and if revegetation and rehabilitation is successful it would provide a substantial net benefit for biodiversity conservation (eg. an additional 7,519 ha to be revegetated). In particular, the fertile agricultural land to be secured as part of the offset strategy will provide highly valued and needed habitat for biodiversity/conservation.
- Based on information provided, not all offset sites have been secured and no details regarding alternative sites have been supplied to determine their suitability as offsets. These alternatives may be inappropriate as offsets. Offset sites discussed should be secured or detail provided regarding alternative sites to be used if the currently proposed sites are unable to be secured. There is also a heavily reliance on revegetation to provide adequate offsets. Since there is the possibility that revegetation and rehabilitation of currently proposed offset sites may not be successful (eg. due to land degradation or isolation of newly installed habitat from source populations), it is recommended that identified alternatives be located in existing woodland areas.
- The Mt Watermark Onsite Offset Site has been proposed as an advanced offset. Due to the location of this site between two of the pits, it is highly likely that this vegetation will be directly and indirectly impacted by Project activities. Therefore, the Mt Watermark Onsite Offset site should only be considered as an adequate offset upon closure of these two mining areas.
- The potential impacts of expected long term seepage of saline water from the Overburden Emplacement Areas (OEAs) on Onsite Offset sites (eg. impacts on revegetation success) and other areas downstream of the Project site (eg. Native Dog Gully, Mooki River) have not been considered in the current EIS. There may also be downstream impacts on flora and fauna in watercourses. These impacts should be assessed and the Biodiversity Offset Strategy should be revised based on the findings of this assessment.
- One of the future proposals for offsets (excluded from current calculations) includes the rehabilitation of the pits upon closure. It is possible that some of these areas will not regenerate, given the potential impacts of expected long term seepage of saline water from the Overburden Emplacement Areas (OEAs) on water and soil (refer Section 8.0). As discussed in Section 8.0 it is difficult to predict the success of rehabilitation of these areas. The potential impacts of this seepage on Onsite Offset sites should be considered and the Biodiversity Offset Strategy should be re-evaluated based on the findings of this assessment.
- Costs associated with the Biodiversity Offset Strategy have been estimated as part of the Economic Impact Assessment in the EIS. However, there is no analysis of costs related to the other ecological impact mitigation measures. This is not consistent with the requirement to provide "the cost of mitigation measures" as outlined in the SEWPaC Requirements (Section 20).

7.4.4 Director General Requirements for Biodiversity

This section addresses the following Director General Environmental Assessment Requirements:

- *Measures taken to avoid, reduce or mitigate impacts on biodiversity.*
- *Accurate estimates of proposed vegetation clearing.*
- *A detailed assessment of potential impacts of the development.*
- *A comprehensive offset strategy to ensure the development maintains or improves the terrestrial and aquatic biodiversity values of the region in the medium to long term.*

Key findings of the review, with respect to the above requirements, are summarised below:

- A detailed Biodiversity Offset Strategy has been proposed (refer Section 7.3.2) to mitigate the potential impacts identified. However, other measures to avoid and reduce impacts on biodiversity are only briefly summarised within the main text of the EIS, and limited further information on these measures are provided in the appendices. Further detail regarding the proposed mitigation and management measures should be provided in the EIS including detailed explanation of how the measures will be implemented and how the outcomes of the Biodiversity Offset Strategy will be monitored.
- The EIS Main Report provides an estimate of proposed vegetation clearance of threatened and common vegetation (4,084 ha, although inconsistently reported in the EIS). This is also supported by the relevant appendices.
- Most potential impacts on threatened species and/or communities were considered, however several gaps were identified as outlined in Section 0.
- A detailed Biodiversity Offset Strategy has been proposed in the EIS. However, the adequacy of this strategy to “ensure the development maintains or improves the terrestrial and aquatic biodiversity values of the region in the medium to long term” is uncertain due to the issues outlined in Section 7.4.3.

8.0 Rehabilitation and Mine Closure

8.1 Overview and Key Conclusions

The key conclusions and actions from the review of the EIS relevant to rehabilitation and mine closure include:

- The rehabilitation and mine closure strategy only partially addresses the following Director General's Environmental Assessment Requirements including provision of:
  - Rehabilitation objectives, methodology, monitoring programs, performance standards and proposed completion criteria; and
  - Nominated final land use, having regard to any relevant strategic land use planning or resource management plans or policies.
- The rehabilitation and mine closure strategy does not address the following Director General's Environmental Assessment Requirements including assessment of the potential for integrating the rehabilitation and mine closure strategy with any other rehabilitation and/or offset strategies in the region.
- 238 ha of surface seepage zones (230 ha Eastern Overburden Emplacement Area; 53 ha Southern Overburden Emplacement Area) from the overburden emplacement areas have been identified and mapped in the Groundwater Impact Assessment (Appendix T; Appendix 6). The surface seepage has the potential to impact downstream surface water quality, rehabilitation success, and post-closure land capability and land use. The rehabilitation and mine closure plan should be updated to account for these areas of potential seepage and the quality of the seepage. Appropriate management strategies for these areas of surface seepage need to be provided.
- Subsidence of backfilled waste material is likely to be significant and could be irregular resulting in ponding across the surface of the dumps. This may affect final land use, particularly for areas designated for agricultural use.
- 1,000 ha of rehabilitated Class III land within the Project disturbance boundary has been flagged for agricultural use, 100 ha of which will be rehabilitated to meet biophysical strategic agricultural land (Appendix AA). It is uncertain whether the composition of the overburden material / pore water / surface seepage will allow for the establishment of Class III agricultural land and biophysical strategic agricultural land (uncertainties with the geochemical assessment of the overburden material are discussed further in Section 4.4).
- 2,384 ha of rehabilitated land will be restored with native vegetation (Appendix AA). It is uncertain whether the composition of the overburden material / pore water / surface seepage will allow for the establishment of the specified native vegetation communities (uncertainties with the geochemical assessment of the overburden material are discussed further in Section 4.4). Further work needs to be undertaken to adequately assess potential impacts related to the geochemistry of the overburden, quality of the dump pore water and surface seepage and potential for subsidence in the overburden emplacement areas.
- No strategies are identified in the Rehabilitation and Mine Closure documentation to assist with the management of neutral, metalliferous and saline drainage that is identified in the Geochemical Assessment (EIS Main Report Section 7.18; Appendix W) and Seepage Water

Quality Assessment (Terrenus, 2012). Detailed management measures need to be developed.

- All conclusions and actions from Section 4 (Water Impacts) of this review are relevant to the rehabilitation and mine closure section of this review.
- All conclusions and actions from Section 5 (Agriculture Impacts) of this review are relevant to the rehabilitation and mine closure section of this review.
- All conclusions and actions from Section 7 (Ecology/Biodiversity Impacts) of this review are relevant to the rehabilitation and mine closure section of this review.

The comments above are based on a review of the work undertaken pertaining to rehabilitation and mine closure (Section 8.2), key findings of this work (Section 8.3) and the issues, uncertainties and gaps identified from relevant rehabilitation and mine closure sections in the EIS identified in Section 8.4.

8.2 Work Undertaken

Key studies undertaken that are relevant to rehabilitation and mine closure for the Watermark Project are:

- Rehabilitation and Mine Closure Strategy (Main Text Section 7.21; Appendix AA).
  - A rehabilitation and mine closure strategy for the proposed Project was prepared by GSS Environmental. The rehabilitation and mine closure strategy outlines rehabilitation objectives, post-mining land use, rehabilitation management, rehabilitation trials and research, final void management, decommissioning and mine closure management, demonstrated capacity to achieve rehabilitation outcomes, rehabilitation monitoring and rehabilitation success criteria.

Other studies of direct relevance to rehabilitation and mine closure include the studies on surface water (refer to Section 4 of this review), groundwater (refer to Section 4 of this review), geochemistry (refer to Section 4 of this review), agriculture (refer to Section 5 of this review) and ecology (refer to Section 7 of this review).

8.3 Key Findings and Issues Reported in EIS

Key findings and issues identified in the Rehabilitation and Mine Closure Strategy are summarised below:

- 3,233 ha of class III rural land will be re-established post-closure, of which 1,000 ha will be dedicated for agricultural production.
- 2,384 ha of native revegetation, predominantly box gum woodland endangered ecological community, will be established post-closure.
- Final landforms have been designed to have 75% of slopes less than 10°, within the natural topography (<15°).
- A small proportion of potential acid forming overburden, interburden and coal reject materials are likely to occur within the mining areas. These materials will be selectively handled and covered with non-acid forming overburden and interburden to prevent acid leachate.
- A rehabilitation monitoring program has been prepared.
- Preliminary rehabilitation success criteria have been prepared. The final success criteria will be developed and agreed in consultation with the relevant government agencies and community.

- The final void in the western mining area will cover an area of approximately 100 ha.
- The final void water level will reach an equilibrium water level of approximately 280-290 m AHD, which is approximately 20-30 m below the overflow level of 310 m AHD.

8.4 Issues, Uncertainties or Gaps Identified in EIS Review

8.4.1 Rehabilitation and Mine Closure Strategy

This section addresses the following Director General Environmental Assessment requirement:

Including the proposed rehabilitation strategy for the site, having regard to the key principles in the Strategic Framework for Mine Closure, including:

- *Rehabilitation objectives, methodology, monitoring programs, performance standards and proposed completion criteria.*

Key findings of the review, with respect to the above requirement, are summarised below:

- Two sets of objectives are presented in the rehabilitation and mine closure strategy (Appendix AA), the objectives of the strategy and the objectives of rehabilitation. The objectives for rehabilitation to not address preservation of downstream water quality.
- The statutory framework, plans, and guidelines section of the rehabilitation and mine closure strategy (Appendix AA) outline the *Strategic Framework for Mine Closure* (SFMC) (Australian and New Zealand Minerals and Energy Council & Minerals Council of Australia, 2000). The third objective of the SFMC is *"to ensure the cost of closure is adequately represented in company accounts and that the community is not left with a liability"*. However there is no reference in the rehabilitation and mine closure strategy (Section 7.26 of the EIS; Appendix AA) to develop cost estimates for rehabilitation and mine closure and to allocate sufficient budget throughout the mine life to ensure adequate resources are available.
- The following risks are not identified in the rehabilitation management section of the strategy (Appendix AA), detailed management strategies for these risks should be included in the strategy:
  - AMD, NMD and salinity, water quality; and
  - Unexpected mine closure.
- As stated in Section 4 of this report the geochemistry for the proposed Project has not been adequately characterised at this point of time. This work (ie. geochemical characterisation, development of a block model and mining schedule) must be completed before an appropriate management strategy for overburden disposal (ie. strategy to minimise potential water quality salinity generation risks) and overburden emplacement area rehabilitation strategy can be developed.
- The Geochemical Over-Interburden Assessment (Appendix AD) notes that a proportion of the overburden/interburden samples collected were sodic or strongly sodic, and that these materials may be prone to dispersion and erosion. Section 7.21 of the EIS does not incorporate the recommendation of the Geochemical Assessment (Appendix AD) for selective disposal of sodic or strongly sodic overburden within the interior of the overburden

emplacement area (ie. encapsulation) or establishment of a good topsoil cover over these materials to minimise erosion.

- A detailed topsoil balance is provided in Section 7.19 and Appendix Y. There are key uncertainties with the topsoil balance that may influence the proposed Project's ability to achieve the post-mining land capability and land use objectives. The key uncertainties with the topsoil balance are:
  - The topsoil balance is based on a rehabilitation area of 3,384 ha, while the disturbance footprint provided in Section 3 of the EIS is 4,084 ha (5,630 ha in Section 7.20 of the EIS). It is unclear whether there is adequate topsoil available for rehabilitation of the entire Project disturbance boundary.
  - It includes soils that were classified in the soil classification (Appendix Y) as not suitable for use in rehabilitation (soil type 4a between 0.25 and 1.2 m, soil type 6a between 0 and 1.2 m, soil type 6b between 0.35 and 1.2 m, soil type 7 between 0.6 and 1.2 m and soil type 8 between 0.25 and 1.2 m).
  - Some of the soils in the soil balance (soil type 3b, soil type 5, soil type 6b and soil type 7) require blending with either limestone or sandy material in order to be appropriate for use in rehabilitation (Appendix Y). It is not stated in the mitigation and management section of Section 7.19 of the EIS or the rehabilitation and mine closure strategy (Section 7.26) that these soils will be blended appropriately prior to use in rehabilitation.
- The natural slopes within the Project area are less than 15°. The preliminary success criteria for the Rehabilitation, Conceptual Final Landform and Mine Closure Section of the EIS, Section 7.21 state that no less than 75 % of the rehabilitated area will have slopes less than 10°. It remains unclear what range of slopes will occur for the remaining 25% of rehabilitated landforms (including the highwall in the final western pit void). This may have implications for post-closure landform stability and use.
- Potential impacts and mitigation strategies associated with the subsidence (eg. settling of unconsolidated waste rock material in overburden emplacement areas) and/or swelling (eg. associated with the wetting of unconsolidated waste rock material in overburden emplacement areas) of the overburden emplacement areas have not been assessed. These potential impacts may affect the ability of the proposed Project to meet post mining / rehabilitation land capability and land use classes.
- The rehabilitation water quality monitoring program does not include the following parameters, required to identify potential post-closure water quality impacts:
  - Dissolved metals, associated with potential acid and/or near-neutral metalliferous drainage.
  - Nutrients, associated with potential application of fertilisers during rehabilitation, dust suppressants and/or ammonium nitrate fuel oil (ANFO) residues in waste rock.
  - Major cations and anions, associated with potential acid and/or near-neutral metalliferous drainage.
- The rehabilitation water quality monitoring program (groundwater) does not specify that it will include areas down hydraulic gradient of the proposed Project or potential discharges to the receiving environment to identify potential water quality impacts outside of the Project disturbance boundary.

- The schedule for rehabilitation and mine closure only extends to year 30 of mine operations. Whilst it is acknowledged that the rehabilitation strategy includes progressive back-filling and rehabilitation of mine voids, it is likely that rehabilitation and decommissioning work will need to be undertaken post-mine closure (ie. beyond year 30). The rehabilitation and mine closure schedule must be extended to account for all rehabilitation and decommissioning activities, including post-closure monitoring and treatment/remediation (if required).
- It is stated in rehabilitation and mine closure strategy (Appendix AA) that any coal, coarse rejects and other carbonaceous material within the final pit void will be buried under a minimum of 3 m of inert overburden material. This mitigation strategy has not been included in Section 7.26 of the EIS and should be extended to include the highwall of the final void (western pit).

8.4.2 Final Land Use

This section addresses the following Director General Environmental Assessment requirement:

Including the proposed rehabilitation strategy for the site, having regard to the key principles in the Strategic Framework for Mine Closure, including:

- *Nominated final land use, having regard to any relevant strategic land use planning or resource management plans or policies.*

Key findings of the review, with respect to the above requirement, are summarised below:

- Section 7.19 and 7.20 identify 696 ha of biophysical strategic agricultural land which will be classified as on-site biodiversity offset areas. This would result in the unavailability 696 ha strategic agricultural land for agricultural production. This review acknowledges the requirement of fertile land for successful biodiversity offset areas. However, it is unclear whether other potential biodiversity offset areas were considered in order to retain the availability of the 696 ha of strategic agricultural land for agricultural purposes or minimise the amount of strategic agricultural land locked up in a biodiversity offset area.
- 238 ha of seepage zones (230 ha Eastern Overburden Emplacement Area; 53 ha Southern Overburden Emplacement Area) from the overburden emplacement areas have been identified and mapped in the Groundwater Impact Assessment (Appendix T; Appendix 6). There is overlap with these seepage areas and the post-mining rehabilitated agricultural land. The rehabilitation and mine closure plan does not account for these areas of seepage or the potential quality of the seepage in its assessment of post-mining land capability.
- 1,000 ha of rehabilitated Class III land within the Project disturbance boundary has been flagged for agricultural use, 100 ha of which will be rehabilitated to meet biophysical strategic agricultural land (Appendix AA). It is unclear whether the composition of the overburden material / pore water / surface seepage will allow for the establishment of Class III agricultural land and biophysical strategic agricultural land (uncertainties with the geochemical assessment of the overburden material are discussed further in Section 4.4).
- 2,384 ha of rehabilitated land will be restored with native vegetation (Appendix AA). It is unclear whether the composition of the overburden material / pore water / surface seepage will allow for the establishment of the specified native vegetation communities (uncertainties with the geochemical assessment of the overburden material are discussed further in Section 4.4).

- Section 7.19 of the EIS and Appendix Y state that no Class II land will be disturbed as a result of the Project, however Class II land is shown within the indicative Project disturbance boundary. The proponent must clarify whether Class II land will be disturbed as a result of the Project and if so, how and to what land class it will be rehabilitated to.
- Similarly, Class 1 agricultural land is located within the Project disturbance boundary, but it is stated in Section 7.19 of the EIS and Appendix Y that no Class 1 agricultural land will be disturbed by the Project. The proponent must clarify whether Class 1 agricultural land will be disturbed as a result of the Project and if so, how and to what land class it will be rehabilitated to.

8.4.3 Integration

This section addresses the following Director General Environmental Assessment requirement:

Including the proposed rehabilitation strategy for the site, having regard to the key principles in the Strategic Framework for Mine Closure, including:

- *The potential for integrating this strategy with any other rehabilitation and/or offset strategies in the region.*

Key findings of the review, with respect to the above requirement, are summarised below:

- The potential for integrating the rehabilitation and offset strategies in the region has not been addressed in Section 7.26 of the EIS or Appendix AA.
- The process for stakeholder consultation regarding the Rehabilitation and Mine Closure strategy has not been clearly defined.

9.0 Socio-Economic and Health Impacts

9.1 Overview and Assessment

The EIS captures a number of potential social, economic and health impacts associated with the Project. The major issue associated with the EIS assessment of these aspects is the uncertainty associated with the assessment of the physical impacts. For example, there appear to be gaps in key areas of understanding such as impact to surface and groundwater and impact to air quality. A full and proper understanding of these key areas is required for a social, economic and health assessment to be considered comprehensive.

9.2 Work Undertaken

The following studies were undertaken:

- Social Impact Assessment (Main Report Section 7.23; Appendix AE).
  - A Social Impact Assessment was undertaken for the Watermark Coal Project by Hansen Bailey in 2012 in order to determine a socio-economic profile of the current community, identifying community values, aspirations and lifestyle, and community cohesion, health and wellbeing, social order and community safety. The SIA focused on the Sub-Regional Study Area and the urban settlements within it. The SIA provided an analysis of anticipated project impacts, considering cumulative impacts of future mining developments in the area. The SIA provides mitigation and management measures to address anticipated social impacts associated with or contributed to by the Watermark Project, which will be implemented through a Social Impact Management Plan pending development consent for the Project.
- Economic Impact Assessment (Main Report Section 7.27; Appendix AF).
  - Gillespie Economics was commissioned by Hansen Bailey Environmental Consultants to conduct an Economic Impact Assessment for the Watermark Coal Project in October 2012. The EIA was conducted to contribute to the EIS and support an application for State Significant Development Consent for the Project under Division 4.1 of Part 4 of the Environmental Planning and Assessment Act 1979 (EP&A Act). The report sought to determine the economic efficiency of the project through conducting a cost benefit analysis (CBA), as well as determine the economic impacts of the Project, considering both impacts to existing livelihoods and potential economic activity provided by the project.
- Visual Impact Assessment (Main Report Section 7.17; Appendix J).
  - JVP Visual Planning and Design was commissioned by Hansen Bailey Environmental Consultants to conduct an Economic Impact Assessment for the Watermark Coal Project, completed in October 2012 (Version 7.0). The assessment is designed to provide an understanding of the potential project impacts on the existing landscape and visual values of the surrounding areas. It also identifies the visual character of the existing landscape and that proposed for the Project. The visibility of the Project from sensitive receptors is considered, as well as the likely visual impacts created by the project including visual effect and sensitivity. Mitigation strategies were detailed to manage adverse visual impacts. The cumulative impacts of projects in the area and night light impacts are also considered in the report.

- Traffic and Transport Impact Assessment (Main Report Section 7.16; Appendix AB).
  - DC Traffic and Engineering Pty. Ltd were commissioned by Hansen Bailey Environmental Consultants to conduct a Traffic and Transport Impact Assessment for the Watermark Coal Project, completed in January 2013. The objective of the assessment is to:
    - Measure road and rail traffic generated during the construction and operation phases of the project;
    - Assess potential impacts on capacity, efficiency, and safety of road and rail network;
    - Assess and identify both temporary and permanent road closures as a result of the project.

9.3 Key Findings and Issues Reported in EIS

9.3.1 Social Impact Assessment

Key findings from the Social Impact Assessment (Appendix AE) are summarised below:

- The Scope of the SIA covers two major areas, the Sub-Regional Study Area and the Regional Study Area. The Sub-Regional Study Area encompasses the directly affected Gunnedah Local Government Area (LGA), as well as the Liverpool and Tamworth Region LGAs. The Regional Study Area of the SIA includes the LGAs of Upper Hunter and Narrabri, as they are anticipated to experience some impacts particularly in relation to accommodation, labour force demand and supply as well as economic benefits.
- The SIA gives reference to a number of other appendices:
  - Aboriginal Cultural Heritage Assessment (ACHA);
  - Aboriginal Cultural Heritage Values Assessment (ACHVA);
  - Economics Impact Assessment;
  - Air Quality & Greenhouse Gas Impact Assessment;
  - Acoustics Impact Assessment;
  - Ecological Impact Assessment;
  - Surface Water Impact Assessment;
  - Groundwater Impact Assessment;
  - Agricultural Impact Statement; and
  - Traffic and Transport Impact Assessment.

Key findings from the Economic Impact Assessment (Appendix AF) are summarised below.

- The Gillespie Economics report found that in general; ‘the revenue, expenditure and employment associated with the construction and operation of the Project would stimulate economic activity for the local and regional economy, as well as for the broader NSW economy.
- Impacts on the local and regional economy associated with Project Construction include:
  - Direct benefits of the employment of a number of workers;
  - Flow on effects associated with firms buying goods and services from each other (production induced)

  - Flow on effects associated with employing people who subsequently purchase goods and services as households (consumption induced). These effects are limited by the number of workers residing in the Study Area.

- It is anticipated that in the peak construction year, the project will make up to the following total annual contribution to the local economy.
  - $206M in annual direct and indirect regional output or business turnover;
  - $89M in annual direct or indirect regional value added;
  - $53M in direct and indirect household income; and
  - 807 direct and indirect jobs.
- The main sectors affected include construction trade services, wholesale and retail trade, ownership of dwellings, legal, accounting, marketing and business management services, other business services, health services, accommodation, cafes and restaurants, education, retail mechanical repairs and personal services.
- Impacts on the local and regional economy associated with Project Operations include:
  - Direct benefits of the employment of a number of workers;
  - Flow on effects associated with firms buying goods and services from each other (production induced)
  - Flow on effects associated with employing people who subsequently purchase goods and services as households (consumption induced). These effects are limited by the number of workers residing in the Study Area.
- It is anticipated that the project will make up to the following total annual contribution to the local economy for the 30 year mine life:
  - $902M in annual direct and indirect regional output or business turnover;
  - $493M in annual direct or indirect regional value added;
  - $80M in direct and indirect household income; and
  - 908 direct and indirect jobs.
- The main sectors affected include:
  - Ownership of dwellings sector;
  - Agricultural and mining machinery manufacturing sector;
  - Retail trade sector;
  - Wholesale trade sector;
  - Construction trade services sector;
  - Health services sector; and
  - Education sector.
- After the 30 year mine life, it is anticipated that mine cessation would result in a ‘contraction’ in local, regional and NSW economic activity. The scale of the contraction would be directly linked to a number of factors including:
  - The movements of workers and their families;

  - Alternative development opportunities; and
  - Economic structure and trends in the regional economy at the time.
- It is anticipated that over the Mine life, there will be approximately:
  - 600 persons employed by the Project during construction, of which approximately 480 are anticipated to be considered non-local hires.
  - The workforce is anticipated to fluctuate during Operations, ranging from approximately 200 employees in year one and peaking in Year 21 with an estimated 600 employees.
  - The project workforce will be recruited locally and nationally, as well as through apprentice, trainee and graduate programs, as well as contract labour.
- There is expected to be competition for skilled labour through competition with other projects regionally and nationally.
- Ideally, the project intends to source much of its workforce from the Sub Regional Study area; however it is anticipated that some skilled labour will be required to be sourced from elsewhere.
- There will be no Fly-in / Fly-Out workforce associated with the project.
- The Project Proponent is committed to assisting the workforce secure permanent accommodation within one hour of the work site.
- Anticipated impacts of the project upon the labour force include:
  - Employment growth;
  - Available labour supply for the Project, particularly from the Sub-Regional Project Area;
  - Availability of the labour force for the non-mining sector;
  - Youth employment;
  - Indigenous employment;
  - Women's labour force participation;
  - Labour force qualifications;
  - Workforce transport arrangements.
- The study notes that it is difficult to predict the Project effects on labour supply and its effects on the non-mining labour force until the project has commenced. It can be noted however from other similar projects that higher wages in the mining sector typically attracts skilled workers away from their current jobs in the Study area. It is noted that there is already a shortage of skilled labour in the region, attributed to existing mining activity in the area.
- Shenhua Watermark has detailed a commitment to providing jobs and training to indigenous people and youth within the Study Area.
- Labour force participation for women is anticipated to improve through both mining and mining support service roles.
- A demand for better trained employees is expected to occur as a result of the project, highlighting a need for more certificate level training to be available locally.
- To maximise the potential workforce benefits of the Project, it was proposed that Shenhua Watermark provide a wide range of employment options for residents of the Gunnedah,

Liverpool Plains and Tamworth LGAs, catering to all skill levels; integrate with secondary schools to develop a trainee program; and to provide flexible employment opportunities to encourage a higher rate of workforce participation.

Impacts on Community Infrastructure and Services

- The Project is expected to encourage an increase in population as a result of its activities and cumulative projects in the area.
- Some population movements have already occurred as a result of Shenhua Watermark's acquisition of properties in the area.
- Twenty six dwellings on 39 properties were acquired by Shenhua Watermark for the purposes of the Project, resulting in the relocation of 44 people, 26 of which have moved off site. Twenty of that 26 have remained in the Sub Regional Study Area. Twelve new residents have since moved into the Project Area – resulting in a net loss of 14 persons from the Project area.
- During construction it is anticipated that the workforce will be predominantly male, and will likely be predominantly sourced (80%) from outside the Sub-Regional Project Area due to specific skill requirements and a short time-frame for hiring.
- Projected temporary population increase in the region is linked to the percentage of the workforce required from outside the region during the construction phase.
- It is expected that a number of these workers would transition into positions in the operational phase at the completion of construction works, with an estimated 398 'flow-on' positions.
- Workers sourced from outside the Sub-regional study area may be accompanied by their partners and children, further increasing the population.
- Population increase as a result of operational activities is expected to be as result of the number of non-local hires who settle in the region and the potential family and household formations as a result of this workforce.
- The exact number of persons who will likely settle in any particular location or LGA as a result of the project is unknown, however it is anticipated that the majority of the population would settle in Gunnedah LGA, followed by Liverpool Plains and Tamworth Regional LGAs.
- It is anticipated that a small proportion of the workforce would settle in other nearby LGAs (Upper Hunter and Narrabri).
- It is anticipated that nearly 100% of the non-local hires would be less than 55 years of age.
- Key concerns relevant to housing and land include:
  - Accommodation for the increased workforce;
  - Cumulative housing affordability as a result of increased demand;
  - Strategies for mitigating housing impacts; and
  - Concern about MAC Workforce Accommodation Camp and its impacts on social cohesion and community values.
- Academic research on the impacts of mining on communities has suggested that in general, business and community development is hindered by high housing costs that arise in mining towns as a result of demand for accommodation.
- It is anticipated that during the construction phase, pressure will be placed upon the short term rental market, especially in Gunnedah LGA, resulting in low vacancies and high rental costs.

- A proposed mitigation measure is the establishment of the Workforce Accommodation Facility (MAC) at Werris Creek as an opportunity for housing the temporary construction workforce.
- The Operational Phase is anticipated to result in a need for further additional housing, with flow on employment opportunities extending the requirement for housing beyond the Project lifespan.
- For those engaging in short term rentals it is anticipated that over time, rental tenants would gradually transition into purchased homes or longer term rentals.
- Impacts on community infrastructure are anticipated predominantly in the health sector, with an anticipated requirement for increased numbers of health professionals (in response to potential work related accidents and general population increase). It is anticipated that local educational facilities will be equipped to cope with increased enrolments attributed to the Project. Some finance based mitigation measures to assist education facilities in coping with increased enrolments are provided, as well as measures to improve tertiary education opportunities, particularly for aboriginal residents.
- The report notes that Emergency Services will need to consider the impacts of increased populations in the area. It is recognised that emergency services already cater for anticipated population growth however some areas (i.e. Werris Creek MAC) may result in a requirement for an expansion of nearby services. The rural fire service has expressed concern that it may be difficult to maintain and encourage new volunteers as a result of work hours associated with mining work, as well as potential for increased frequency of fires associated with changing land types (farm area may become buffer zone) and increased population. Mitigation measures were detailed, including financial programs to support local services through donations and salary sacrificing, and flexible working arrangements for volunteers in times of need.
- Increased needs for recreation, leisure, cultural and sporting facilities were noted, and per the report, Shenhua Watermark was recommended to support these facilities through promoting them to new residents, and supporting them in a financial capacity.

Impacts on Social Amenity

- Key community cohesion values such as longstanding social relationships with community members and neighbours are anticipated to be challenged by the movement of workers into local towns.
- Community concerns regarding identity, values, aspirations and lifestyle impacts primarily refer to the integration of new residents into the existing towns and lifestyles. The biggest impacts associated with the Project are anticipated to be recognised in Breeza. Community consultation has revealed many concerns regarding integration into a 'rural' community, particularly for those coming from urban environments in which expectations of the level, quality and accessibility to services may be different.
- Key issues identified in relation to health and wellbeing include:
  - Fatigue Management;
  - Family issues;
  - Mental health issues;
  - Drug and alcohol issues.

- Shift work is expected to result in fatigue as well as changes to family lifestyles associated with modified sleep patterns for workers. This may lead to changes in homes particularly in relation to time spent for recreation with other family members, and increased pressure on non-mining family members to manage family schedules alone.
- An anticipated increase in the male population is also expected to require an increased focus on men's health (particularly in regard to high risk / alcohol-fuelled violence). It is noted that attracting and retaining health professionals to the area may be difficult. A key mitigation measure identified includes implementing strict drug and alcohol management programs for workers employed by the Project.
- The study states that there is no evidence that the Project will contribute to a decrease in social order and community safety.
- The report gives reference to a community perception of a decrease in social order and community safety attributed to an anticipated increase in single men in the community without accompanying families, particularly those associated with the MAC Workforce Camp in Werris Creek.
- It is suggested that a Social Impact Management Plan be established to develop strategies for managing actual and perceived impacts of the Project

Description of Mitigation and Management Measures

- Thirty social mitigation and management procedures are outlined in the Main Report, as taken from the Social Impact Assessment. The EIS details that Shenhua Watermark intend to enter into a Voluntary Planning Agreement (VPA) with the Gunnedah Shire Council (GSC), Liverpool Plans Shire Council (LPSC) and Tamworth Regional Council (TRC) to provide in kind and monetary contributions to ensure the mitigation of potential social impacts of the Project in each of these Local Government Areas.

Detailed Cost Benefit Analysis

- Gillespie Economics has conducted a Benefit Cost Analysis guided by the theoretical foundations of the NSW Treasury (2007) as well as the NSW DP&I Draft *Guidelines for Economic Effects and Evaluation in EIA* (James and Gillespie 2002).
- The BCA for the Shenhua Watermark Project was under taken from a global and national level perspective.
- Only the costs and benefits from the mining of the coal from the Shenhua Watermark Project and its delivery to Port are relevant.
- A baseline scenario was considered for the BCA (i.e. the land required for the Project would continue to be used for rural and other purposes).
- The main decision criterion for assessing the economic desirability of a Project to society is its net present value, which is the present value of benefits less the present value of costs.
- The Project will have net production benefits of $3,047 M with a minimum of $1,310 M of these net production benefits accruing to Australia.
- Production costs included in the assessment included:
  - Opportunity costs of land and capital;
  - Development cost of the Project;

  - Annual operating costs of the Project; and
  - Rehabilitation and Decommissioning Costs.
- Net production benefits included:
  - Value of coal;
  - Residual value (of capital equipment and land excluding offsets) at end of evaluation period.
- Potential environmental, social and cultural impact costs in the assessment included:
  - Greenhouse gas impacts;
  - Noise and blasting impacts;
  - Air quality impacts;
  - Surface water impacts;
  - Groundwater impacts;
  - Ecology impacts;
  - Road transport impacts;
  - Aboriginal heritage impacts;
  - Non-aboriginal heritage impacts;
  - Visual impacts.
- Potential environmental, social and cultural impact benefits in the assessment included:
  - Any non-market benefits of employment;
  - Value of ecological offsets; and
  - Value of Aboriginal heritage offsets.
- The project is anticipated to have net social benefits to Australia of between $1,315M to $1,639M.
- Net benefits are anticipated to be distributed amongst a range of stakeholders including:
  - Shenhua Watermark Shareholders (via after-tax profits);
  - The Commonwealth Government (via taxes);
  - The NSW Government (via royalties); and
  - The local and regional community in the form of voluntary contributions to community infrastructure and services.
- All costs experienced will be mitigated or compensated for.
- A sensitivity analysis was conducted to reduce uncertainties.
  - The BCA result was tested for ±20%changes to the following variables at a 4%, 7% and 10% discount rate:
    - Opportunity costs of land;
    - Development costs;

- Operating costs;
- Value of coal;
- Greenhouse costs;
- Surface and groundwater impacts;
- Road transport impacts; and
- Non-market employment impacts.

– The results were most sensitive to decreases in the sale value of coal. A continued reduction in coal price (over 55%) would be required to make the Project welfare reducing.

Traffic and Transport

The EIS provides a detailed description of the names and locations of local road and rail networks, providing daily estimates of average traffic volumes.

- The impacts of the Project on Traffic and Transportation were clearly broken down by Project Phase.
- It was anticipated that staff moving to and from the project would do so twice a day, at 7am and 7pm reflecting the two major shifts.
- It is anticipated that during construction phase the major sources of increased road traffic would be workforce and supply truck movement.
- It is proposed that the construction workforce would be transported by both bus (30%) and car (70% of workforce with 1 person / vehicle).
- It is anticipated that for the operational phase, the workforce would travel 100% by car (1 person / vehicle).
- Shenhua Watermark has proposed the upgrade of a number of roads to divert current traffic away from the Project by establishing a bypass. The Bypass would increase the distance required to be travelled from 6.3km to 13km, increasing travel time at an average of five minutes per vehicle.
- It is anticipated that a number of roads will be permanently closed as a result of the Project. This includes:
  - The entire length of Court Lane (7.5km);
  - The entire length of Rowarth Road (6.3km);
  - 3.6km of Whitby Road;
  - 6.3km of the Dip Road; and
  - Other unnamed roads bounded by Kamilaroi Highway, Court Lane, Nea Siding Road and the Dip Road.
- Alternative routes are proposed for Court Lane and the Dip Road. It is proposed that those who would usually use Court Lane as a through route would take the Dip Road as an alternative. This alternative route is 18.5km in comparison to the previous 7.5km along Court Lane, and would increase travel time by approximately seven minutes.

- It is anticipated that a dry weather only alternative route would be available for the section of the Dip Road that would be closed. This route would be 13km and requires consultation with the Gunnedah Shire Council for its development. The alternative route would be approximately five minutes longer than the original time. This detour is anticipated to be required by Year 15 of the mine plan.
- Other permanently closed roads are not expected to require alternative routes as no residences will remain along the routes and therefore access is not expected to be required.
- Some roads are expected to be closed temporarily as a result of Project activities, including:
  - Sections of the Dip Road from Year 10 to Year 21;
  - Sections of Clift Road from Year 21 – 25; and
  - Sections of Werner Road from Year 21 to 25.
- Alternative routes were provided in the Assessment, excluding Werner Road, in which residences would have to wait until the road re-opened after blasting is completed.
- A conceptual plan for managing the highway realignment is provided however it is noted that the actual construction strategy will likely vary from this.
- The report outlines a low baseline risk of vehicle accidents within the study area. It notes however that the construction of the mine access road and it's joining to the Kamilaroi Highway may present a 'conflict point' between turning vehicles and high speed vehicles on the highway.
- Impacts upon rail transport have been identified as below:
  - The Project is approximately 282km by rail from the export Port of Newcastle, with product coal expected to travel via the Werris Creek - Moree Railway Line.
  - This railway line extends to the south-east and connects with the Main Northern Railway Line at Werris Creek, where it continues to the Port of Newcastle. This line is part of the Hunter Valley Rail Corridor and extends in a south-easterly direction towards the Muswellbrook-Ulan Railway Line at Muswellbrook. South of this junction, the rail line continues in a south-easterly direction towards the Port of Newcastle via Singleton, Branxton and Maitland.
- The ARTC has identified a number of rail network and fleet limitations associated with the anticipated rail path, including:
  - A dedicated double track line runs between the Port of Newcastle and Maitland;
  - A shared double track line runs between Maitland and Muswellbrook;
  - A single shared track with passing loops continues from Muswellbrook towards the Project;
    - Note: Passing loops on this section were found to have insufficient lengths.
  - The section of the network surrounding the project is limited to a maximum axle load of 25 tonnes (100 tonne wagons).
  - The fleet currently consists of 33 trains of 120 tonne wagons of varying lengths, and eight trains of 100 tonne wagons of varying lengths, as well as two trains composed of non-standard wagons.

  - The railway lines experience some operational delays associated with train size (i.e. 60kmh speed limits for trains with loaded 120 tonne wagons 80kmh for empty and 80km/h limits for 100 tonne wagons regardless of load).

- It is expected that rail hauls as a result of the project would take place six days per week, equating to 312 days per year. Based on haul loads of 5,688 tonnes per train, 2,110 train movements per year would be required (split equally between north-bound and southbound). This equates to eight train movements per day.
- The report notes the train movement constraints of the Liverpool Ranges at Ardglen, as loaded trains are unable to efficiently traverse the steep grades. As a result loaded train carriages are 'banked', and transferred in small groups, before being regrouped to continue their journey.
- A proposed Liverpool Ranges Duplication Project may assist in managing this however it is currently at proposal stage. This strategy, developed by the ARTC is listed in the report including proposed strategies for track duplication, and allowing for longer trains lengths.
- Four new passing loops were proposed along the Werris Creek- Moree line by the ARTC, three of which would benefit the Watermark Project.
- It is noted that these are not formal mitigation measures as proposed by the study.
- It is recommended that Shenhua Watermark works alongside the ARTC in addressing the issues related to rail transport.
- Four sites were identified as high risk rail crossings, including:
  - White Street, 20m south of New England Highway, Blandford.
  - Livingston Street, 25m East of New England Highway, Wingen.
  - Gateleys Road, 65m East of New England Highway, Wingen.
  - Halcolm Road, 25m East of New England Highway, north of Aberdeen.
- In these sites it is possible that traffic queued at intersections may stack back over the railway line, leaving vehicles at risk from oncoming rail traffic. This observation does not include anticipated increases to traffic volumes as a result of the project. Some recommendations for management and mitigation are provided, including additions of further signage and boom gates. Other measures include banning long vehicles, designating 'escape routes' and shifting traffic lanes to increase queuing space.
- Cumulative impacts on the rail network are anticipated to be quite significant, with nearby projects requiring train services that will contribute to 47 additional train movements per day – approximately one northbound and one southbound train each hour. These trains will be required to compete with passenger, freight and agricultural freight services, resulting in severe scheduling constraints. Coal train services are anticipated to run 24 hours a day. No management and mitigation measures are presented to reduce these anticipated pressures on existing services.
- Some mitigation and management measures are provided in regards to road safety, blasting impacts and the highway realignment. Road safety measures primarily include the construction of adequate length turning lanes for Mine Access Road connection to the Kamilaroi Highway to allow vehicles to sufficiently gain or decrease in speed when joining traffic on each road. Two routes to provide access from the Highway to Breeza – Curababula Road are provided. There

are few suggestions for traffic management including additional signage and warnings of changed traffic conditions.

- It is suggested that blasting impacts on road closure can be minimised by installing adequate signage to inform motorists of changed traffic conditions and conducting dangerous activities such as blasting outside of peak traffic times.
- To manage high risk level crossings, recommendations for management and mitigation including additions of further signage and boom gates are provided. Other measures include banning long vehicles, designating 'escape routes' and shifting traffic lanes to increase queuing space.

9.4 Issues, Uncertainties or Gaps Identified in EIS Review

The EIS captures a number of potential social, economic and health impacts associated with the Project. The major issue associated with the EIS assessment of these aspects is the uncertainty associated with the assessment of the physical impacts. For example, there appear to be gaps in key areas of understanding such as impact to surface and groundwater and impact to air quality. A full and proper understanding of these key areas is required for a social, economic and health assessment to be considered comprehensive.

Other socio-economic aspects where further assessment is considered necessary include:

- A further investigation into the volumes of road and rail traffic associated with seasonal agricultural and harvest activities, in particular railway freight (as opposed to average amounts).
- An evaluation of economic impacts associated with potential delays to agricultural rail freight.
- An evaluation of potential mitigation measures for managing rail network capacity limitations outside the proposed ARTC rail network upgrades, for example priority scheduling for agricultural freight during peak harvest seasons.
- Confirmation of the construction of the MAC Workforce Accommodation Camp in Werris Creek to ensure it can be described as an effective mitigation strategy to reduce pressure on short-term housing in the Project area during construction.
- Consideration of environmental, social and cultural impacts gaps identified in the EIS review process and how these may affect levels of uncertainty within the Benefit-Cost Analysis (BCA).
- Integration of findings in the Rehabilitation and Closure Strategy (Appendix AA) as relevant to visual impacts including:
  - Seepage zones anticipated to occur as a result of the Project;
  - The 40m overburden anticipated to occur as a result of Project backfilling; and
  - Changes to natural slopes as a result of Project activities.
- Investigation into the condition of existing roads and how detoured transport routes and increased traffic volume and heavy vehicles may affect the requirement and/or frequency of maintenance.
- Investigation into cumulative impacts of regional projects upon volumes of road traffic, particularly for the Kamilaroi Highway.

10.0 Archaeology and Cultural Heritage

10.1 Overview and Assessment

Detailed assessment work has been conducted regarding the potential impact of the Project on Aboriginal archaeology, Aboriginal cultural heritage and historic heritage as detailed in Section 10.2 below. To ensure that adequate management and mitigation measures are in place the Proponent should commit to the following:

- Conduct further Aboriginal archaeological surveys within the disturbance footprint during the staged Aboriginal heritage clearance process to address concerns of the Registered Aboriginal Parties (RAPs) regarding survey coverage and limitations due to poor ground surface visibility.
- Prior to disturbance activities, develop measures for chance finds of unrecorded Aboriginal archaeological evidence (such as human skeletal remains and totemic animal remains) in consultation with OEH, NSW police, NSW Heritage Branch and RAPs to minimise potential impacts these resources.

The comments above are based on a review of the work undertaken pertaining to impacts on archaeological and cultural heritage (Section 10.2), key findings of this work (Section 10.3) and the issues, uncertainties and gaps identified from relevant sections in the EIS identified in Section 10.4.

10.2 Work Undertaken

Key studies undertaken that are relevant to archaeological and cultural heritage for the Watermark Project are:

- Aboriginal Archaeology Impact Assessment (EIS Main Report, Section 7.13; Appendix O).
  - This study, conducted by AECOM, investigated the Aboriginal archaeological resources of the Project area to provide an appropriate management strategy based on the likely impacts. The study involved a comprehensive desktop assessment (including a search for all registered sites within the vicinity of the Project Boundary in the OEH Aboriginal Heritage Information Management System (AHIMS) database), development of a predictive model for the survey of Aboriginal archaeological sites within the Project area and a targeted field survey (by landform types). An Arboricultural Assessment of potential Aboriginal scarred trees was also conducted by Australian Tree Consultants.
- Aboriginal Cultural Heritage Values Assessment (EIS Main Report, Section 7.14; Appendix P).
  - This study, conducted by Connect for Effect, assessed the Aboriginal cultural values and significance of the land in the Project area, in consultation with the Aboriginal community. Building upon the Aboriginal Archaeology Impact Assessment (Appendix O - see above), the study included consultation with Registered Aboriginal Parties (RAPs), workshop discussions and archival investigations, Senior Elders and Elders Walks on Country, RAP self-assessment of cultural values, and historic use of land context statements. In total, 123 Registered Aboriginal Parties (RAPs) were consulted.
- Geotechnical and Geomorphology Investigation of Grinding Groove Sites (EIS Main Report, Section 7.14, Appendix Q).
  - An investigation was conducted by SCT Operations Pty Ltd, to evaluate the effectiveness of potentially relocating two (2) significant Grinding Groove sites (WM-GG1-11 and WM-

GG3-12) that were identified in the proposed open-cut mining areas. 3D photogrammetric surveys were conducted to provide a detailed baseline and rock strength, sub-surface extent and the feasibility of site relocation were assessed.

- Historic Heritage Impact Assessment (EIS Main Report, Section 7.15; Appendix R).
  - This study, conducted by AECOM, aimed to assess the current status of historic heritage in the Project area and recommended management and mitigation measures. Reviews of historical and archival research and searches in Commonwealth and State heritage lists were conducted for the Project Boundary and a 5 km buffer area. Field surveys to identify and record heritage sites were undertaken, as well as discussions with local residents, the Gunnedah Shire Council and members of the Gunnedah District Historical Society.
- Aboriginal Archaeology and Cultural Heritage Assessments Synopsis (Appendix N).
  - This document provides a synopsis of the above studies undertaken to assess the Aboriginal archaeology and cultural heritage values and potential impacts associated with the proposed Project, as well as details of the consultation process with Aboriginal community stakeholders.

10.3 Key Findings and Issues Reported in EIS

10.3.1 Aboriginal Archaeology

Key findings reported in the EIS relating to Aboriginal archaeology include:

- A total of 55 Aboriginal archaeological sites were identified in the field survey within the Project Boundary, including 51 new sites and 4 AHIMS registered sites. Of these, 43 have the potential to be impacted by the Project through open cut mining activities and/or construction of associated infrastructure. This includes 36 open artefact sites, 5 scarred trees and 2 grinding groove sites. A total of eight (8) sites identified within the Project Boundary were assigned high scientific significance and twelve (12) were assigned a moderate scientific significance (based on the relevant criteria from the Burra Charter (Australia ICOMOS, 1999)).
- A total of 29 Aboriginal archaeological sites within the Disturbance Boundary will be directly impacted. All remaining 26 sites will be conserved.
- In considering the impacts on archaeological resources, the 29 directly impacted sites represent 19.6% of all known Aboriginal archaeological sites within the region (defined as a 160,000 ha area). However, as only a fraction of the study region has been subject to archaeological survey, AECOM assert that the true impact of the Project on the Aboriginal archaeological resource of the study region is likely to be significantly lower than the percentages derived from calculations involving the AHIMS site data.

10.3.2 Aboriginal Cultural Heritage

Based on the cultural heritage values assessment (using the principles of the Burra Charter), it was found that RAPs have a significant connection the land within the Project Boundary and its surrounds. Consultation with RAPs indicated the following:

- The area is of high cultural and historical significance to RAPs based on the pre-contact landscape that sustained the Gameroi people and the shared post contact experiences of the Gameroi people, other Aboriginal groups and non-Aboriginals.
- The area is of high archaeological significance to RAPs, with the Watermark Gully area and known sites (WM-IF14-11, WM-IF15-11, WM-IF22-12, WM-AS9-11,M-ST8-11 and WM-ST9-11),

grinding groove complexes, scarred trees and camping areas along the Mooki River also being of high cultural significance. Some of the land in the Project Boundary is also considered to be of moderate to high aesthetic significance[12], including Mt Watermark, Mooki River and areas that have been less disturbed by agriculture.

- Key potential impacts of the Project on Aboriginal cultural heritage were determined in consultation with RAPs. These included:
  - Potential impacts on recorded cultural sites or landscape features of significant cultural value, including direct impacts on two grinding groove sites.
  - Potential impacts on subsurface cultural sites or items that are unrecorded.
  - Increased threats to cultural values such as animal habitats and the drawdown of water courses.
  - Loss of bush foods, medicinal plants, cultural resources, animals and plants.
  - Change in land tenure resulting in an inability to access land in the region, leading to a loss of opportunities for knowledge to be passed on to the younger generations.
  - Loss of ability to conduct culturally important practices on Country.
  - General landscape becoming unrecognisable as a result of the Project and cumulative impacts of development in the region.

10.3.3 Historic Heritage

Key findings reported in the EIS relating to historic heritage include:

- A total of 18 sites were identified within the Project Boundary, 14 of which were identified as being of historic significance.
- The development of the Project will result in direct impacts (ie. removal) to 10 historic heritage sites identified within the Disturbance Boundary.
- The Project could also indirectly impact the structural integrity of identified historic heritage sites through blasting, although the Acoustics Impact Assessment undertaken by Bridges Acoustics concluded that the blast vibration and overpressure generated by the Project will not exceed the recommended criteria at any of the identified heritage sites.
- Four (4) heritage sites (Farm Complex 3, 7, 12 and 13) have the potential to experience visual amenity impacts over the life of the Project due to the proximity to the Disturbance Boundary.

[12] Aesthetic significance is a component of cultural significance as defined in the Burra Charter. The Burra Charter defines cultural significance the *"aesthetic, historic, scientific or social value for past, present or future generations"* (Australia ICOMOS 1999).

10.4 Issues, Uncertainties or Gaps Identified in EIS Review

10.4.1 Aboriginal Archaeology and Cultural Heritage

This section addresses the following under the Director General Environmental Assessment Requirement:

An Aboriginal cultural heritage assessment (including cultural and archaeological significance) which must:

- *Demonstrate effective consultation with Aboriginal communities in determining and assessing impacts, and developing and selecting options and mitigation measures.*
- *Outline any proposed impact mitigation and management measures (including an evaluation of the effectiveness and reliability of measures).*

Key findings of the review, with respect to the above requirement, are summarised below.

- The Aboriginal Archaeology Impact Assessment (Appendix O) and the Aboriginal Cultural Heritage Values Assessment (Appendix P) has, for the most part, been conducted in a manner consistent with the DGRs and best practice guidelines. Extensive consultation with the Aboriginal community was conducted during the EIS process (detailed in Section 5.5 of the EIS), involving a total of 132 Registered Aboriginal Parties (RAPs). The consultation process followed the four stages outlined in the *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010 (DECCW, 2010)* guidelines and RAP members were also involved in all field surveys.
- In the Aboriginal Archaeology Impact Assessment (Appendix O), it is stated that 43 sites have the potential to be directly impacted by the Project, whilst the EIS states that 29 sites will be directly impacted (Section 7.13.3, p208). The EIS does not clearly distinguish potential impacts from residual impacts.
- There is no mention in the EIS of the three additional grinding groove sites which are located on Springhurst Mountain (approximate coordinates E 244 500, N 6 545 000), close to the Project Boundary (*personal communication,* SoilFutures Consulting Pty Ltd, 9/4/2013).
- There is no discussion in the EIS as to whether groundwater extraction will impact culturally significant sites as per the Aquifer Interference Policy[13], nor has the EIS considered whether impacts on river flow will also impact cultural heritage values such as the camping sites along the Mooki River and the use of the river for fishing, hunting and gathering.
- Section 7.9 of the EIS addresses the potential indirect impacts of blasting on the grinding groove sites. However, as noted in the Appendix P, RAPs indicated a concern regarding the risk from blasting vibrations (perceived or actual) to a number of cultural heritage sites and places of significance. This includes the risk of impact to the Breeza and Curlewis Cemeteries and to a number of other cultural heritage locations identified through non-disclosed discussions (Connect for Effect, 2012). The blasting assessment appears to have considered some but not all of these sites.

[13] The AIP specifies that 40 m from a groundwater dependent ecosystem or culturally significant site, cumulative variation in the water table should be less than or equal to 10% (AGE, 2013).

- The Proponent has committed to the development of an Aboriginal and Cultural Heritage Management Plan (ACHMP). Whilst this has included a number of avoidance, management and mitigation measures as recommended by the relevant guidelines, several key measures recommended in Appendices O and P have not been addressed in the EIS. These include:
  - Development of measures for chance finds of unrecorded Aboriginal archaeological evidence (such human and totemic skeletal remains) in consultation with OEH, NSW Police, NSW Heritage Branch and RAPs.
  - Commitment to conducting additional archaeological surveys prior to disturbance as recommended in Appendix O and P (due to poor ground surface visibility and RAP concerns regarding survey coverage).
  - Obtaining an Aboriginal Heritage Impact Permit (AHIP) from the NSW Office of Environment and Heritage for any salvage work conducted prior to Project and ACHMP approval.
  - Provision of further details on the protection and conservation of archaeological sites within the Project Boundary (that will not be directly impacted by the Project) such as including these sites on mine plans and conducting inductions for staff and contractors prior to construction, as well as throughout the life of the Project.
  - Further details on how monitoring would be conducted to determine the effectiveness of mitigation and management measures, and to verify the predictions of the assessment.
  - Provision of cultural heritage awareness training to Project personnel and contractors involved in Aboriginal cultural heritage management and in ground disturbance activities that could impact Aboriginal archaeological sites.
  - Provisions for investigations in response to complaints or for compensation measures to the Aboriginal community for loss of cultural resources.
  - Details on potential institutional arrangements, timeframes and the ongoing consultation program for the development and implementation of the ACHMP.
  - Development of an Aboriginal Engagement Policy.

10.4.2 Historic Heritage

This section addresses the following under the Director General Environmental Assessment Requirement:

A Historic Heritage assessment (including archaeology) which must:

- *Contain a detailed history and land use summary of the site.*
- *Include a statement of heritage impact (including significance assessment) for any State significant or locally significant historic heritage items.*
- *Outline any proposed mitigation and management measures (including an evaluation of the effectiveness and reliability of measures).*

Key findings of the review, with respect to the above requirement, are summarised below:

- The EIS Main Report (Section 7.15) and Appendix R appears to have adequately addressed this requirement.

11.0 Other Studies

11.1 Overview and Assessment

The acoustic impact assessment by Bridges Acoustics appears to be thorough, employing sound method, citing all relevant legislation and employing the noise criteria therein. However, the following key issues were identified:

- The potential impact of flyrock associated with blasting activities has not been assessed. It has been stated that a 500 m buffer zone will be enforced during blasting. This has not been mapped but is likely to extend beyond the Project Boundary, with potential to impact on people, livestock or property.
- The assessment of noise impacts appears to be compromised by the lack of high quality wind data for the Project area (as is the case for the air quality impact assessment).
- There is no specific mention of compensation or "negotiated agreements" that may be required to address residual noise impacts from the Project. This is a particular concern given that several residents are expected to be significantly or moderately impacted by Project-related noise, even when "reasonable and feasible mitigation measures" are implemented.
- Furthermore, the Proponent does not appear to have committed to establishing a formal grievance mechanism to address any complaints due to unforeseen noise, vibration and/or blasting-related impacts on people, livestock or property.

To fully understand the issues around waste and hazards (including bushfires) associated with this development, and to ensure that adequate management measures are in place, the Proponent should commit to the development of detailed measures to address the following:

- Environmental emergency and incident response;
- Fire, explosions, shot-firing, fly-rock; and
- Spontaneous combustion.

The comments made above are based on a review of work undertaken in relation to other specialist studies (Section 11.2), key findings of this work as identified in the EIS (Section 11.3), and the issues, uncertainties and gaps in the EIS identified in Section 11.4.

11.2 Work Undertaken

Other studies and aspects covered in the EIS for the Watermark Project include:

- Acoustics Impact Assessment (EIS Main Report, Section 7.8; Appendix H).
  - This study, conducted by Bridges Acoustics, included a desktop review of background noise monitoring data from 5 representative receiver locations (from July to December 2010) and assessment of prevailing weather conditions that may affect noise propagation to receivers in the vicinity of the Project. A noise model was developed using Environmental Noise Model (ENM) software to predict potential noise impacts during construction and operations, associated with construction activities, mining, coal handling and processing, road and rail traffic, blasting noise and vibration levels. The potential for sleep disturbance to nearest receivers was also assessed. The impacts were assessed with and without implementation of feasible and reasonable noise and vibration mitigation

and management measures. A cumulative impact assessment including the conceptual Caroona Coal Project was also conducted.

- Blasting Impact Assessment (EIS Main Report, Section 7.9; Appendix H and I).
  - Potential impacts associated with blasting, such as airblast overpressure and vibration, were assessed as part of the Acoustics Impact Assessment (described above).
  - In addition, a separate study was conducted by SCT Operations Pty Ltd (SCT) to assess Blasting Impacts on Landforms and Slopes. This study assessed the risks associated with blasting on sensitive sites, landforms and slopes in each mining area. This is described further in Section 5.
- Hazards Analysis (EIS Main Report, Section 7.22 and 7.23; Appendix AC).
  - The Preliminary Hazard Analysis was prepared by Hansen Bailey to identify the potential risks from hazardous materials and processes associated with the Project. The hazard analysis was conducted in accordance with *SEPP 33 – Hazardous and Offensive Development Application Guidelines (*DUAP, 1994) and the *Hazardous Industry Planning Advisory Paper No. 6 – Hazard Analysis* (HIPAP Guidelines) (DOP, 2011). The report includes an initial qualitative risk analysis which addresses the risks of incident such as fire, leaks and spills, explosion, malfunction of equipment, theft and unauthorised access to site.
  - An initial review was conducted to ascertain the risk of bushfires in the Project area, including a review of land use characteristics and potential bushfire ignition sources. The risk of ignition from Project activities was also considered.
- Waste (EIS Main Report, Section 7.25).
  - The various waste streams and potential quantities of waste associated with the Project were reviewed and relevant management and mitigation measures were considered.

11.3 Key Findings and Issues Reported in EIS

11.3.1 Acoustics Impact Assessment

Key findings reported in the EIS relating to noise impact assessment include:

- The main sources of background noise included Kamilaroi Highway traffic, agricultural activity, aircrafts, wind, cattle, birds, insects and frogs.
- Background noise levels regularly occur at or below 30 dBA during all time periods (day, evening and night) at all monitoring locations. As required by the INP, a Rating Background Level (RBL) of 30 dBA was therefore adopted for the Project.
- During construction, modelled noise levels from the Project were generally within the relevant assessment criteria, with the exception of one receiver (due to construction of the Mine Access Road, Kamilaroi Highway realignment and rail spur).
- During operations, 6 receivers were predicted to experience significant noise impact; 4 of these receivers were expected to experience maximum noise levels in excess of the sleep disturbance criterion (under a worst case scenario without noise mitigation). A further 7 vacant properties will be subject to significant noise impacts over more than 25% of the property. Four receivers will experience moderate noise impacts at residences. A further 3 vacant properties will be subject to moderate noise impacts over more than 25% of the property.

- Road traffic noise was predicted to increase by up to 0.6 dBA at receivers along the Kamileroi Highway, and up to 5.6 dBA at receivers along Cull Road, The Dip Road and northern section of Clift Road (during Cull Road upgrade works). However, this will not result in exceedence of the relevant traffic noise criterion.
- Rail traffic noise was predicted to increase by around 0.6-0.7 dBA compared to noise from background rail traffic, and contribute to an average noise level exceedence of 0.6 dBA above the night time criterion at 3 receivers located between Breeza and Willow Tree. This impact was also considered to be insignificant.
- Typical noise levels that will be experienced by livestock in the vicinity of the Project area are 35-40 dBA. Whilst this exceeds background levels by 5-10 dBA, it was reported that livestock are not sensitive to environmental noise and will therefore not be adversely impacted.
- Cumulative noise levels, with simultaneous operation of the Watermark and Caroona Coal Projects, were expected to be unlikely to occur given the extended distance to the conceptual location of the Caroona Coal Project's surface infrastructure.

11.3.2 Blasting Impact Assessment

Key findings reported in the EIS relating to blasting impact assessment include:

- Results indicate blasting associated with the Project is expected to produce acceptable ground vibration and overpressure levels at all privately owned residences and structures.
- Three Aboriginal grinding groove sites have been identified within the Project Boundary; WM-GG1-11, WM-GG2-11 and WM-GG3-12. Two of these sites are located within the proposed mining areas (WM-GG1-11 and WM-GG3-12) and would therefore require relocation during the Project life. Nonetheless, prior to relocation, a 100 m buffer from blasting activities was considered necessary to protect the sites from overbreak or cracking.
- Blasting impacts were expected to be acceptable at identified sensitive heritage structures, although a blasting vulnerability study by a suitably qualified and experienced structural engineer was recommended to confirm the adopted criteria and minimise the risk of damage to sensitive structures owned by the Proponent.
- A detailed blast management plan was also recommended to control ground vibration levels at residences and sensitive structures and to minimise disruption to the community due to local road closures that may be intermittently required.
- Key findings of the SCT study are summarised in Section 5 and not repeated here.

11.3.3 Waste

As documented in Section 7.25 of the EIS, the Project is expected to produce the following waste streams and estimated quantities:

- Approximately 300 tonnes of domestic general waste that is no longer usable or recyclable annually.
- Approximately 4 ML of hazardous waste (grease and oil) annually.
- Approximately 600,000 L of sewage annually.
- Approximately 86.6 Mt of coarse rejects and up to 38.6 Mt of tailings.

11.3.4 Hazards

As documented in Section 7.23 of the EIS, potential hazardous materials associated with the Project include: diesel, explosive material (including initiating products, detonators, and emulsion explosives), Liquid Petroleum Gas (LPG) and oxy-acetylene are flammable gases, oil, grease, coolant, sealing and adhesive compounds, cleaning products, paints, flocculating agents and chemicals. Potentially hazardous processes associated in the Project include:

- Transportation and delivery of explosives, fuel, chemicals and general goods to the Project Boundary.
- Transportation of coal product out of the Project Boundary (rail loop and conveyor operations).
- Storage of explosives, fuel, chemicals and general goods.
- CHPP operations, including flocculation and management of reject materials.
- Blasting activities required for the removal of overburden and interburden materials.
- General Project operations including the construction phase of the Project.
- Exploration and monitoring activities.

As described in Section 7.22 of the EIS:

- The bushfire season in the Liverpool Range region occurs predominantly during the hotter months from October to the end of March. The main sources of bushfire ignition in the Liverpool Range region are dry lightning storms, escaped private burning fires, accidental ignition and arson.
- The Bushfire Risk Management Plan for the Upper Hunter, Liverpool Plains, and Gunnedah LGAs (Liverpool Range area), developed by the Liverpool Range Bush Fire Management Committee in 2010, identifies areas Liverpool Range region and associated community assets subject to the risk of bushfire. The land within the Project Boundary was considered to pose a moderate to low bushfire risk to the Project due to the limited fuel source, the existing vegetation composition and current agricultural land use practices.
- During construction and operation of the Project, a combination of select activities (such as transport and delivery of explosives and chemicals to site), equipment and fuel sources could lead to the ignition of a bushfire.

11.4 Issues, Uncertainties or Gaps Identified in EIS Review

11.4.1 Construction, Operational and Off-site Transport Noise Impacts

This section addresses the following under the Director General Environmental Assessment Requirement:

A quantitative assessment of potential: Construction, Operational and off-site transport noise impacts.

Key findings of the review, with respect to the above requirement, are summarised below:

- Construction, operational and off-site transport noise impacts are addressed in the EIS Main Report (Section 7.8) and Appendix H.
- The assessment of noise impacts appears to be compromised by the lack of high quality wind data for the Project area, as is the case for predicted air quality impacts (see Section 6).

11.4.2 Blasting Impacts on People, Livestock and Property

This section addresses the following Director General Environmental Assessment Requirement:

A quantitative assessment of potential: Blasting Impacts on People, Livestock and Property.

Key findings of the review, with respect to the above requirement, are summarised below:

- Blasting impacts such as noise (overpressure) and vibration are described very briefly in the EIS Main Report (Section 7.9) and Appendix H.
- The potential impact of flyrock associated with blasting activities has not been assessed. It has been stated that a 500 m buffer zone will be enforced during blasting. This has not been mapped but is likely to extend beyond the Project Boundary, with potential to impact on people, livestock or property.
- The transportation impact assessment notes that local traffic may be delayed for 15-20 minutes during blast times (9 am - 5 pm, Mon-Sat) where roads intersect the blast exclusion zone (eg. The Dip Road, Clift Road and Werner Road) although this was not discussed in the Blasting Impact Assessment in Section 7.9.
- Potential air quality impacts (relating to particulate matter and NO_x emissions) from blasting have been considered in the Air Quality Impact Assessment but were not discussed in the Blasting Impact Assessment in Section 7.9.
- Potential noise and vibration impacts to livestock are described in Section 5.8 and Appendix H, which state that "*mining operations within the region and elsewhere have for many years used company-owned land in close proximity to open cut mining to raise beef cattle and operate dairy farms. This practise suggests livestock are not sensitive to environmental noise. Similarly, livestock quickly become accustomed to vibration from blast events, which will limit the potential for impacts on livestock health*". However:
  - Research into the effects of noise on animals is relatively scarce and the results obtained are frequently contradictory or inconclusive (DRET, 2009). Given that noise levels are predicted to increase from <30 dBA to around 35-40 dBA in the vicinity of the Project area, the potential for impact on livestock should not be dismissed.
  - As noted above, the potential impacts of flyrock on livestock have not been assessed.

11.4.3 Reasonable and Feasible Mitigation Measures

This section addresses the following Director General Environmental Assessment Requirement:

Reasonable and feasible mitigation measures (including assessment of restricted night time operations), including evidence that there are no such measures available other than those proposed.

Key findings of the review, with respect to the above requirement, are summarised below:

- "Reasonable and feasible mitigation measures" are described in the EIS Main Report (Section 7.9) and Appendix H.

- There is no specific mention of compensation or "negotiated agreements"[14] that may be required to address residual noise impacts from the Project. This is a particular concern given that several residents are expected to be significantly or moderately impacted by Project-related noise, even when "reasonable and feasible mitigation measures" are implemented.
- Furthermore, the Proponent does not appear to have committed to establishing a formal grievance mechanism to address any complaints due to unforeseen noise, vibration and/or blasting-related impacts on people, livestock or property.

11.4.4 Monitoring and Management Measures

This section addresses the following Director General Environmental Assessment Requirement:

Monitoring and management measures, in particular real-time, attended noise monitoring and predictive meteorological forecasting.

Key findings of the review, with respect to the above requirement, are summarised below:

- The requirement for monitoring and management measures, in particular real-time, attended noise monitoring and predictive meteorological forecasting is described in EIS Main Report (Section 7.8) and Appendix H. Some further detail on predictive meteorological forecasting as a basis for blast scheduling is provided in the EIS Main Report Section 7.6 (Air Quality Impact Assessment).

11.4.5 Hazards

This section addresses the following under the Director General Environmental Assessment Requirement:

Hazards – including bushfires

Key findings of the review, with respect to the above requirement, are summarised below:

- There is no clear distinction between the risk assessment conducted for the Project (Appendix F) and the Preliminary Hazard Analysis (Appendix AC).
- A number of potentially hazardous materials (eg. drilling additives, dust suppressants, treatment chemicals) and hazardous processes (eg. fire, flood) have not been specified or considered in the analysis.
- The potential impacts associated with hazardous materials and processes are not clearly described. The EIS simply states that "no aspect of the Project is considered to be hazardous or offensive if the management measures identified in the Preliminary Hazard Analysis are implemented".
- Several management and mitigation measures from the Preliminary Hazard Analysis (Appendix AC) were excluded from the EIS Main Report. For example, there is no discussion in the EIS in relation to management plans and procedures for:
  - Environmental emergency response;

[14] "A formal agreement struck between applicant/proponent and affected community" - *Coalmines and Associated Infrastructure EIS Guidelines* (2000). "*The process could be initiated when the proponent has demonstrated that the project specific noise levels could not be met*" (INP, 2000).

  - Environmental incidents;
  - Fire, explosion and shot-firing;
  - Spontaneous combustion (including consideration of AMD management).
- The bushfire assessment in the EIS Main Report is very brief (Section 7.22) and while it is referred to as a "risk assessment" does not make reference to the risk assessment conducted for the Project (Appendix F) or the PHA (Appendix AC).
- The risk of spontaneous combustion of coal and other carbonaceous materials is considered in Section 7.18 (Geochemical Assessment) and 7.6 (Air Quality) but not Section 7.22 (Bushfire).

11.4.6 Waste

This section addresses the following under the Director General Environmental Assessment Requirement:

Waste - including:

- *Accurate estimates of the quality and nature of potential waste streams of development, including the tailings and course rejects.*
- *A detailed description of the measures that would be implemented to minimise production of waste onsite, and ensure that any waste produced is appropriately managed.*

Key findings of the review, with respect to the above requirement, are summarised below:

- The EIS provides a brief description of the type and quantity of different waste streams associated with the Project. These include general waste, hazardous waste, sewage (EIS Section 7.25) and course reject and tailings (EIS Section 3.4.4). However, there is no consideration of process wastewater and major sources of waste such as used tyres. Batteries should also be considered hazardous waste (not general waste).
- The EIS does not assess the potential environmental or health/safety impacts associated with the production of waste from the Project. Section 7.25.2 describes management and mitigation measures rather providing an Impact Assessment.
- The Proponent has committed to the development of a Waste Management Plan which covers waste recycling, waste classification, removal, training and monitoring. However:
  - There are no details on proposed waste minimisation strategies, aside from a statement that training will be provided to improve efficiency in the minimisation of waste streams, reuse and recycling options and management.
  - A detailed description of waste management measures has not been provided. The need for surface water runoff and sewage treatment was mentioned but the proposed treatment methods were not described.
  - The proposed management measures for course reject and tailings are not sufficient to addressed the potential salinity issues associated with leachate from this material due to sulfide oxidation (see Section 4).

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APPENDIX A Environmental Planning and Assessment Regulation 2000 – Schedule 2, Clause 6 and 7

Appendix A - Environmental Planning and Assessment Regulation 2000 - Schedule 2

Clause 6 - The Form of Environmental Impact Statement

An environmental impact statement must contain the following information:

(a) The name, address and professional qualifications of the person by whom the statement is prepared
(b) The name and address of the responsible person
(c) The address of the land:
    i. In respect of which the development application is to be made, or
    ii. On which the activity or infrastructure to which the statement relates is to be carried out
(d) A description of the development, activity or infrastructure to which the statement relates
(e) An assessment by the person by whom the statement is prepared of the environmental impact of the development, activity or infrastructure to which the statement relates, dealing with the matters referred to in this Schedule
(f) A declaration by the person by whom the statement is prepared to the effect that:
    i. The statement has been prepared in accordance with this Schedule, and
    ii. The statement contains all available information that is relevant to the environmental assessment of the development, activity or infrastructure to which the statement relates, and
    iii. That the information contained in the statement is neither false nor misleading.

Clause 7 – The Content of Environmental Impact Statement

(1) An environmental impact statement must also include each of the following:
    i. A summary of the environmental impact statement
    ii. A statement of the objectives of the development, activity or infrastructure
    iii. An analysis of any feasible alternatives to the carrying out of the development, activity or infrastructure, having regard to its objectives, including the consequences of not carrying out the development, activity or infrastructure
    iv. An analysis of the development, activity or infrastructure, including:
        a. A full description of the development, activity or infrastructure, and
        b. A general description of the environment likely to be affected by the development, activity or infrastructure, together with a detailed description of those aspects of the environment that are likely to be significantly affected, and
        c. The likely impact on the environment of the development activity or infrastructure, and
        d. A full description of the measures proposed to mitigate any adverse effects of the development, activity or infrastructure on the environment, and
        e. A list of any approvals that must be obtained under any other Act or law before the development, activity or infrastructure may lawfully be carried out
    v. A compilation (in a single section of the environmental impact statement) of the measures referred to in item (d) (iv)
    vi. The reasons justifying the carrying out of the development, activity or infrastructure in the manner proposed, having regard to biophysical, economic and social

considerations, including the principles of ecologically sustainable development set out in subclause (4).

(2) Subclause (1) is subject to the environmental assessment requirements that relate to the environmental impact statement.

(3) Subclause (1) does not apply if:

i. The Director-General has waived (under clause 3 (9)) the need for an application for environmental assessment requirements in relation to an environmental impact statement in respect of State significant development, and

ii. The conditions of that waiver specify that the environmental impact statement must instead comply with requirements set out or referred to in those conditions.

(4) The principles of ecologically sustainable development are as follows:

i. The **"precautionary principle"** , namely, that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. In the application of the precautionary principle, public and private decisions should be guided by:

   a. Careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment, and

   b. An assessment of the risk-weighted consequences of various options

ii. **"inter-generational equity"**, namely, that the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations

iii. **"conservation of biological diversity and ecological integrity"**, namely, that conservation of biological diversity and ecological integrity should be a fundamental consideration

iv. **"improved valuation, pricing and incentive mechanisms"**, namely, that environmental factors should be included in the valuation of assets and services, such as:

   a. Polluter pays, that is, those who generate pollution and waste should bear the cost of containment, avoidance or abatement

   b. The users of goods and services should pay prices based on the full life cycle of costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any waste

   c. Environmental goals, having been established, should be pursued in the most cost effective way, by establishing incentive structures, including market mechanisms that enable those best placed to maximise benefits or minimise costs to develop their own solutions and responses to environmental problems.

APPENDIX B Director General and SEWPaC Requirements

Director General's Environmental Assessment Requirements

Section 78A(8A) of the *Environmental Planning and Assessment Act 1979*

State Significant Development

Application Number	SSD 4975
Development	The Watermark Coal Project, which includes: • developing a new open cut mining operation to extract up to 10 million tonnes of coal a year for 30 years; • constructing and operating a range of associated infrastructure including a coal handling and preparation plant, rail spur line, rail loop and rail loading facility, mine access roads, water supply and management, electricity supply, communications, administration and service infrastructure; • transporting coal from the mine by rail; and • rehabilitating the site.
Location	Kamilaroi Highway, Breeza, Gunnedah Shire LGA.
Applicant	Shenhua Watermark Coal Pty Limited.
Date of Issue	April 2012
General Requirements	The Environmental Impact Statement (EIS) for the development must meet the form and content requirements in Clauses 6 and 7 of Schedule 2 of the *Environmental Planning and Assessment Regulation 2000*. In addition, the EIS must include a: • detailed description of the development, including: – need for the proposed development; – justification for the proposed mine plan, including efficiency of coal resource recovery, mine safety, and environmental protection; – likely staging of the development - including construction, operational stage/s and rehabilitation; – likely interactions between the development and existing, approved and proposed mining operations in the vicinity of the site; – plans of any proposed building works; • consideration of all relevant environmental planning instruments, including identification and justification of any inconsistencies with these instruments; • risk assessment of the potential environmental impacts of the development, identifying the key issues for further assessment; • detailed assessment of the key issues specified below, and any other significant issues identified in this risk assessment, which includes: – a description of the existing environment, using sufficient baseline data; – an assessment of the potential impacts of all stages of the development, including any cumulative impacts, taking into consideration relevant guidelines, policies, plans and statutes; and – a description of the measures that would be implemented to avoid, minimise and if necessary, offset the potential impacts of the development, including proposals for adaptive management and/or contingency plans to manage any significant risks to the environment; and • consolidated summary of all the proposed environmental management and monitoring measures, highlighting commitments included in the EIS.

	The EIS must address the requirements of the Commonwealth Department of Sustainability, Environment, Water, Populations and Communities (SEWPaC) set out in Attachment 4.
Key Issues	The EIS must address the following specific issues: • **Agricultural and Other Land Resources** – including an Agricultural Impact Statement that includes a specific focused assessment of the impacts of the proposal on strategic agricultural land, having regard to the draft gateway criteria in the draft New England North West Strategic Regional Land Use Plan. The EIS must also include a detailed description and assessment of the potential impacts on: - soils and land capability (including salinisation and contamination); - landforms and topography, including cliffs, rock formations, steep slopes, etc; - land use, including agricultural, forestry, conservation and recreational use, with particular reference to agricultural land use and Breeza State Forest; - agricultural resources and/or enterprises in the local area, with particular reference to highly productive alluvial soils that may be impacted directly or indirectly by the project, and including: o pre-mining and post-mining agricultural assessment and mapping (including Land Capability and Agricultural Suitability mapping) of soil characteristics across all proposed disturbance areas, and an assessment of their value and rehabilitation limitations; o definition of the limit of the Upper Namoi Alluvium, and justification for the nominated limit; o any change in land-use arising from requirements for biodiversity offsets; o a detailed description of the measures that would be implemented to avoid, reduce or mitigate impacts of the development on local agricultural resources and/or enterprises; and o justification for any significant long term changes to agricultural resources, particularly highly productive soils potentially affected by the development; • **Water Resources** – including: - detailed assessment of potential impacts on the quality and quantity of existing surface and ground water resources, including: o detailed modelling of potential groundwater impacts; o impacts on affected licensed water users and basic landholder rights; o impacts on riparian, ecological, geo-morphological and hydrological values of watercourses, including environmental flows; and o a consideration of the proposal against the draft Aquifer Interference Policy; - a detailed site water balance, including a description of site water demands, water disposal methods (inclusive of volume and frequency of any water discharges), water supply infrastructure and water storage structures; - an assessment of proposed water discharge quantities and quality/ies against receiving water quality and flow objectives; - assessment of impacts of salinity from mining operations on groundwater and surface water resources, including disposal and management of coal rejects and modified hydrogeology, a salinity budget and the evaluation of salt migration to surface, near surface and groundwater sources; - identification of any licensing requirements or other approvals under the *Water Act 1912* and/or *Water Management Act 2000*; - demonstration that water for the construction and operation of the development can be obtained from an appropriately authorised and

	reliable supply in accordance with the operating rules of any relevant Water Sharing Plan (WSP) or water source embargo; - a detailed description of the proposed water management system (including sewage), water monitoring program and other measures to mitigate surface and groundwater impacts; and - a detailed flood impact assessment, which identifies impacts on local and regional flood regimes, including: o an assessment of the potential for flooding to occur in the open-cut pits; and o any measures proposed to mitigate potential flood impacts. • **Biodiversity** – including: - measures taken to avoid, reduce or mitigate impacts on biodiversity; - accurate estimates of proposed vegetation clearing; - a detailed assessment of potential impacts of the development on any: o terrestrial or aquatic threatened species or populations and their habitats, endangered ecological communities and groundwater dependent ecosystems; and o regionally significant remnant vegetation, or vegetation corridors; - a comprehensive offset strategy to ensure the development maintains or improves the terrestrial and aquatic biodiversity values of the region in the medium to long term. • **Heritage** – including an assessment of impacts on Aboriginal cultural heritage and Historic heritage, including: - an Aboriginal cultural heritage assessment (including cultural and archaeological significance) which must: o demonstrate effective consultation with Aboriginal communities in determining and assessing impacts, and developing and selecting options and mitigation measures; o outline any proposed impact mitigation and management measures (including an evaluation of the effectiveness and reliability of the measures); and - a Historic heritage assessment (including archaeology) which must: o contain a detailed history and land-use summary of the site; o include a statement of heritage impact (including significance assessment) for any State significant or locally significant historic heritage items; and, o outline any proposed mitigation and management measures (including an evaluation of the effectiveness and reliability of the measures); • **Air Quality** – including a quantitative assessment of potential: - construction and operational impacts, with a particular focus on dust emissions (including $PM_{2.5}$ and PM_{10} emissions, and dust generation from coal transport), as well as diesel and blast fume emissions; - spontaneous combustion properties of overburden or reject material; - reasonable and feasible mitigation measures to minimise dust, diesel and blast fume emissions, including evidence that there are no such measures available other than those proposed; and - monitoring and management measures, in particular real-time air quality monitoring and predictive meteorological forecasting. • **Greenhouse Gases** – including: - a quantitative assessment of potential Scope 1, 2 and 3 greenhouse gas emissions; - a qualitative assessment of the potential impacts of these emissions on the environment; and - an assessment of reasonable and feasible measures to minimise greenhouse gas emissions and ensure energy efficiency; • **Noise, Vibration & Blasting** – including a quantitative assessment of potential: - construction, operational and off-site transport noise impacts; - blasting impacts on people, livestock and property;

	- reasonable and feasible mitigation measures (including assessment of restricted night time operations), including evidence that there are no such measures available other than those proposed; and - monitoring and management measures, in particular real-time, attended noise monitoring and predictive meteorological forecasting; • **Traffic & Transport** – including: - a detailed assessment of the potential impacts of the development on the capacity, safety and efficiency of the: o local and regional rail network, having regard to the strategic objectives and cumulative impacts for the passenger and freight rail network; and o local and regional road network, with particular regard to a cumulative traffic impact assessment, condition assessment of the existing network, proposed new road infrastructure and impacts of coal trains on level crossing operations; - details of mine to port or other domestic customer transport movements, train path availability and any required rail infrastructure works; and - a detailed description of the measures that would be implemented to maintain and/or improve the capacity, efficiency and safety of the road and rail networks in the surrounding area over the life of the project; • **Visual** – including: - a detailed assessment of the: o changing landforms on the site during the various stages of the project; and o potential visual impacts of the project on private landowners in the surrounding area as well as key vantage points in the public domain, including lighting impacts; and - a detailed description of the measures that would be implemented to minimise the visual impacts of the project; • **Waste** - including: - accurate estimates of the quantity and nature of the potential waste streams of the development, including tailings and coarse reject; and - a detailed description of the measures that would be implemented to minimise the production of waste on site, and ensure that any waste produced is appropriately managed; • **Hazards** - including bushfires; • **Social & Economic** – including an assessment of the: - potential direct and indirect economic benefits of the project for local and regional communities and the State; - potential impacts on local and regional communities, including: o increased demand for local and regional infrastructure and services (such as housing, childcare, health, education and emergency services); and o impacts on social amenity; - a detailed description of the measures that would be implemented to minimise the adverse social and economic impacts of the project, including any infrastructure improvements or contributions and/or voluntary planning agreement or similar mechanism; and - a detailed assessment of the costs and benefits of the development as a whole, and whether it would result in a net benefit for the NSW community; and • **Rehabilitation** – including the proposed rehabilitation strategy for the site, having regard to the key principles in the Strategic Framework for Mine Closure, including: - rehabilitation objectives, methodology, monitoring programs, performance standards and proposed completion criteria; - nominated final land use, having regard to any relevant strategic land use planning or resource management plans or policies; and

	- the potential for integrating this strategy with any other rehabilitation and/or offset strategies in the region.
Plans and Documents	The EIS must include all relevant plans, architectural drawings, diagrams and relevant documentation required under Schedule 1 of the *Environmental Planning and Assessment Regulation 2000*. These documents should be included as part of the EIS rather than as separate documents.
Consultation	During the preparation of the EIS, you must consult with relevant local, State or Commonwealth Government authorities, service providers, community groups and affected landowners. In particular you must consult with the: • Commonwealth Department of Sustainability, Environment, Water, Population and Communities; • Office of Environment and Heritage (including the Heritage Branch and the Environment Protection Authority; • Division of Resources and Energy within the Department of Trade and Investment, Regional Infrastructure and Services; • Department of Primary Industries (including the NSW Office of Water; NSW Forestry, Agriculture and Fisheries sections; and the Catchments and Lands (Crown Lands Division)); • Transport for NSW (including the Centre for Transport Planning and Roads and Maritime Services); • NSW Health; • Australian Rail Track Corporation, and downstream coal chain operators including Railcorp, Newcastle Ports Corporation and the Hunter Valley Coal Chain Co-ordinator; • Namoi Catchment Management Authority; • Gunnedah Shire Council; • Liverpool Plains Shire Council; and • Tamworth Regional Council. The EIS must: • describe the consultation process used and demonstrate that effective consultation has occurred; • describe the issues raised by public authorities, service providers, community groups and landowners; • identify where the design of the development has been amended in response to issues raised; and • otherwise demonstrate that issues raised have been appropriately addressed in the assessment.
Further consultation after 2 years	If you do not lodge a DA and an EIS for the development within 2 years of the issue date of these DGRs, you must consult further with the Director-General in relation to the requirements for lodgement.
References	The assessment of the key issues listed above must take into account relevant guidelines, policies, and plans as identified. While not exhaustive, Attachment 2 contains a list of some of the guidelines, policies, and plans that may be relevant to the environmental assessment of this development.

ATTACHMENT 1

POLICY STATEMENT

INTERIM STRATEGIC AGRICULTURAL LAND POLICY FOR STATE SIGNIFICANT AND TRANSITIONAL PART 3A MINING AND COAL SEAM GAS PROPOSALS IN THE UPPER HUNTER AND NEW ENGLAND NORTH WEST REGIONS

Background

Draft Strategic Regional Land Use Plans (SRLUPs) for the Upper Hunter and New England North West regions are on public exhibition until 3 May 2012. The draft SRLUPs identify strategic agricultural land in these regions and propose to apply a gateway process to State significant mining and coal seam gas proposals on or within 2km of this land.

The SRLUPs will be finalised following the consideration of all submissions received during the exhibition period, including final maps of strategic agricultural land and final details of the gateway process. In the meantime, there are a number of current and pending State significant mining and coal seam gas applications that are proposed on or within 2 km of land mapped as strategic agricultural land in the draft SRLUPs.

In March 2012 (concurrent with the release of the draft SRLUPs), the NSW Government introduced a requirement for an Agricultural Impact Statement (AIS) for all State significant development (SSD) applications for mining and petroleum (including coal seam gas) projects (as well as applications for associated State significant infrastructure such as pipelines) which have the potential to affect agricultural resources or industries. The purpose of an AIS is to ensure a focused assessment of the potential impacts of these projects on agricultural resources or industries. The information will form a key component of the assessment process in terms of evaluating and avoiding impacts on and loss of agricultural lands. A guideline that sets out the purpose and content of an AIS is available at http://haveyoursay.nsw.gov.au/document/show/195.

Purpose of this policy statement

Until the final policy position on protecting strategic agricultural land is finalised as part of the Upper Hunter and New England North West SRLUPs, it is important to ensure that the potential impacts of mining and coal seam gas projects on strategic agricultural land are comprehensively considered as part of the assessment process.

This policy statement outlines the interim arrangements for State significant and transitional Part 3A mining and coal seam gas applications on or within 2 km of land mapped as strategic agricultural land in the draft SRLUPs.

Interim policy arrangements

The following interim arrangements apply to all SSD and Part 3A mining and petroleum (including coal seam gas) applications and significant modifications that:

- are located on or within 2 kilometres of land mapped as strategic agricultural land in the draft SRLUPs, and
- have been or will be lodged with the Department before the finalisation of the SRLUPs.

(1) Projects which have not commenced public exhibition or that have not been deemed adequate for exhibition as at 6 March 2012 (date of commencement of exhibition of the draft SRLUPs) will be required to submit an AIS that includes a specific focused assessment of the impacts of the proposal on strategic agricultural land, having regard to the draft gateway criteria in the draft SRLUPs.

The implementation of this requirement will vary according to the stage of the project, ie:

A <u>Projects for which Director General's Requirements are yet to be issued:</u>
This requirement will be included in the DGRs.

B <u>Projects for which Director General's Requirements have been issued but which have not yet commenced public exhibition (SSD) or which have not yet been deemed adequate for public exhibition (Part 3A):</u>
The Department will issue supplementary DGRs to include this requirement.

(2) For SSD and Part 3A applications that have progressed to or beyond public exhibition, the Department will conduct an assessment of the impacts of the proposal on strategic agricultural land as part of its assessment of the project and may, in limited circumstances, require additional information from the applicant to assist this assessment.

It is acknowledged that the gateway criteria are draft only. Applicants should use their best endeavours to address the draft gateway criteria when assessing the impacts of the proposal on strategic agricultural land. In addition, the assessment can include site verification information if the applicant believes that the land mapped as strategic agricultural land does not meet the published draft criteria for strategic agricultural land. Finally, as the Government is yet to publish a cost benefit methodology, the applicant may submit any additional information relating to the social, environmental and economic aspects of the proposal that may be relevant to the consideration of whether the proposal would be in the public interest.

ATTACHMENT 2
Technical and Policy Guidelines

The following guidelines may assist in the preparation of the Environmental Impact Statement. This list is not exhaustive and not all of these guidelines may be relevant to your proposal.

Many of these documents can be found on the following websites:
http://www.planning.nsw.gov.au
http://www.bookshop.nsw.gov.au
http://www.publications.gov.au

Policies, Guidelines & Plans

Risk Assessment	
	AS/NZS 4360:2004 Risk Management (Standards Australia)
	HB 203: 203:2006 Environmental Risk Management – Principles & Process (Standards Australia)
Biodiversity	
	Threatened Species Survey and Assessment Guidelines: Field Survey Methods for Fauna – Amphibians (DECCW 2009)
	Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities – Working Draft (DECC 2004)
	Threatened Species Assessment Guidelines: the Assessment of Significance (DECC 2007)
	Guidelines for Threatened Species Assessment (DoP 2005)
	BioBanking Assessment Methodology and Credit Calculator Operational Manual (DECCW 2008)
	NSW State Groundwater Dependent Ecosystem Policy (DLWC)
	Policy & Guidelines - Aquatic Habitat Management and Fish Conservation (NSW Fisheries)
	Policy & Guidelines - Fish Friendly Waterway Crossings (NSW Fisheries)
	State Environmental Planning Policy No. 44 – Koala Habitat Protection
Water Resources	
Surface Water	National Water Quality Management Strategy: Australian Guidelines for Fresh and Marine Water Quality (ANZECC/ARMCANZ)
	National Water Quality Management Strategy: Australian Guidelines for Water Quality Monitoring and Reporting (ANZECC/ARMCANZ)
	National Water Quality Management Strategy: Guidelines for Sewerage Systems – Effluent Management (ARMCANZ/ANZECC)
	National Water Quality Management Strategy: Guidelines for Sewerage Systems – Use of Reclaimed Water (ARMCANZ/ANZECC)
	Using the ANZECC Guideline and Water Quality Objectives in NSW (DEC)
	State Water Management Outcomes Plan
	Any relevant Water Sharing Plans for surface waters under the *Water Management Act 2000*
	NSW Government Water Quality and River Flow Objectives (DECC)
	Approved Methods for the Sampling and Analysis of Water Pollutants in NSW (DEC)
	Managing Urban Stormwater: Soils & Construction (Landcom) and associated Volume 2E: Mines and Quarries.
	Managing Urban Stormwater: Treatment Techniques (DECC)

	Managing Urban Stormwater: Source Control (DECC)
	Floodplain Development Manual (DIPNR)
	Floodplain Risk Management Guideline (DECC)
	A Rehabilitation Manual for Australian Streams (LWRRDC and CRCCH)
	Technical Guidelines: Bunding & Spill Management (DECC)
	Environmental Guidelines: Use of Effluent by Irrigation (DECC)
Groundwater	National Water Quality Management Strategy Guidelines for Groundwater Protection in Australia (ARMCANZ/ANZECC)
	NSW State Groundwater Policy Framework Document (DLWC, 1997)
	NSW State Groundwater Quality Protection Policy (DLWC, 1998)
	NSW State Groundwater Quantity Management Policy (DLWC, 1998)
	Murray-Darling Basin Groundwater Quality. Sampling Guidelines. Technical Report No 3 (MDBC)
	Murray-Darling Basin Commission. Groundwater Flow Modelling Guideline (Aquaterra Consulting Pty Ltd)
	Guidelines for the Assessment & Management of Groundwater Contamination (DECC, 2007)
	Any relevant Water Sharing Plan for groundwater resources under the *Water Management Act 2000*
Air Quality	
	Protection of the Environment Operations (Clean Air) Regulation 2010
	Approved Methods for the Modelling and Assessment of Air Pollutants in NSW (DEC)
	Approved Methods for the Sampling and Analysis of Air Pollutants in NSW (DEC)
Noise & Blasting	
	NSW Industrial Noise Policy (DECC)
	Environmental Noise Management – Assessing Vibration: a technical guide (DEC)
	NSW Road Noise Policy (DECCW)
	Interim Guideline for the Assessment of Noise From Rail Infrastructure Projects (DECC)
	Technical basis for guidelines to minimise annoyance due to blasting overpressure and ground vibration (ANZECC)
Agriculture / Land Resources	
	Agricultural Impact Statement Guideline 2012 (DP&I)
	Rural Land Capability Mapping (DLWC)
	Agfact AC25: Agricultural Land Classification (NSW Agriculture)
	Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Sites (ANZECC)
Traffic & Transport	
	Guide to Traffic Generating Development (RTA)
	Road Design Guide (RTA)
Heritage	
Aboriginal	Draft Guidelines for Aboriginal Cultural Heritage Assessment and Community Consultation (DEC 2005)
	The Burra Charter (The Australia ICOMOS charter for places of cultural significance)
Historic	NSW Heritage Manual (NSW Heritage Office)
	The Burra Charter (The Australia ICOMOS charter for places of cultural significance)
Greenhouse Gases	
	National Greenhouse Accounts Factors (Australian Department of Climate Change (DCC))
	Guidelines for Energy Savings Action Plans (DEUS)
Waste	

	Waste Classification Guidelines (DECC)
Hazards	
	State Environmental Planning Policy No. 33 – Hazardous and Offensive Development
	Hazardous and Offensive Development Application Guidelines - Applying SEPP 33
	Hazardous Industry Planning Advisory Paper No. 6 – Guidelines for Hazard Analysis
Rehabilitation	
	Mine Rehabilitation – Leading Practice Sustainable Development Program for the Mining Industry (Commonwealth of Australia)
	Mine Closure and Completion – Leading Practice Sustainable Development Program for the Mining Industry (Commonwealth of Australia)
	Strategic Framework for Mine Closure (ANZMEC-MCA)
Socio-Economic	
	Draft Economic Evaluation in Environmental Impact Assessment (DoP)
	Techniques for Effective Social Impact Assessment: A Practical Guide (Office of Social Policy, NSW Government Social Policy Directorate)

Department of the Sustainability, Environment, Water, Population and Communities – requirements for environmental assessment

Section 75F(3) of the NSW *Environmental Planning and Assessment Act 1979*

The Commonwealth Minister for Sustainability, Environment, Water, Population and Communities has determined the Watermark Coal Project (EPBC 2011/6201), involving the proposed construction and operation of an open cut coal mine approximately 35 km south east of Gunnedah in New South Wales, to be a controlled action under section 75 of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

The controlled action is likely to have a significant impact on the EPBC Act listed critically endangered ecological community White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland (Box-Gum Woodland) and EPBC Act listed migratory and threatened species including the Regent Honeyeater (A*nthochaera phrygia*). Significant impacts are also considered possible for a number of other species and communities protected by the EPBC Act including, but not limited to, those listed in Appendix A.

In accordance with the one-off accredited assessment process for this project, the environmental assessment of the impacts of the controlled action must be assessed under the *Environmental Planning and Assessment Act 1979* (EP&A Act). Pursuant to section 75F(3) of part 3A of the EP&A Act the Director-General is required to notify the proponent of these requirements.

The assessment should include enough information about the controlled action and its relevant impacts to allow the Commonwealth Minister for Sustainability, Environment, Water, Population and Communities to make an informed decision whether or not to approve the controlled action under the EPBC Act.

The following assessment requirements are to be integrated into the assessment requirements of the EP&A Act. The following matters in the EPBC Act and schedule 4 of the *Environment Protection and Biodiversity Conservation Regulations 2000* should be considered.

General information

1. The background of the action, including:
    a. the title of the action;
    b. the full name and postal address of the designated proponent;
    c. a clear outline of the objective of the action;
    d. the location of the action;
    e. the background to the development of the action;
    f. how the action relates to any other actions (of which the proponent should reasonably be aware) that have been, or are being, taken or that have been approved in the region affected by the action;
    g. the current status of the action; and
    h. the consequences of not proceeding with the action.

Description of the controlled action

2. A description of the action, including:
    a. all the components of the action;
    b. the precise location of any works to be undertaken, structures to be built or elements of the action that may have relevant impacts;
    c. how the works are to be undertaken and design parameters for those aspects of the structures or elements of the action that may have relevant impacts;
    d. the timing and duration of the works to be undertaken; and
    e. to the extent reasonably practicable, a description of any feasible alternatives to the controlled action that have been identified through the assessment, and their likely impact, including:
        i. if relevant, the alternative of taking no action;
        ii. a comparative description of the impacts of each alternative on the matters protected by the controlling provisions for the action;
        iii. sufficient detail to clarify why any alternative is preferred to another.

Description of the existing environment

3. A description of the existing environment of the proposal location and the surrounding areas that may be affected by the action, including:
    a. surveys using accepted methodology for targeting listed threatened species, ecological communities and their respective habitat, including but not limited to OEH's *Survey and assessment guidelines* (2009), available at: http://www.environment.nsw.gov.au/threatenedspecies/surveymethodsfauna.htm and the Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) species-specific survey guidelines for nationally threatened species, available at: http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl

    In addition to the requirements outlined in OEH's *Survey and assessment guidelines* (2009) and DSEWPaC survey guidelines for relevant species, the following must also be included:

    b. a description of the distribution and abundance of threatened species and ecological communities, as well as suitable habitat (including breeding, foraging, roosting habitat, habitat critical to the survival of threatened species) within the site and in surrounding areas that may be impacted by the proposal; and
    c. the regional distribution and abundance of suitable and potential habitat surrounding the site.

Description of the relevant impacts of the controlled action

4. An assessment of all relevant impacts[3] with reference to the *EPBC Act Policy Statement 1.1 Significant Impact Guidelines Matters of National Environmental Significance (2009)* that the controlled action has, will have or is likely to have on relevant threatened species and/or threatened ecological communities (s18 and s18A),and migratory species (s20 and s20A). Information must include:

[3] The term "relevant impact" is defined in section 82 of the EPBC Act.

a. a description of the relevant impacts of the action on matters of national environmental significance;

b. a detailed assessment of the nature and extent of the likely short term and long term relevant impacts;

c. a statement whether any relevant impacts are likely to be unknown, unpredictable or irreversible;

d. analysis of the significance of the relevant impacts;

e. notwithstanding mitigation and offset, details on the cumulative impacts on matters of National Environmental Significance at a regional scale; and,

f. any technical data and other information used or needed to make a detailed assessment of the relevant impacts.

5. A description of the relevant impacts on the ecological communities should include an analysis of the vegetation condition on the site, as well as the methods by which this was determined. It should also include direct, indirect, cumulative and facilitative impacts on the:

    a. extent of the ecological community, including connectivity with other areas of the ecological communities;

    b. quality or integrity of the ecological community including, but not limited to, assisting invasive species, that are harmful to the ecological communities to become established; or causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the communities which kill or inhibit the growth of species in the ecological community;

    c. EPBC Act listed species in, or in any way dependent upon, the ecological community;

    d. composition of the ecological community;

    e. habitat present on site critical to the survival of the ecological community[4]; and

    f. abiotic (non-living) factors (such as water, nutrients or soil) necessary for the ecological community survival, for example increasing groundwater levels or making the site wetter, soil disturbance or substantial alteration of surface water drainage patterns.

    These impacts should be described for the construction and operation phases of the controlled action.

    This information should be provided with reference to the ecological community as it is defined and listed under the EPBC Act.

6. Where there is a potential habitat for EPBC Act listed species (Appendix A), surveys must be undertaken. These surveys must be timed appropriately and undertaken for a suitable period of time by a qualified person[5]. A subsequent description of the relevant impacts on such EPBC Act listed species should include, inter alia, direct, indirect, cumulative and facilitative impacts on the:

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[4] "habitat critical to the survival of a species or ecological community" refers to areas that are necessary:

- for activities such as foraging, breeding, roosting, or dispersal;
- for the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators);
- to maintain genetic diversity and long term evolutionary development; or
- for the reintroduction of population or recovery of the species or ecological community.

Such habitat may be, but is not limited to: habitat identified in a recovery plan for the species or ecological community as habitat critical for that species or ecological community; and/or habitat listed on the register of Critical Habitat maintained by the Minister under the EPBC Act.

[5] Where available, species-specific survey guidelines can be obtained on the department's *Species Profile and Threats Database*: http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl

a. population of the species at the site;

b. area of occupancy of the species;

c. habitat critical to the survival of the species;

d. breeding cycle of the population; and

e. availability or quality of habitat for the species.

If an endangered ecological community, threatened or migratory species listed at Appendix A is not believed to be present on the proposed site, detailed information must be included in the Environmental Assessment Report to provide certainty that this community will not be impacted.

Information relating to water

The Environmental Assessment Report must consider any water related impacts associated with the proposed project on MNES.

7. How the proponent will comply with all relevant Commonwealth, state and local government environment laws and policies pertaining (either directly or indirectly) to water quality management;
8. A description and maps of all surface water and groundwater sources relevant to the Project, and a delineation of their associated NWQMS environmental values;
9. The results of surface water and groundwater hydrological assessments, including an assessment of hydrological interactions where water sources are connected;
10. Hydro-geological reports;
11. A geological map showing fault lines;
12. A topographical map;
13. Hydrological modelling information;
14. Baseline data and information on current water quality, including reference and test site data. Where this information does not exist, there should be an undertaking to carry out the necessary investigations in order to provide the required baseline data, including a description of how these investigations will be carried out (methodology and timeframe);
15. Data and information on proposed discharge water quality, including timing of discharges, concentrations, and loads of toxicants and stressors;
16. Water quality issues, including planning, monitoring and management informed by the National Water Quality Management Strategy (http://www.environment.gov.au/water/policy-programs/nwqms):
    a. Sewage treatment; and,
    b. Water way crossings;
17. Modelling showing the cumulative environmental impacts of the action; and
18. A comprehensive water quality risk management and monitoring plan for the project, including management triggers to detect potential issues in a timely manner and to avoid, minimise or ameliorate adverse impacts. This should include:
    a. Identification and description of all potential water quality hazards;
    b. Water quality risks should be considered and, where possible, quantified;
    c. Cumulative effects, including environmental impacts, should be considered;

d. Threshold trigger and/or guideline values that protect MNES should be considered;
e. Biological as well as chemical monitoring and assessment;
f. Statistical analysis such as data averages, standard deviation and number of samples;
g. Test and reference site locations;
h. Sampling and analytical methods; and,
i. Quality control and quality assurance data

19. Some of the main water quality issues the proponent should consider include:
    a. Salinity;
    b. Sedimentation;
    c. Nutrients;
    d. Stressors such as pH, EC, turbidity
    e. Heavy metals and metalloids;
    f. Macroinvertebrate species assemblages, compositions and assessment results
    g. Disturbed/exposed acid sulfate soils;
    h. Hydrocarbons, hydrocarbon derivatives and PAHs.

Proposed safeguards and mitigation measures

20. A description of feasible mitigation measures, changes to the controlled action or procedures, which have been proposed by the proponent or suggested in public submissions, and which are intended to prevent or minimise relevant impacts. Information must include:

    a. a description of the mitigation measures that will be undertaken to prevent or minimise the relevant impacts of the action. These mitigation measure should be substantiated and based on best available practices;

    b. an assessment of the expected or predicted effectiveness of the mitigation measures including the effect on abundance and condition of species, suitable habitat and ecological communities;

    c. any statutory or policy basis for the mitigation measures;

    d. the cost of the mitigation measures;

    e. an environmental management plan that sets out the framework for continuing management, mitigation and monitoring programs (including any relevant thresholds for corrective actions) for the relevant impacts of the action. Include the person or agency responsible for implementing these programs and the effectiveness of all mitigation measures, including any provisions for independent environmental auditing;

    f. the name of the agency responsible for endorsing or approving each mitigation measure or monitoring program;

    g. identification of mitigation measures proposed to be undertaken by State governments, local governments or the proponent;

    h. any changes to the controlled action which prevent or minimise relevant impacts on listed threatened species and communities.

Offsets

21. Should any residual impact exist that cannot be mitigated it may be necessary for offset measures to be considered in order to ensure the protection of matters of national environmental significance in perpetuity. If required, the department may negotiate offsets with you during the assessment phase. Reference should be made to the Department's draft

policy statement, including any revisions to this statement, at : http://www.environment.gov.au/epbc/publications/draft-environmental-offsets.html

a. the description of any offset package should include how the offset compensates for the residual impacts, when the offset will be delivered and how the offset will be managed;

b. an assessment of the impact of the offsets on other matters of environmental, economic, or social significance; and

c. analysis of cost, both financial and other, related to offsets.

Other approvals and conditions

22. Any other requirements for approval or conditions that apply, or that the proponent reasonably believes are likely to apply, to the proposed action. Information must include:

    a. details of any local or State government planning scheme, or plan or policy under any local or State government planning system that deals with the proposed action, including:

        i. what environmental assessment of the proposed action has been, or is being, carried out under the scheme, plan or policy; and

        ii. how the scheme provides for the prevention, minimisation and management of any relevant impacts;

    b. a description of any approval that has been obtained from a State, Territory or Commonwealth agency or authority (other than an approval under the Act), including any conditions that apply to the action;

    c. a statement identifying any additional approval that is required;

    d. a description of the monitoring, enforcement and review procedures that apply, or are proposed to apply, to the action.

Economic and social matters

23. A description of the short-term and long-term social and economic implications and/or impacts of the project.

Environmental record of person proposing to take the action

24. Details of any proceedings under a Commonwealth, State or Territory law for the protection of the environment or the conservation and sustainable use of natural resources against:

    a. the proponent; and

    b. for an action for which a person has applied for a permit, the person making the application.

25. Details of the proponent's environmental policy and planning framework.

Information sources

26. For information given in an environment assessment, the draft must state:

    a. the source of the information;

    b. how recent the information is;

    c. how the reliability of the information was tested; and

    d. what uncertainties (if any) are in the information.

Consultation

27. Any consultation about the action, including:

    a. any consultation that has already taken place;

    b. proposed consultation about relevant impacts of the action;

    c. if there has been consultation about the proposed action — any documented response to, or result of, the consultation.

28. Identification of affected parties, including a statement mentioning any communities that may be affected and describing their views.

Appendix A

Threatened Ecological Communities

- White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland (Box-Gum Woodland)
- The Weeping Myall Woodlands
- *Grey Box (Eucalyptus macrocarpa)Grassy Woodlands and Derived Native Grasslands of South-eastern Australia*
- *Weeping Myall Woodlands ecological community*

Threatened Flora

- *Prasaophyllum sp.* Wybong (C.Phelps ORG 5269)
- *Pterostylis cobarensis*
- *Swainsona murrayana*
- *Thesium austral*
- *Tylophora lineraris*

Threatened Fauna

- *Anthochaera phrygia* (Regent Honeyeater), also Migratory
- *Lathamus discolor* (Swift Parrot)
- *Polytelis swainsonii* (Superb Parrot)
- *Chalinolobus dwyeri* (Large-eared Pied Bat)
- *Petrogale penicillata (*Brush-tailed Rock-Wallaby*)*
- *Pseduomys novaehollandiae* (New Holland Mouse*)*
- *Pteropus poliocephalis* (Grey-headed Flying-fox)
- *Rostratula australis* (Painted Snipe), also Migratory
- *Maccullochella peelii peelii (Murray Cod)*
- *Nyctophilus corbeni (South-eastern Long-eared Bat)*
- *Dasyurus maculatus maculatus* (Spotted-tailed Quoll)
- *Underwoodisaurus sphyrurus* (Border Thick-tailed Gecko)